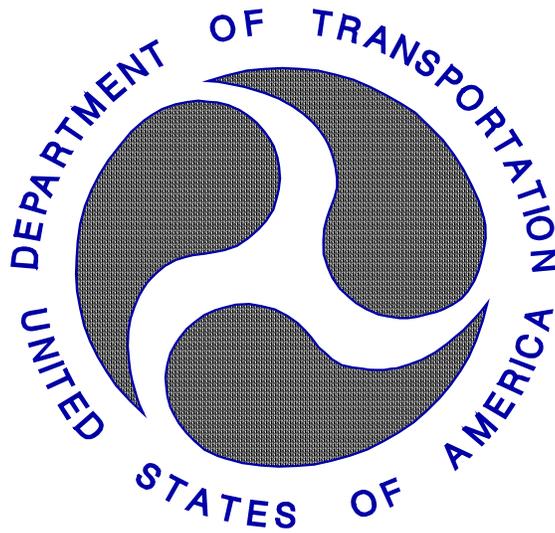


# **U.S. DEPARTMENT OF TRANSPORTATION**

**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**

## **LABORATORY TEST PROCEDURE FOR NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING**



**September 2012**

**OFFICE OF VEHICLE SAFETY  
OFFICE OF CRASHWORTHINESS STANDARDS  
1200 NEW JERSEY AVE, SE  
ROOM W43-410  
WASHINGTON, DC 20590**

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## **NCAP LABORATORY TEST PROCEDURE**

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

FRONTAL RIGID BARRIER IMPACT TEST

| <b>TEST PROCEDURE</b> |             | <b>NEW CAR ASSESSMENT PROGRAM<br/>FRONTAL IMPACT TESTING</b> |                       | <b>DESCRIPTION</b>   |
|-----------------------|-------------|--|-----------------------|--|
| <b>REV. No.</b>       | <b>DATE</b> | <b>AMENDMENT</b>   | <b>EFFECTIVE DATE</b> |  |
| 00                    | 09/22/2010  |  | 09/22/2010            | Minor changes to procedure. Photo list update and clarifications. Removal of test reporting requirements from main procedure and insertion in Appendix N.  |
| 01                    | 01/13/2010  |  | 01/13/2010            | Minor changes to procedure. Added information to allow for high resolution barrier. Updated Appendix G to allow for redundant femur load cells.  |
| 02                    | 05/18/2012  |  | 05/18/2012            | Minor changes to procedure. Changes test speed measurement requirements to km/h. Moved FMVSS 305 data sheets to a separate procedure. Removed information in Appendix O and reserved. Moved load cell barrier information to Appendix P. |
| 03                    | 09/24/2012  |  | 09/24/2012            | Minor changes to test procedure. Reinstated vehicle Z accelerometers. Changed data sheet 1 in Appendix N.  |
| 04                    |             |  |                       |  |
| 05                    |             |  |                       |  |
| 06                    |             |  |                       |  |
| 07                    |             |  |                       |  |
| 08                    |             |  |                       |  |

## 1. PURPOSE AND APPLICATION

The Office of Crashworthiness Standards (OCWS) provides Contractor laboratories with Laboratory Test Procedures as guidelines for obtaining crash test data. The data are used to provide ratings that allow consumers to compare the crashworthiness of vehicles and make informed purchasing decisions. In addition, it provides market incentives for automobile manufacturers to produce safer vehicles. The purpose of the OCWS Laboratory Test Procedure is to present a uniform testing and data recording format, and to provide suggestions for the use of specific equipment and procedures. If any Contractor views any part of an OCWS Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard (FMVSS) or observes deficiencies in a Laboratory Test Procedure, the Contractor is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of NCAP testing.

Every Contractor is required to submit a detailed internal test procedure to the COTR before initiating its NCAP 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 with make and model number. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer's instructions. There shall be no contradictions between the Laboratory Test Procedure and the Contractor's in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the NCAP test program. 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 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 of the COTR.

**NOTE: The NCAP Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct NCAP tests for the OCWS, are not rules, regulations, or NHTSA interpretations regarding the meaning of an FMVSS or this procedure. The Laboratory Test Procedures may not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the Laboratory Test Procedures may specify test conditions that are more or less severe than the minimum requirements of the standard.**

## 2. GENERAL REQUIREMENTS

This laboratory test procedure is derived from the FMVSS No. 208 test procedure. Each vehicle shall be tested by impacting it into an instrumented, fixed, rigid concrete barrier that conforms to the definition in Part 571.3—Definitions, 49 CFR Part 571.3-. The contract laboratories are directed by this test procedure to use an impact velocity of 56.30

± 0.80 km/h). Any changes to or deviations from this test procedure must be approved by the Contracting Officer's Technical Representative (COTR).

**NOTE: Vehicles are tested with a 50<sup>th</sup> percentile male Hybrid III in the driver position and a 5<sup>th</sup> percentile female Hybrid III placed in the front right outboard seating position. When tested according to the conditions outlined in this test procedure, each 50<sup>th</sup> percentile occupant shall comply with the injury criteria listed in section S6 of 49CFR571.208 and each 5<sup>th</sup> percentile occupant shall comply with injury criteria listed in section S15 of 49CFR571.208.**

### 3. SECURITY

The Contractor shall provide appropriate security measures to protect NCAP test vehicles, dummies, load cell barrier and any GFP during the entire crash test program and shall be responsible for all equipment removed from test vehicles before and after the crash test. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Acquisition Management, within two (2) working days after the incident. A letter containing specific details of the security problem shall be sent to the IPM (with copy to the COTR) within 48 hours. Vehicle equipment thefts or acts of vandalism must be reported to NHTSA authorities immediately. Under no circumstances shall any vehicle components be removed during a visitor inspection unless authorized by OCWS engineers. All data developed from the crash test program shall be protected.

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***NO INDIVIDUALS OTHER THAN THE CONTRACTOR'S PERSONNEL DIRECTLY INVOLVED IN THE CRASH TEST PROGRAM SHALL BE ALLOWED TO WITNESS A FRONTAL NCAP TEST OR INSPECT, PHOTOGRAPH OR VIDEOTAPE ANY TEST VEHICLE UNLESS AUTHORIZATION IS GRANTED BY A REPRESENTATIVE FROM THE OCWS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SECURE THE TEST SITE AREA DURING A TEST AND TO SHIELD THE BARRIER IMPACT AREA FROM THE PUBLIC VIEW BY THE USE OF CANVAS OR OTHER BLOCKING DEVICES.***

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#### 3.1 RULES FOR CONTRACTORS

- A. No vehicle manufacturer's representative(s) or anyone other than the Contractor's personnel working on NCAP contracts and NHTSA personnel shall be allowed to inspect NHTSA vehicles or witness vehicle preparations and/or crash testing without prior permission of the OCWS. Such permission can never be assumed.
- B. All communications with vehicle manufacturers shall be referred to the OCWS, and at no time shall the Contractor release crash test data, videos, or photos without the permission of the OCWS.

- C. Unless otherwise specified, the vehicle manufacturer's representatives shall only be authorized to visit the Contractor's test facility on the day that the test is scheduled, and the representatives must be escorted by NHTSA 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.

**NOTE: No vehicle parts should be tampered with or removed from the vehicle without the consent of the COTR. Individual data plots cannot be viewed by manufacturer representatives until they are reviewed by NHTSA personnel and granted express permission by the COTR.**

- E. Photographs and video 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 videos of vehicle preparation must be approved by OCWS. The Contractor's personnel shall not respond to any questions from the manufacturer's representatives regarding NCAP. 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 NHTSA COTR. NHTSA shall advise interested parties that such access and inspection shall be limited to a specified day and hours and require prior approval from the Office of Crashworthiness Standards. The Contractor shall refer all visit requests from vehicle manufacturer's representatives and consumers 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 NHTSA. The Contractor shall make his own arrangements with interested parties for expenses incurred beyond providing access and inspection services. All inquiries by manufacturers concerning NCAP (vehicle, procedures, data, etc.) shall be directed to OCWS representatives.

#### **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 with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

#### **5. TEST SCHEDULING AND MONITORING**

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. All testing shall be coordinated to allow monitoring by the COTR.

## 6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS

### 6.1 TOW ROAD

- A. The tow road should be at least 500 feet in length and terminate at the face of the non-energy-absorbing barrier as shown in **FIGURE 1**. The first 100 feet (approximate) from the head of the tow road will be used to accelerate the test vehicle up to the specified velocity without exceeding 0.5g, which would affect the positioning of the P572 test dummies in the test vehicle. The second 100 feet (approximate) of tow road shall be used for dummy stabilization. At this juncture, the test vehicle should have reached the desired impact velocity and should be experiencing zero acceleration. The remaining 300 feet (approximate) of tow road will be used for test vehicle speed stabilization.
- B. The width of the tow road should be approximately 8 to 14 feet and should be straight and level so that the test vehicle does not oscillate vertically in excess of 0.29 G's.
- C. A photographic pit will be located in the tow road at the stationary barrier face so that structural crush and possible fluid leakage of Stoddard solvent can be photographed during the impact event. The pit shall be covered using the following guidelines:
  - 1. Use a material that allows for use of pit cameras.
  - 2. The covering and its supports should simulate road strength in case the vehicle structure should come in contact with it during the NCAP test.
  - 3. The entire pit should be covered except for the area needed for the tow system to operate.
  - 4. Precautions must be taken to ensure there is no electromagnetic interference generated by the pit cover material.

### 6.2 TEST VEHICLE PREPARATION BUILDING/STRUCTURE

The following applies to labs with outdoor impact surfaces. In order that the test vehicle can be prepared for crash testing at the head of the tow road during hot or cold weather, the Contractor shall have a temperature-controlled building constructed which is large enough to house the test vehicle and allow for government, vehicle manufacturer, and laboratory personnel to move around the test vehicle. The building climate control must be capable of maintaining the ambient air temperature between 20.6°C and 22.2°C (69°F and 72°F).

### 6.3 TOW AND GUIDANCE SYSTEMS

- A. A guidance system is required to assure that the test vehicle impacts the barrier at the proper angle. At most laboratories, a monorail running down the center of the tow road is used to guide a dolly to which the vehicle is connected. **NO HARD POINT CONNECTIONS BETWEEN THE MONORAIL AND TEST VEHICLE WILL BE ALLOWED.**

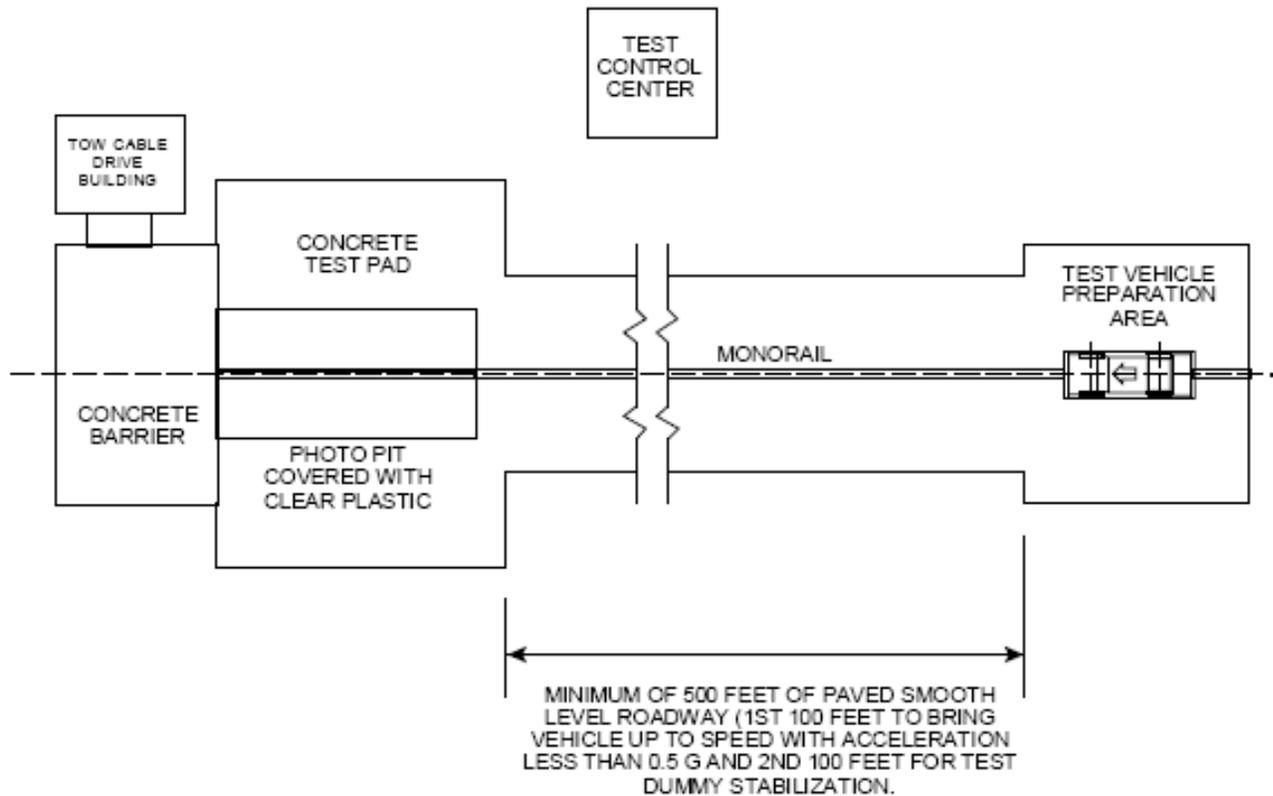
- B. A “soft” lateral guidance system is required to assure that the test vehicle will impact the barrier face at the designated 90° angle (straight perpendicular impact). It is suggested that the Contractor's lateral guidance system include steel cables or chains extending from the vehicle lower 'A' arms or front frame rails to the monorail dolly or shoe. The dolly will ride on the monorail and may engage the tow cable through a set of gripper jaws. The dolly will be stopped at the end of the tow road monorail or at the head of the photographic pit releasing the vehicle cables or chains at the same time allowing the vehicle to proceed to the barrier face for impact.
- C. A “soft” connection (seat belt webbing, steel cables, chains, etc.) between the tow cable attachment device and the test vehicle front frame assembly shall be provided by the Contractor. **NO HARD POINT CONNECTIONS BETWEEN THE TOW CABLE AND THE TEST VEHICLE SHALL BE ALLOWED.** The tow cable attachment shall release from the cable so that the vehicle will roll into the barrier at a constant velocity (no acceleration).
- D. The tow system must be capable of ensuring that the test vehicle shall impact the barrier face at a speed of 56.30 km/h  $\pm$  0.80 km/h, or range of 55.50 km/h to 57.10 km/h. *Any photographs of the test speed readout must show the impact speed in km/h, to two decimal places ONLY. Test data submitted without a photograph of the test speed readout, or displaying a primary test speed that does not conform to this range may be considered nonconforming.*

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**FOR THE VEHICLE TOWING AND LATERAL GUIDANCE SYSTEMS, THE PERFORMANCE REQUIREMENT OF “SOFT” CONNECTIONS IS CONSTRUED TO BE SYSTEMS WHICH DO NOT OBSTRUCT OR RESTRAIN THE VEHICLE STRUCTURAL DEFORMATION DURING IMPACT. SYSTEMS THAT FAIL TO COMPLY WITH THIS REQUIREMENT ARE INTERPRETED AS SYSTEMS WITH 'HARD-POINT' CONNECTIONS, AND ARE GROUNDS FOR RETEST.**

**IN ADDITION, ENGAGEMENT OF THE VEHICLE TOWING AND GUIDANCE SYSTEMS SHALL NOT ALTER THE NATURAL ATTITUDE OF THE VEHICLE. MODIFICATION OF ANY KIND TO THE TEST VEHICLE FOR TOWING PURPOSES, SUCH AS WELDING, DRILLING, ETC IS PROHIBITED.**

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**Figure 1 - Typical Frontal NCAP Rigid Barrier Impact Test Facility**

#### 6.4 *FIXED COLLISION BARRIER*

The basic fixed collision barrier must conform to the definition in Part 571.3—Definitions, 49 CFR Part 571.3, and at a minimum should consist of a reinforced concrete structure, 6 feet high, 6 feet thick, and 12 feet wide, weighing approximately 100,000 pounds. The Government furnished property (GFP) load cell barrier shall be firmly attached to the reinforced concrete structure prior to every test unless otherwise directed by OCWS.

#### 6.5 *TEST VEHICLE VELOCITY MEASUREMENT*

- A. The speed of the test vehicle must be controlled to obtain and maintain the vehicle speed in the range of 56.30 km/h  $\pm$  0.80 km/h, or range of 55.50 km/h to 57.10 km/h.
- B. Primary test vehicle impact speed measurement may be achieved by the use of break wires, photocells, or laser beams located within 5 feet of the barrier. Usually, 2 sets of break wires or 2 photocell transmitters and receivers are used in the final speed trap,

which records the time, on an electronic counter, for the test vehicle to travel the last 5 feet before barrier impact. The test vehicle's velocity shall be constant (zero acceleration or deceleration) for a minimum of the last 5 feet of travel before impact. The final velocity shall be measured when the front of the test vehicle is within 1 foot of the barrier face, and the reported impact velocity will take into consideration all of the response characteristics of the entire velocity measurement system utilized in its determination.

- C. Impact velocity will be measured by no less than 2 sets of timing devices and the timing devices shall be accurate to within plus or minus .08 km/h (0.05 mph). The basis for the speed measurement (time and distance) shall be calibrated by an instrument traceable to the National Institute of Standards and Technology (NIST). The impact velocity shall be permanently recorded, at a minimum by the photograph taken to satisfy the requirements of this procedure's **Appendix N**, Test Deliverables and Report Requirements. 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. Another method of permanently documenting the velocities recorded by these timing devices is highly encouraged, as is a source of battery power as a backup.
- D. A timing device shall monitor the velocity of the test vehicle to permit aborting the test if the vehicle's speed is outside of the specified velocity range. A third timing device may be placed along the tow road at a sufficient distance from the barrier face for monitoring the velocity of the test vehicle and permitting aborting of the test if the vehicles speed is outside the velocity range specified below. If the contractor is capable of documenting the velocity recorded by this third device it may be also used as a third verification of test velocity in any test.

## 6.6 TEST BRAKE ABORT SYSTEM

- A. The laboratory shall provide an abort system capable of bringing the vehicle to a controlled stop.
- B. An aborted test can be restarted only after notification is given to the COTR, and dummy positioning and vehicle preparation items affected by the abort have been redone.

## 6.7 STATIC ROLLOVER DEVICE

The laboratory shall provide a static rollover device, used to conduct an FMVSS No. 301 and/or FMVSS No. 305 test, which 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. 90° of rotation must take place within 1 to 3 minutes.

## 7. GOVERNMENT FURNISHED PROPERTY (GFP)

### 7.1 TEST VEHICLES

- A. The Contractor has the responsibility of accepting NHTSA-provided test vehicles. The Contractor acts on NHTSA's behalf when signing an acceptance of test vehicles. The Contractor must check to verify the following:
1. All options listed on the "window sticker" are present on the test vehicle.
  2. Tires and wheel rims are the same as listed.
  3. There are no dents or other interior or exterior flaws.
  4. The vehicle has been properly prepared and is in running condition.
  5. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
  6. Proper fuel filler cap is supplied on the test vehicle.
  7. Verify that spare tire, jack, lug wrench, and tool kit (if applicable) is located in the vehicle cargo area.
  8. The Contractor shall check for damage that may have occurred during transit. The COTR is to be notified of any damage prior to preparation of the vehicle for testing.

### 7.2 ANTHROPOMORPHIC TESTING DEVICES

An adequate number of Part 572 Subpart E (50<sup>th</sup> Percentile Male) test dummies and Part 572 Subpart O (5<sup>th</sup> Percentile Female) test dummies will be furnished to the contract laboratory by the NCAP.

In addition, Part 572 Subpart N (6-year old), Subpart P (3-year old), and Subpart R (12-month-old) test dummies will be provided if needed. The dummies will be instrumented with 6-axis neck load cells and instrumented lower legs; all other dummy instrumentation shall be provided by the Contractor. The Subpart E (50th male), O (5th female), and N (6-year old) dummies shall be stored in an upright sitting position with the weight supported by the internal structure of the pelvis. The dummies shall be held upright by using a strap around the chest or the base of the neck so that the neck is not supporting the weight of the dummy. If used, Subpart P (3-year-old), and R (12-month-old) dummies shall be stored in a hanging position using the bracket and positioning shown in figures 1 and 2. The dummies shall be stored in a secured room, which is kept between 55°F and 85°F and 10-70% relative humidity.

The Contractor shall check the dummy components for damage after each crash test and complete a Dummy Damage Checklist that will be included with the post test dummy calibration. The COTR will be kept informed of the dummies' condition in order that replacement parts can be provided.

The Contractor shall keep a detailed record for each dummy, describing parts replaced

and the results of calibration tests.

### 7.3 *LOAD CELL BARRIER*

A barrier will be provided to the contract laboratory by the NCAP. Details on some typical load cell barriers can be found in **Appendix P, Load Cell Barrier Configurations**

## 8. CALIBRATION AND TEST INSTRUMENTATION

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

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 12 months for instruments and 12 months for the calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.
  1. Accelerometers shall be calibrated at a minimum of every six months or after a vehicle fails to meet any minimum performance requirements or after any indication from calibration checks or recent test data that there may be a problem with the accelerometer (whichever comes sooner).
  2. Load cells shall be calibrated at a minimum of every twelve months or after a vehicle fails to meet any minimum performance requirements or after any indication from calibration checks or recent test data that there may be a problem with the load cell (whichever comes sooner).
- 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 that assures the maintenance of established calibration schedules.

- F. All such records shall be readily available for inspection when requested by the COTR. The history of the record shall be updated in an electronic file. The calibration system will need the acceptance of the COTR before NCAP testing commences.
- G. Test equipment shall receive a system functional check-out using a known test input before and after the test. This check shall be recorded by the test technician(s) and submitted with the final report.
- H. Anthropomorphic test devices (ATDs) shall be calibrated before and after every NCAP test. The calibrations and calibration check shall be submitted with the final report.

**NOTE: In the event an ATD body region exceeds the performance standards required by FMVSS 208, that region on the ATD must be recalibrated.**

- I. The Contractor-Furnished data acquisition shall have a sufficient number of channels available for recording and processing signals from ATD and vehicle sensors. It must record time histories of the head and chest acceleration, chest displacement, neck forces and moments, right and left femur axial loads, and any additional 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 most recent requirements of SAE Recommended Practice J211-1.

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

- J. An instrument calibration system capable of performing individual tests on all data channels used in acquiring the acceleration and force data shall conform to the appropriate section of the most recent version of SAE J211-1.
- K. A full-face GFE load cell barrier will be mounted onto the face of the Contractor's fixed barrier assembly. All questions regarding the load cell barrier assembly, maintenance and calibration shall be directed to:

Safety Performance Standards  
Office of Crashworthiness Standards (NVS-110)  
1200 New Jersey Avenue, SE  
Washington, D.C. 20590  
(202) 366-1740

- L. Load cells shall be calibrated on an "as needed" basis and a minimum of one (1) time per year. Accelerometers shall be calibrated on an "as needed" basis and a minimum of once every six (6) months. Need shall be established by pre- and post-test shunt calibration. If

bridge balance remains unchanged (pre- and post-test) and if full-scale shunt calibration results in the same factor, then the transducer characteristics are within calibration. If loads become suspect, linearity of the load cell shall be checked with a universal compression testing machine. If the load cell is non-linear or if pre- and post-test calibration results in a “drift,” the load cell shall be returned to the manufacturer for check-out and calibration. Notify the COTR whenever calibration problems arise.

**NOTE: Load cells are prone to corrosion when exposed to damp environments. Therefore, extra precautions shall be taken to prevent moisture entering the cells.**

***CAUTION:*** Weep holes are provided for equalization of barometric pressure and must be directed downward. If cells are found with the hole pointing upward, the cell must be removed and calibrated by compression testing. If they are found to be non-linear, they must be returned to the manufacturer. The load cell barrier shall be covered between tests. When the load cell barrier will not be used for a period of time, it shall be removed from the barrier area and placed in a dry storage area. The plywood blocks shall be intact and completely bonded to the backup support. If these blocks receive significant damage during crash testing, they shall be replaced or repaired such that a full surface is present.

M. Normal practice shall be employed with recorders and equipment calibrations for load cells. When load cells are calibrated, a system calibration procedure shall be employed where the load cell is calibrated in the system used for amplifying/recording the load cell output signal. Alternatively, the system may be calibrated separately, but this is not the desired method.

## 9. PHOTOGRAPHIC DOCUMENTATION

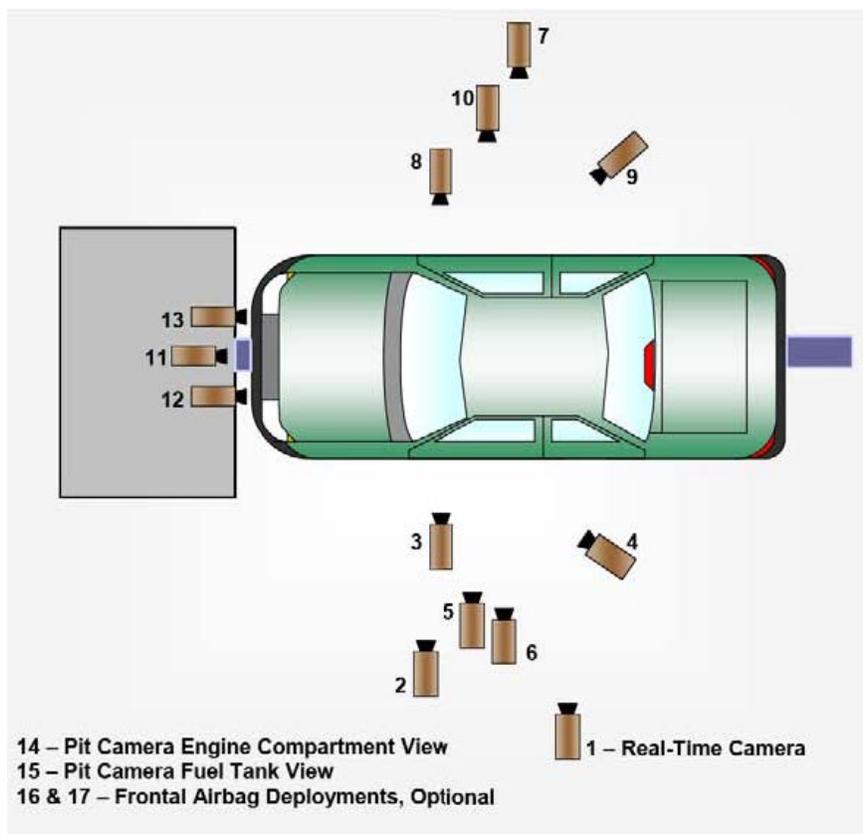
### 9.1 CAMERAS

#### High-Speed Digital Cameras

- A. The Contractor shall document the frontal crash event with high-speed digital cameras, arranged as shown in **Figure 2**, that operate at 1000 frames-per-second (fps) for 5 ms before the vehicle contacts the barrier and for 300 ms after vehicle contacts the barrier.
- B. The minimum resolution for these cameras shall be 1536 CMOS sensors per every two rows of pixels, with 80% of the horizontal distance of the two rows covered by effective light sensors. There shall be a minimum of 1024 rows of sensors.
- C. Glare or lights showing on any glass area (closed windows or vents) must be minimized so that views of the dummies during the test are visible for video analysis.
- D. A time zero mark **must be registered in a frame** to indicate when contact with the barrier occurs. Each frame shall contain the camera speed and the frame number beginning with the time zero frames labeled as “Frame 0.” The frame numbers prior to time zero shall be negative numbers.
- E. If hard copies are needed, digital video files shall be transferred to a compact disc (CD) or DVD as AVI or MPEG format with standard or generally available “codec”. These are also the acceptable formats for video files being transferred to the FTP site. Other types of files can be used if approved by the COTR.
- F. The vehicle interior may require auxiliary on-board lighting to ensure adequate exposure.

#### Real Time Camera

The Contractor shall use a “real time” color digital video camera that operates at 24-30 frames per second to document the views indicated below. The video shall be transferred to the FTP site, compact disc (CD) or DVD as .AVI, .MPEG, or .WMV files with standard or generally available “codec”.



**Figure 2 - Camera Positions for Frontal Impacts**

- Camera 1**      Filename: **Camera No. 1 – REAL-TIME LEFT OVERALL**  
 Real-time (24-30 fps) left side view camera to follow the test vehicle down the tow road, across the photographic pit, and into the barrier face.
- Camera 2**      Filename: **Camera No. 2 - DRIVER CLOSE-UP**  
 High-speed left side view camera to cover the vehicle's left side from the barrier face to a point rearward of the vehicle's front seat backs. The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.
- Camera 3**      Filename: **Camera No. 3 – LEFT FRONT HALF**  
 High-speed left side view camera positioned adjacent to the vehicle's A-post to document the driver dummy's head movement during the impact event in the windshield area and windshield zone intrusion area. The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.

- Camera 4**      Filename: **Camera No. 4 – LEFT ANGLE**  
High speed left side view camera positioned adjacent to the vehicle's B-post or center post at an angle to document the movement of the driver dummy during the impact event.
- Camera 5**      Filename: **Camera No. 5 – STEERING COLUMN – TOP\***  
High speed left side view camera positioned adjacent to the vehicle's B post to document the movement of the vehicle's steering column/wheel assembly relative to the roof targets and the rear sill target during the impact event. (This camera is also used for steering column displacement analysis.) The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.
- Camera 6**      Filename: **Camera No. 6 – STEERING COLUMN – BOTTOM\***  
High-speed left side view camera positioned adjacent to the vehicle's left front door and underneath to document the movement of the vehicle's steering column/wheel assembly relative to the roof target and the rear sill targets during the impact event. (This camera is also used for steering column displacement analysis.) The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.
- Camera 7**      Filename: **Camera No. 7 – RIGHT OVERALL**  
High speed right side view camera to cover the entire right side of the test vehicle during the impact event. The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.
- Camera 8**      Filename: **Camera No. 8 – PASSENGER CLOSE-UP**  
High speed right side view camera positioned adjacent to the vehicle's A-post to document the passenger dummy's head movement in the windshield area during the impact event and windshield zone intrusion. The centerline of the camera shall be perpendicular to the longitudinal centerline of the vehicle.
- Camera 9**      Filename: **Camera No. 9 – RIGHT ANGLE**  
High speed right side view camera positioned adjacent to the vehicle's B post or center post at an angle to document the movement of the passenger dummy during the impact event.
- Camera 10**     Filename: **Camera No. 10 – RIGHT FRONT HALF**  
High speed right side view camera positioned adjacent to the vehicle's right front door to document the movement of the

passenger dummy during the impact event.

**Camera 11** Filename: **Camera No. 11 – WINDSHIELD**

High speed overhead camera positioned directly above the vehicle's windshield centerline to cover the windshield area during the entire crash event. A polarizing filter may be used to eliminate windshield glare.

**Camera 12** Filename: **Camera No. 12 – DRIVER WINDSHIELD**

High speed front view camera mounted above the barrier face to document the movement of the driver dummy during the impact event and windshield zone intrusion.

**Camera 13** Filename: **Camera No. 13 – PASSENGER WINDSHIELD**

High speed front view camera mounted above the barrier face to document the movement of the passenger dummy during the impact event and windshield zone intrusion.

**Camera 14** Filename: **Camera No. 14 – PIT FRONT\***

High speed photographic pit camera positioned beneath the vehicle's engine compartment to record the vehicle structural crush and document any Stoddard solvent spillage.

**Camera 15** Filename: **Camera No. 15 – PIT REAR\***

High speed photographic pit camera positioned beneath the vehicle's fuel tank to document any Stoddard solvent spillage.

**NOTE:** Cameras 16 and 17 (see **Figure 2**) are optional views that may be installed in any feasible location in any NCAP test at the COTR's request. It is suggested that if no special request is made by the COTR, the contractor install cameras 16 and 17 regardless. They can be positioned inside the test vehicle over each dummy's inboard shoulder such that they may capture frontal airbag deployment. In addition, the outside rearview mirrors may be removed to eliminate any camera view obstructions in any NCAP test.

**\*Camera view may be recorded at 500 fps if necessary.**

## 9.2 *COLORING REQUIREMENTS FOR PHOTOGRAPHIC PURPOSES*

- A. Vehicle interior surfaces such as the instrument panel, A-post trim panels, door trim panels, console, etc., shall be painted with flat white paint. The air bag indicator light on the dash shall **NOT** be painted so as to be visible prior to testing.
- B. Vehicle underbody components such as the floor pan, frame rail members, steering

mechanism, suspension components, engine oil pan, and all fuel system components shall be painted with different colored paint (pink, green, blue, orange, etc.).

- C. Parts of the anthropomorphic testing devices shall be coated with colored chalk/water solutions to show contact points with the vehicle's interior, with their own components (such as head to knee contact), and with each other. The chalk/water solution shall be applied after final dummy positioning.

**CHALK COLORS TO BE USED ON TEST DUMMIES**

| <b>DUMMY PART</b>               | <b>DRIVER</b> | <b>PASSENGER</b>                 |
|---------------------------------|---------------|----------------------------------|
| <b>Nose</b>                     | <b>Red</b>    | <b>Yellow</b>                    |
| <b>Lips</b>                     | <b>Red</b>    | <b>Yellow</b>                    |
| <b>Face</b>                     | <b>Blue</b>   | <b>Red</b>                       |
| <b>Top of Head</b>              | <b>Yellow</b> | <b>Blue</b>                      |
| <b>Back of Head</b>             | <b>Red</b>    | <b>Yellow</b>                    |
| <b>Left Knee</b>                | <b>Red</b>    | <b>Yellow</b>                    |
| <b>Right Knee</b>               | <b>Blue</b>   | <b>Blue (FMVSS 208 uses Red)</b> |
| <b>Lower Steering Wheel Rim</b> | <b>Red</b>    | <b>N/A</b>                       |

**NOTE:** Face chalk should extend below the chin.

- D. The driver dummy and passenger dummy clothes shall be contrasting colors so that the motion of each dummy can be identified during video analysis.
- E. Tires and wheels should be painted with two white perpendicular lines to reveal tire motion.

**9.3 VEHICLE AND DUMMY PHOTOGRAPHIC COVERAGE (REAL-TIME)**

- A. A real-time camera (24-30 fps) shall be used to document the pre-test and post-test condition of the test vehicle in addition to the pre-test and post-test positions of the test dummies, including, but not limited to, the placement of the lap and shoulder belts. The positions of the belt load cells shall be documented along with the tape supports for the shoulder belt load cells. **Particular attention must be exercised to fully document the proper closing of all vehicle doors, including any rear hatchback or tailgate.**

- B. The removal, installation and tightening of the vehicle's fuel filler cap and the cap's rotation to its locked position by Contractor's personnel will be documented. This video footage shall appear in the final released movie print to show that the filler cap was properly installed and tightened prior to the crash test.

The real-time camera (24-30 fps) shall be used to record any Stoddard solvent spillage from the test vehicle after the impact event or during the static rollover test.

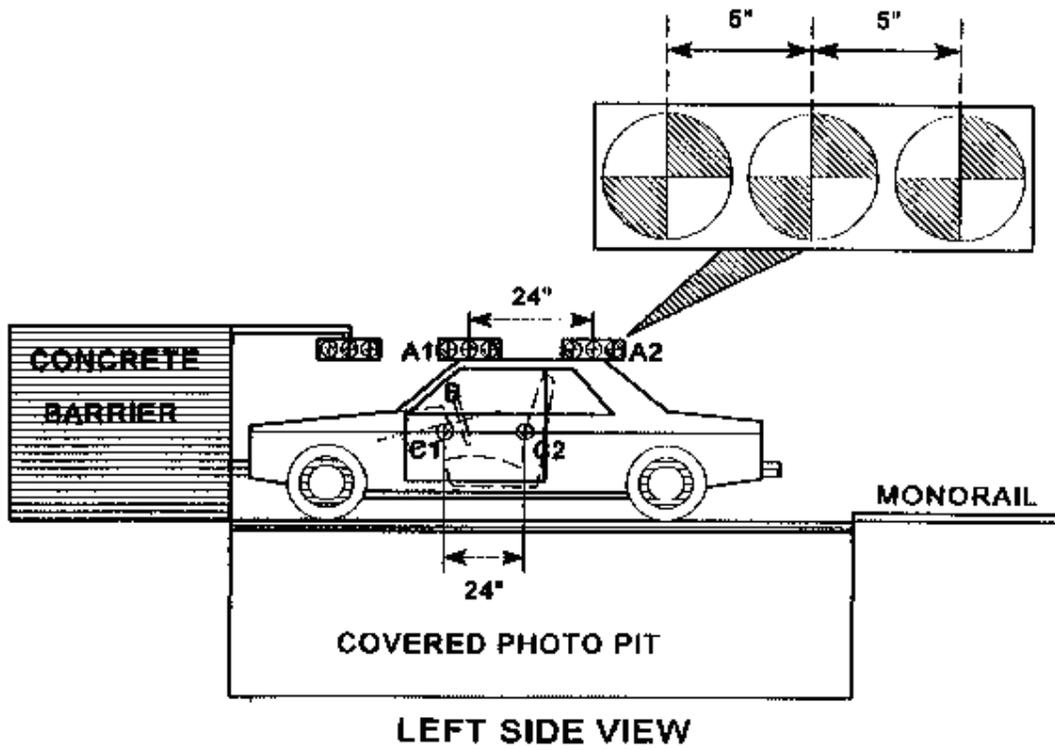
#### 9.4 *IMPACT EVENT MARKERS*

Strobe lights or taped photoflash bulbs (cloth tape on bulb exterior to form small slit for light passage) shall be placed in the field-of-view of all cameras to mark the beginning (time zero) of the crash test. Light from the impact detectors **SHOULD NOT COVER MORE THAN 3 FRAMES OF HIGH-SPEED VIDEO**. Suggested locations for impact detectors or “time zero” markers are as follows:

- A. Vehicle's roof panel along longitudinal centerline above windshield header
- B. Top surface of vehicle's instrument panel along longitudinal centerline
- C. Adjacent to engine oil pan
- D. Adjacent to vehicle's fuel tank

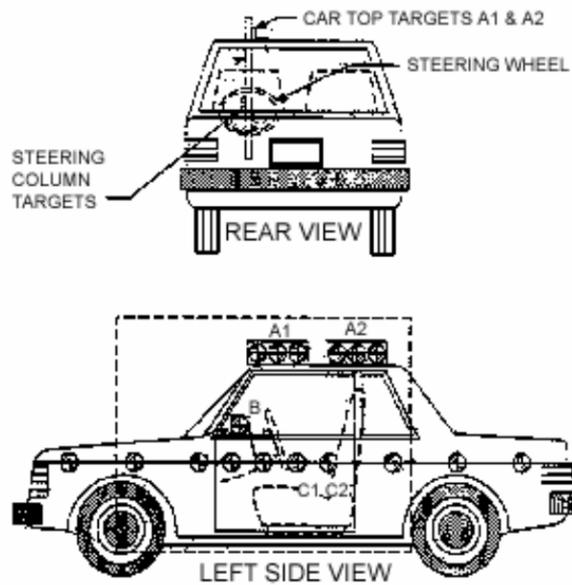
#### 9.5 *PHOTOGRAPHIC TARGETS AND TAPE FOR TEST VEHICLE*

### REFERENCE PHOTO TARGETS



LEFT SIDE VIEW  
Figure 3 - Reference Photo Targets

PHOTOGRAPHIC DOCUMENTATION... Continued



REAR VIEW  
LEFT SIDE VIEW  
Figure 4 - Reference Photo Targets, Cont'd

- A. Reference photographic targets shall be rigidly mounted on the test vehicle and attached to the barrier assembly as shown in **Figures 3 and 4**. The primary moving reference targets A1 and A2 **MUST BE** mounted 24 inches (609.6mm) apart on a flat rectangular panel, and be firmly fixed to a structure of the vehicle that remains undisturbed by the crash, such as the vehicle roof. The panel must be in the same plane as the plane of motion. The setup rotation of the panel within the motion plane is unimportant. To ensure against unexpected displacements of the car top, the backup moving reference targets C1 and C2 should also be attached to undisturbed portions of the vehicle, such as the vehicle door or body, and must also be 24 inches (609.6mm) apart.
- B. 1-inch wide checkerboard tape should be applied down the center of the vehicle, including top of hood, roof, and deck lid. Also apply tape down both sides of vehicle approximately 4 inches above wheel opening.
- C. Photographic targets should be placed at 12” intervals along the side of the vehicle along the 1-inch tape. Target placement should be documented.
- D. Stadia poles or similar fixed ground reference targets are to be positioned vertically from the roadway surface on the driver and passenger sides of the vehicle (in the camera view, and at about door midpoint), to assist in high speed video evaluation of the event.
- E. The dummies shall have targets on each side of the head with the center of the target as close as possible to the center of gravity of the head in the x and z direction (relative to the measuring directions of the accelerometers). Targets shall be placed on the outboard shoulder of each dummy. Cut away a section of the sleeve (do not remove the sleeve) of the dummy and place the target as high up on the arm as possible at the intersection of the arm and the shoulder.
- F. The top portion of the steering wheel shall have tape with 1-inch squares (the squares having alternating colors such as black and yellow) placed on it.

#### 9.6 *TARGET VEHICLE INFORMATION PLACARDS*

Vehicle identification placards shall be positioned so that at least 1 placard will be visible in the field-of-view for each of the high speed cameras. The following information will be shown:

- Vehicle's NHTSA Number
- The words “NCAP 35 MPH FRONTAL”
- Date of crash test
- Vehicle year, make and model

**NOTE: The name of the test laboratory should not be present on any vehicle placards used in photos and videos submitted to NHTSA.**

9.7 *DOCUMENTATION VIDEO TITLE AND SEQUENCE*

The pre-and post-test real-time documentation video shall include the following title frames:

- A. “The following 35 mph frontal barrier impact test was conducted under contract with the National Highway Traffic Safety Administration by (name and location of test laboratory)”

35 MPH FRONTAL BARRIER IMPACT TEST  
 TEST VEHICLE MODEL YEAR, MAKE AND MODEL  
 NHTSA No. CXXXXX  
 DATE OF IMPACT EVENT  
 CONTRACT NO.: DTNH22-9X-X-XXXXX

- B. The ending frame shall state “THE END”

9.8 *DOCUMENTATION VIDEO RECORDING AND EDITING*

The video shall be recorded and edited in the following sequence:

- A. Title
- B. Pre-test Coverage (at barrier)
- a. Left side of vehicle (pan from front to rear of vehicle)
  - b. Right side of vehicle (pan from front to rear of vehicle)
  - c. View of gas cap being removed and correctly replaced
  - d. Left side view of vehicle interior and driver dummy (with vehicle door open)
  - e. Right side view of vehicle interior and passenger dummy (with vehicle door open)
  - f. Frontal view looking through windshield at both dummies
  - g. Cycling of airbag indicator light
  - h. Door closings
- C. Real-Time Pan Coverage
- D. Post test Coverage
- a. Left side of vehicle (pan from front to rear of vehicle, including footage of vehicle’s front end damage)
  - b. Driver dummy post-test positioning (close up with door closed)
  - c. Right side of vehicle (pan from front to rear of vehicle, including footage of vehicle’s front end damage)
  - d. Passenger dummy post-test positioning (close up with door closed)
  - e. Frontal view looking through windshield at both dummies
  - f. Left side view of vehicle interior and driver dummy (as technician opens vehicle door)
  - g. Right side view of vehicle interior and passenger dummy (as technician opens vehicle door)

- E. Rotating Fixture Coverage (a minimum 10 seconds “burst” during 0 to 90 degree roll)
  - a. View of Rollover – 0 degrees
  - b. View of Rollover – 90 degrees
  - c. View of Rollover – 180 degrees
  - d. View of Rollover – 270 degrees
  - e. View of Rollover – 360 degrees
- F. If applicable, any fuel system, windshield, seat back, or other vehicle failures or testing anomalies. If the contractor has concerns about whether a test issue should be included, please contact the COTR.
- G. “The End”

### 9.9 STILL PHOTOGRAPHS

Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken to document the test. A target vehicle information placard, identifying the test vehicle model as well as the NHTSA number, along with an indication of whether the photo was taken pre-test or post-test, shall appear in each photograph and be legible. A time/date stamp on each photo is also highly recommended. Each photograph shall also be labeled when transferred to the FTP site as part of the QuickLook data. In addition, the photos should be labeled in **Appendix A** of the final test report and on the final CD provided to NCAP. A list of photographs with their labeling convention can be found in **Section 3** of **Appendix N**.

## 10. DEFINITIONS

The contractor shall check the Code of Federal Regulations for the most recent definitions. A citation is provided after each definition not specified in Standard 208.

- A. **Automatic-locking retractor:** A retractor incorporating adjustment hardware by means of a positive self-locking mechanism which is capable when locked of withstanding restraint forces. (571.209, S3)
- B. **Designated seating capacity:** The number of designated seating positions provided. (571.3)
- C. **Designated seating positions:** Any plan 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. Any bench or split-bench seat in a passenger car, truck or multipurpose passenger vehicle with a GVWR less than 4,586 kilograms (10,000 pounds), having greater than 127 centimeters (50 inches) of hip room (measured in accordance with SAE Standard J1100 (a)) shall have not less than three seat designated seating positions, unless the set design or vehicle design is such that the center position cannot be used for seating. For the sole purpose of determining the classification of any vehicle sold or introduced into interstate commerce for purposes that include carrying students to and from school or related events, any location in such

vehicle intended for securement of an occupied wheelchair during vehicle operation shall be regarded as four designated seating positions. (571.3)

- D. **Emergency-locking retractor:** A retractor incorporating adjustment hardware by means of a locking mechanism that is activated by vehicle acceleration, webbing movement relative to the vehicle, or other automatic action during an emergency and is capable when locked of withstanding restraint forces. (571.209, S3)
- E. **Fixed Collision Barrier:** A flat, vertical, unyielding surface with the following characteristics:
  1. The surface is sufficiently large that when struck by a tested vehicle, no portion of the vehicle projects or passes beyond the surface,
  2. The approach is horizontal surface that is large enough for the vehicle to attain a stable attitude during its approach to the barrier, and that does not restrict vehicle motion during impact,
  3. When struck by a vehicle, the surface and its supporting structure absorb no significant portion of the vehicle's kinetic energy, so that a performance requirement described in terms of impact with a fixed collision barrier must be met no matter how small an amount of energy is absorbed by the barrier. (571.3)
- F. **Fuel Spillage:** The fall, flow, or run of fuel from the vehicle but does not include wetness resulting from capillary action (571.301, S3)
- G. **Gross axle weight rating or GAWR:** The value specified by the vehicle manufacturer as the load-carrying capacity of a single axle system as measured at the tire-ground interfaces (571.3)
- H. **Gross vehicle weight rating or GVWR:** The value specified by the manufacturer as the loaded weight of a single vehicle. (571.3)
- I. **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, "Manikins for Use in Defining Vehicle Seating Accommodations," November 1962 (571.3)
- J. **Longitudinal or longitudinally:** Parallel to the longitudinal centerline of the vehicle. (571.3)
- K. **Outboard designated seating position:** A designated seating position where a longitudinal vertical plane tangent to the outboard side of the seat cushion is less than 12 inches from the innermost point on the inside surface of the vehicle at a height between the design H-point and the shoulder reference point (as shown in fig. 1 of Federal Motor Vehicle Safety Standard No. 210) and longitudinally between the front and rear edges of the seat cushion. (571.3)
- L. **Overall vehicle width:** The nominal design dimension of the widest part of the vehicle, exclusive of signal lamps, marker lamps, outside rearview mirrors, flexible fender extensions, and mud flaps, determined with doors and windows closed and the wheels in the straight-ahead position. (571.3)
- M. **Rated cargo and luggage capacity weight (RCLW):** RCLW = vehicle capacity weight – (68 kg x designated seating capacity) Maximum RCLW used in testing a truck, MPV, or bus is 136 kg.
- N. **Seating reference point (SgRP):** The unique design H-point, as defined in SAE J1100 (June 1984), which:

1. Establishes the rearmost normal design driving or riding position of each designated seating position, which includes consideration of all modes of adjustment, horizontal, vertical, and tilt, in a vehicle;
  2. Has X, Y, and Z coordinates, as defined in SAE J1100 (June 1984), established relative to the designed vehicle structure;
  3. Simulates the position of the pivot center of the human torso and thigh; and
  4. Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in SAE J826 (May 1987), or, if the drafting template with the 95<sup>th</sup> percentile leg cannot be positioned in the seating position, is located with the seat in its most rearward adjustment position. (571.3)
- O. **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.
- P. **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.
- Q. **Telltale:** A display that indicates the actuation of a device, a correct or defective functioning or condition, or a failure to function. (571.101, S4)
- R. **Type 1 seat belt assembly:** A lap belt for pelvic restraint (571.209 S3)
- S. **Type 2 seat belt assembly:** A combination of pelvic and upper torso restraints (571.209 S3)
- T. **Unloaded vehicle weight:** The weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but without cargo, occupants, or accessories that are ordinarily removed from the vehicle when they are not in use. (571.3)
- U. **Vehicle capacity weight:** The rated cargo and luggage load plus 68 kilograms times the vehicle's designated seating capacity. (571.110, S3)
- V. **Vehicle fuel tank capacity:** The tank's unusable capacity (i.e., the volume of fuel left at the bottom of the tank when the vehicle's fuel pump can no longer draw fuel from the tank) plus its usable capacity (i.e., the volume of the fuel that can be pumped into the tank through the filler pipe with the vehicle on a level surface and with the unusable capacity already in the tank). The term does not include the vapor volume of the tank (i.e., the space above the fuel tank filler neck) nor the volume of the fuel tank filler neck. (571.3)
- W. **Windshield trim:** Molding of any material between the windshield glazing and the exterior roof surface, including material that covers a part of either the windshield glazing or exterior roof surface. (571.216, S3)

## 11. TEST EXECUTION

### 11.1 TEST VEHICLE PREPARATION

#### A. TEST VEHICLE INFORMATION

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

applicable data sheet.

1. Model Year, make, model and body style
2. Body Color and VIN
3. NHTSA No. (supplied by COTR)
4. Build date (or month and year of manufacture)
5. Engine data – Number of cylinders, displacement (CID, liters or cc) and placement (longitudinal or lateral)
6. Transmission Data – Number of speeds, manual or automatic and whether it is equipped with overdrive
7. Final Drive – rear, front or four-wheel drive
8. Current odometer reading
9. Safety Restraints – List and describe all available front occupant restraints
10. Options – List major options

**B. TIRE DATA RECORDED FROM FMVSS 110 VEHICLE PLACARD OR OPTIONAL TIRE INFLATION PRESSURE LABEL**

Record the following information onto the applicable data sheet:

1. Recommended tire size
2. Recommended cold tire pressure
3. Number of occupants
4. Vehicle Capacity Weight (VCW)

**C. DATA RECORDED FROM TIRE SIDEWALL**

Record the following information onto the applicable data sheet:

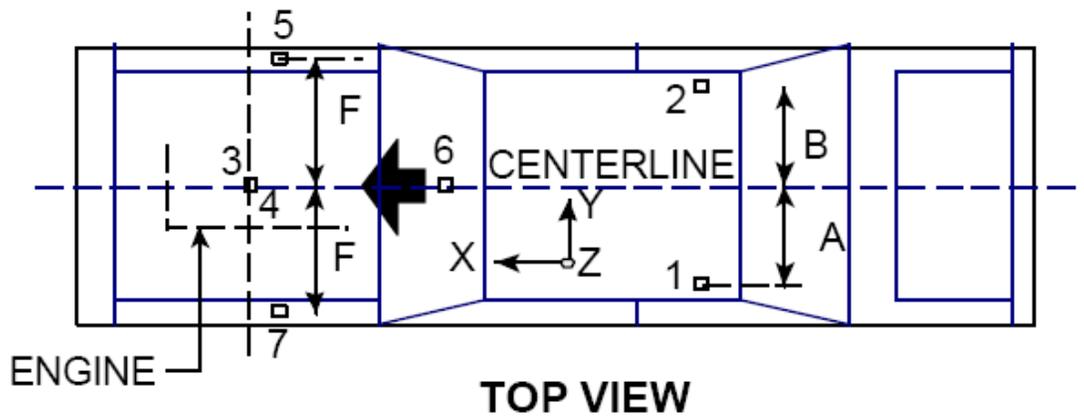
1. Size of tires (Verify that the tire size(s) meet the manufacturer's specification as listed on the vehicle placard or optional tire label.)
2. Tire Manufacturer
3. Tire Pressure for maximum load carrying capacity (Verify that this pressure exceeds or is equal to the recommended cold tire pressure listed on the vehicle placard.)
4. Treadwear, traction, and temperature ratings

**D. SEAT TYPE**

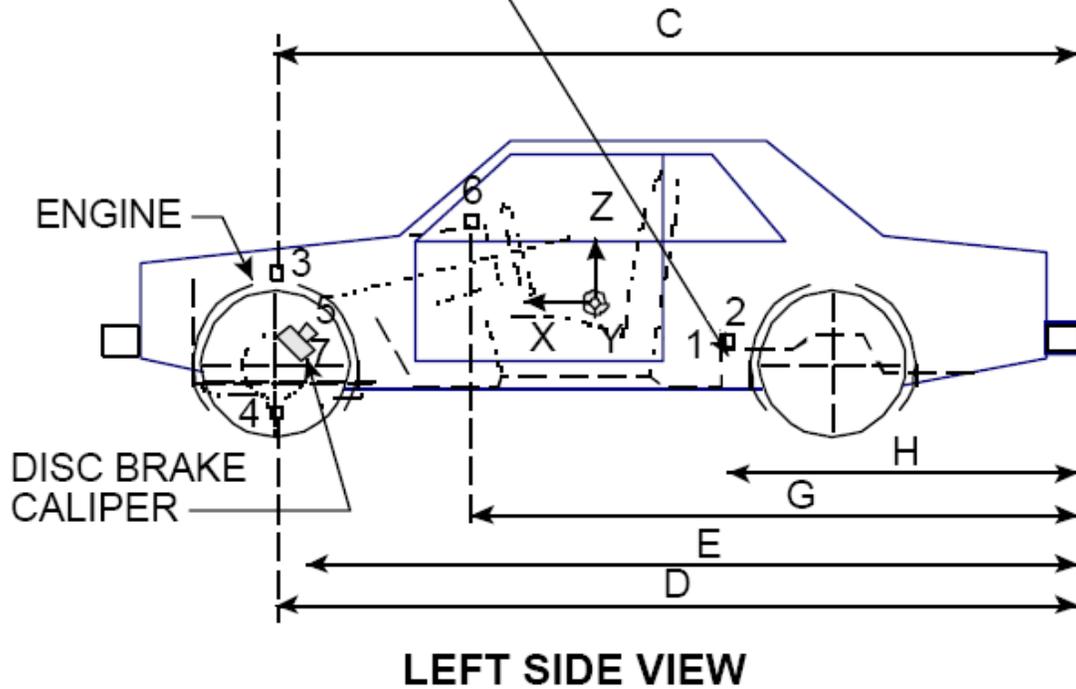
Record the following information onto the applicable data sheet. Visually inspect the seat to verify seat type.

1. Type of front seat – bucket, bench, or split bench
2. Type of front seat back – fixed or adjustable with lever or knob
3. Type of rear seat – bucket, bench or split bench
4. Type of rear seat back – fixed or adjustable with lever or knob

E. VEHICLE ACCELEROMETERS



REAR SEAT CUSHION  
ASSY. FRONT ATTACHMENT  
BRACKET SUPPORT



**Figure 5 - Vehicle Accelerometer Locations**

F. Place the following accelerometers in the test vehicle according to Figure 5. Record coordinates and accelerometer responses on the applicable data sheet.

1. **Left Rear Seat Crossmember:** Accelerometers mounted on the left rear seat

crossmember to measure Ax, redundant Ax, and Az.

2. **Right Rear Seat Crossmember:** Accelerometers mounted on the right rear seat crossmember to measure Ax, redundant Ax, and Az.
3. **Top of Engine:** One uniaxial accelerometer mounted on the top of the engine block to measure Ax.
4. **Bottom of Engine:** One uniaxial accelerometer mounted on the bottom of the engine block to measure Ax.
5. **Right Front Disc Brake Caliper:** Not currently collected.
6. **Center of Instrument Panel:** Not currently collected
7. **Left Front Disc Brake Caliper:** Not currently collected

**NOTE:** *The location of the accelerometers as well as the acceleration versus time output shall be recorded and included in the final test report and tape/disk.*

#### G. AS DELIVERED VEHICLE WEIGHT CONDITION

1. Fill the transmission with transmission fluid to full capacity.
2. Drain fuel from vehicle.
3. Run the engine until fuel remaining in the fuel delivery system is used and the engine stops.
4. Record the useable fuel tank capacity supplied by the COTR.
5. Record the fuel tank capacity supplied by the owner's manual.
6. 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," or gasoline, fill the fuel tank. Record the amount.

**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.*

7. Fill the coolant system to capacity.
8. Fill the engine with motor oil to the max. mark on the dip stick.
9. Fill the brake reservoir with brake fluid to its normal level.
10. Fill the windshield washer reservoir to capacity.
11. 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 on the applicable data sheet.
12. Record the vehicle weight at each wheel to determine the **As Delivered** or **Unloaded Vehicle Weight (UVW)** condition, which is found by totaling the weight recorded at each of the four wheels.

H. VEHICLE ATTITUDE MEASUREMENTS – **AS DELIVERED** or **UVW**

1. With the vehicle in the **As Delivered/UVW** weight condition, place it on a flat, level surface.
2. Mark a point on each vehicle body above the center of each wheel.
3. Measure the perpendicular distance from the level surface to the four (4) points marked on the vehicle and record each.

I. CALCULATION OF VEHICLE TARGET TEST WEIGHT

1. Calculate the **Rated Cargo and Luggage Weight (RCLW)** as follows:

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

2. Record **VCW** on the data sheet, where **VCW** = Vehicle capacity weight from the vehicle placard.
3. Record the **DSC** on the data sheet, where **DSC** = Designated seating capacity as indicated on the vehicle placard.
4. Record **RCLW** on the applicable data sheet. **FOR TRUCKS, MPVs, OR BUSES – If the RCLW calculated above is greater than 136 kg, use 136 kg as the RCLW.**
5. Calculate the **Test Vehicle Target Weight** by adding the **As Delivered** weight, the **RCLW**, and the total actual weight of the dummies. Record on the applicable data sheet.

J. **FULLY LOADED** VEHICLE WEIGHT CONDITION

1. With the vehicle in the **As Delivered/UVW** condition, load the vehicle with 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 dummies in the appropriate front outboard seating positions.
3. Record the vehicle weight at each wheel to determine the **Fully Loaded** weight.

K. VEHICLE ATTITUDE MEASUREMENTS – **FULLY LOADED** WEIGHT CONDITION

1. With the vehicle in the **Fully Loaded** weight condition, place it on a flat, level surface.
2. Measure the perpendicular distance from the level surface to the four (4) points previously marked on the vehicle and record each.

## L. AS TESTED VEHICLE WEIGHT CONDITION

1. With the test vehicle in the **Fully Loaded** test weight condition, drain the fuel system and operate the engine until the fuel system is dry.

**NOTE:** *The removal process must prevent solvent contact with substances which may be soluble in the Stoddard solvent. (i.e. undercoating, paints used for identifying under-vehicle components, etc.).*

2. Slowly refill the entire fuel system with Stoddard solvent which has been dyed purple, 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."
3. Fill the tank to 93 percent ( $\pm 1\%$ ) of usable capacity. Crank the engine to fill the fuel delivery system with Stoddard solvent.
4. Drain transmission fluid, engine coolant, motor oil, and windshield washer fluid from the test vehicle so that Stoddard solvent leakage from the fuel system will be evident.
5. Remove **RCLW** from the cargo area.
6. Load the vehicle with the appropriate dummies (if not already present) necessary onboard test equipment (including all instrumentation boxes, cameras, lighting, etc.) Secure the equipment in the load-carrying area and distribute it, as nearly possible, to obtain the proportion of axle weight indicated by the gross axle weight ratings and center it over the longitudinal centerline of the vehicle.
7. Calculate the **Target Vehicle Test Weight (TVTW)** range as follows:

Calculated Weight = **As Delivered/UVW** + **RCLW** + (Total Weight of Dummies)

**Maximum Test Vehicle Target Weight (TVTW) = Calculated Weight - 4.5 kg**

**Minimum Test Vehicle Target Weight (TVTW) = Calculated Weight - 9 kg**

The **As Tested** weight should fall as follows:

$TVTW-9.0kg \leq \text{As Tested weight} \leq TVTW-4.5kg$

8. Record the vehicle weight at each wheel. 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 manufacturer's data provided by the COTR.
9. On the data sheet, record the weight of the added ballast, if any.
10. On the data sheet, record the weight of each vehicle component that was removed.

**NOTE:** *If the calculated **TEST VEHICLE TARGET WEIGHT (TVTW)** is exceeded, the Contractor should consult the vehicle setup information to determine which parts, if any, have been suggested for removal. The*

*Contractor **must** notify the COTR to confirm the removal of vehicle components. If no components were provided with the vehicle setup information, the Contractor must also contact the COTR for guidance about parts removal. Under no circumstances shall the **As Tested** weight be greater than the maximum **Test Vehicle Target Weight**.*

M. VEHICLE ATTITUDE MEASUREMENTS – **AS TESTED** WEIGHT CONDITION

1. With the vehicle in the **As Tested** weight condition, place it on a flat, level surface.
2. Measure the perpendicular distance from the level surface to the four (4) points previously marked on the vehicle and record each.

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

N. SEAT ADJUSTMENT REFERENCE MARKS

Prior to placing the dummies in the front seating positions, consult **Appendix F** of this document for a check list pertaining to the proper procedures.

O. SETTING THE SEATS

Prior to setting the front seating positions, consult **Appendix F** of this document for a check list pertaining to the proper procedure.

P. ADJUSTABLE HEAD RESTRAINTS

Prior to adjusting the head restraints, consult **Appendix F** of this document for a check list pertaining to the proper procedure.

Q. STEERING WHEEL ADJUSTMENT

Consult **Appendix F** of this document for a check list pertaining to the proper procedure for adjusting the steering wheel.

R. ADJUSTABLE ARMRESTS

Place any adjustable armrest in the retracted position.

S. ADJUSTABLE BELT ANCHORAGES

1. **50<sup>th</sup> Male Dummy** – Place adjustable anchorages in the nominal adjustment position in accordance with the manufacturer’s data supplied by the COTR.
2. **5<sup>th</sup> Female Dummy** – Place adjustable anchorages in the nominal adjustment

position in accordance with the manufacturer's data supplied by the COTR.

#### T. WINDOWS

1. Place driver and passenger front windows in the fully open position. Place all other windows and vents in the fully closed position unless otherwise specified by the COTR.
2. The windshield mounting material and all vehicle components in direct contact with the mounting material must be at a temperature between 15°F and 110°F. This temperature measurement must be made within 15 minutes of the impact test event.
3. Adjustable cowl tops or other adjustable panels in front of the windshield are in the position used under normal operation during inclement weather.

#### U. SUNROOF

Place sunroof(s) in the full closed position.

#### V. DOOR LOCKS

Vehicles without automatic door locks should remain unlocked during the event. If the vehicle has automatic door locks (ADLs), they will also remain unlocked UNLESS the equipment is standard **and** the dealer is the only entity that can deactivate the system.

**NOTE: If there are any instructions in the owner's manual describing how a consumer may deactivate the ADLs, the vehicle *must be left unlocked during the event.***

#### W. CONVERTIBLE TOPS

Place convertible tops in the closed passenger compartment configuration.

#### X. DOORS

1. Place all doors, hatchback or tailgate, in the fully closed and latched position. Check instrument panel telltales just prior to ensure that all doors and hatches are closed. Do not lock any door, hatchback, or tailgate.
2. Before performing the act of door closing, knowledge of the door configuration and operation must be acquired (from test vehicle preparation data submitted by vehicle manufacturer). Particular care must be exercised to close doors with 2-stage (primary and secondary) latch systems.
3. Confirm that all doors are properly closed by checking indicators in vehicle instrument panel if so equipped. Also, as indicated in Section 9.7 of this document, a full documentation of door closings with a real-time camera should be included as part of the documentation movie.

## Y. TRANSMISSION ENGAGEMENT

1. **Manual Transmission** – Place manual transmissions in neutral.
2. **Automatic Transmission** – Place automatic transmissions in neutral.

## Z. PARKING BRAKE DISENGAGEMENT

Disengage the parking brake.

## AA. IGNITION SWITCH

The key shall be in the ignition and switched to the “ON” position. Check to ensure that the “Airbag Readiness Indicator” shows the airbag system as being functional.

## BB. LAP AND SHOULDER BELT LOAD CELLS

1. Load cells, if allowed by the vehicle manufacturer per the provided Form 1, shall be mounted on the front outboard lap and shoulder belts (4 load cell units required). Attachment of load cells shall not affect seat belt positioning or function in any way.
2. **Lap Belt Units:** The lap belt load cells shall be positioned on the belt webbing so as to avoid contact with any objects other than the lap belt to which they are attached.
3. **Shoulder Belt Units:** The shoulder belt load cells shall be mounted immediately behind the dummy's outboard shoulder according to the distance provided by the COTR via the vehicle's setup information (Form1) such that during the frontal crash test, they do not come in contact with anything other than the belt to which they are attached.
4. Each load cell shall be suspended by a support such as masking tape so that the weight of the load cell does not introduce any slack into the belt system as the test vehicle travels down the tow road. The tape should be strong enough to carry the load cell's weight, but not strong enough to affect belt stretch or loading. Normally, if 1-inch wide tape is used, a tear across the tape approximately ¾-inch long at the center suspension point between the load cell and the vehicle's inner roof rail will be sufficient to ensure that an immediate break-away condition will exist at the moment of barrier impact.

**NOTE:** *If a mounting distance from the D-ring is not provided along with the vehicle setup information (Form 1), contact the COTR for instructions on whether or not to run the test with any shoulder belt load cells.*

## 11.2 TEST DUMMY PREPARATION, POSITIONING, AND PLACEMENT

- A. Place a properly clothed and calibrated 50<sup>th</sup> percentile male (in accordance with **Appendix A**) and a properly clothed and calibrated 5<sup>th</sup> percentile female (in accordance with **Appendix B**) in the front outboard seating positions in accordance with **Appendix F**, “DRIVER AND PASSENGER DUMMY SEATING AND POSITIONING

PROCEDURES.”

- B. Document the final positions of the dummy after it is seated in the test vehicle by taking the following measurements (accurate to  $\pm 3$  mm). Record measurements on the applicable data sheet.

### DUMMY MEASUREMENT FOR FRONT SEAT PASSENGERS

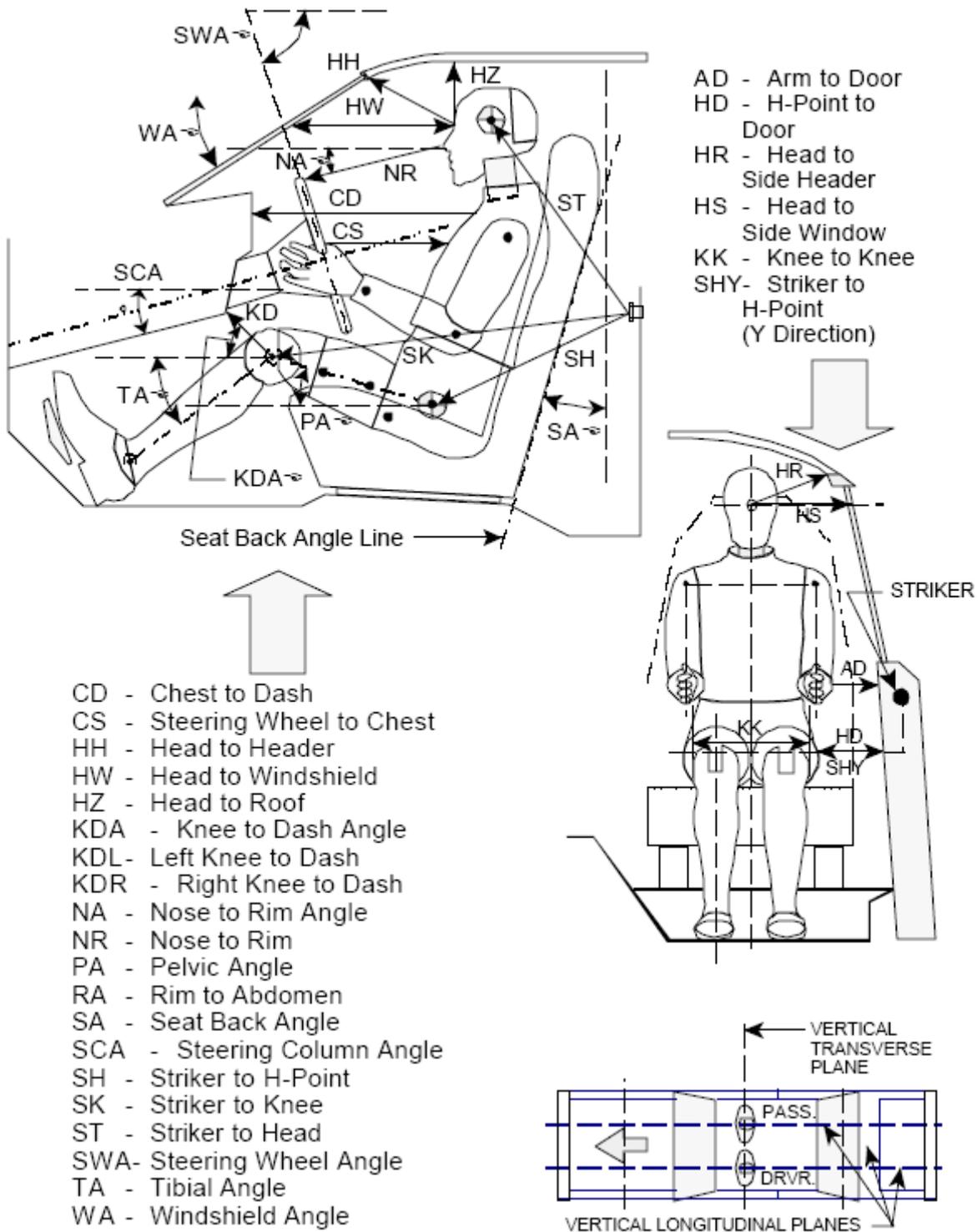


Figure 6 - Dummy Measurements for Front Seat Passengers

C. DUMMY LONGITUDINAL CLEARANCE DIMENSIONS (see **Figure 6** and any additional diagrams that may be included)

The following measurements are to be made within a vertical longitudinal plane:

1. **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.
2. **HW - Head to Windshield** - Taken from the point where the dummy's nose meets his forehead (between his eyes) to a point on the windshield. Use a level.
3. **HZ - Head to Roof** - Taken from the point where the dummy's nose meets his forehead (between his eyes) to the point on the roof directly above it. Use a level.
4. **CS- Steering Wheel to Chest** - Taken from the center of the steering wheel hub to the dummy's chest. Use a level.
5. **CD - Chest to Dash** - Place a tape measure on the tip of the dummy's chin and rotate five inches of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Measure 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.



i. CD, Chest to Dash, 1



ii. CD, Chest to Dash, 2

6. **RA - Steering Wheel Rim to Abdomen** - Taken from the bottommost point of the steering wheel rim horizontally rearward to the dummy. Use a level.
7. **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, the **Nose to Rim Angle, NA** (see below).
8. **KDL, KDR - Left and Right Knees to Dashboard**\*<sup>1</sup> - 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 to Dash Angle, KDA**.



iii. KDL/KDR, Knee to Dash Left, Right

9. **SH, SK, ST - Striker to H-Point, Knee, and Head** - These measurements are 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, outer knee bolt, and head target. When taking this measurement a firm device that can be rigidly connected to the striker should be used. Use a level. The angles of these measurements with respect to the horizontal should also be recorded. The measurement in the Y (transverse) direction from the striker to the H-point, designated **Striker to H-Point, SHY** (see below) should also be taken.



**iv. SH, Striker to H-Point, 1**



**v. SH, Striker to H-Point, 2**



vi. SK, Striker to Knee, 1



vii. ST, Striker to Knee, 2



**viii. ST, Striker to Head**

The following measurements are to be made within a vertical transverse plane:

1. **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 that allows a level measurement. Use a level.



**ix. HS, Header to Side Window**

2. **AD - Arm to Door** - Taken from the outer surface of the elbow pivot bolt on a Hybrid II dummy to the first point it hits on the door. In the case of a Hybrid III dummy, measure from the bolt on the outer biceps. When a SID is used make the measurement from the center of the bottom of the arm segment where it meets the dummy's torso.
3. **HD - H-point to Door**, taken from the H-point on the dummy to the closest point on the door. Use a level.
4. **HR - Head to Side Header**, measure the shortest distance from the point where the dummy's nose meets his forehead (between his eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.
5. **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.



x. SHY, Striker to H-Point Y-Direction

6. **KK - Knee to Knee** - For Hybrid III dummies measure the distance between the outboard knee clevis flange surfaces. (This measurement may not be exactly transverse)

The following angles are to be measured and recorded:

1. **SA - Seat Back Angle** - Find this angle using the instructions provided by the COTR via the manufacturer. If the manufacturer instructions aren't clear enough contact the COTR.
2. **PA - Pelvic or Femur Angle** - Taken by inserting the pelvic angle gauge into the H-point gauging hole on the Hybrid III dummies and taking this angle with respect to the horizontal.
3. **SWA - Steering Wheel Angle** - Find this angle by placing a straight edge against the steering wheel rim along the longitudinal plane. Then measure the acute angle of the straight edge with respect to the horizontal.
4. **SCA - Steering Column Angle** - measured with respect to the horizontal by placing an inclinometer on the center of the underside of the steering column.
5. **NA - Nose to Rim Angle** - Measure the angle made when taking the measurement NR with respect to the horizontal.
6. **KDA - Knee to Dash Angle** - Measure the angle that KD is taken at with respect to the horizontal. Only get this angle for the outboard knee.



**xi. KDA, Knee to Dash Angle**

7. **WA - Windshield Angle** - Place an inclinometer along the transverse center of the windshield exterior (measurement is made with respect to horizontal).
8. **TA - Tibia Angle** - Use a straight edge to connect the dummy's knee and ankle bolts. Then place an inclinometer on the straight edge and measure the angle with respect to the horizontal.

- D. All dummy joints should be inspected for mobility prior to each crash test and reset to hold 1G. This amount of friction will just barely restrain the weight of the individual limb when it is extended horizontally.

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***TEST DUMMIES SHOULD BE PLACED IN THE TEST VEHICLE ON THE MORNING OF TEST DAY. DO NOT PLACE THE DUMMIES IN THE VEHICLE THE DAY BEFORE TESTING FOR OVERNIGHT STORAGE.***

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- E. The final positions of the driver and passenger dummies shall be recorded using the appropriate final report data sheet, and the occupant clearances to vehicle interior surfaces dimensions shall be recorded on a separate data sheet.
- F. The dummy calibration procedures are attached as **Appendices A and B**. The calibration data for each dummy used in a vehicle barrier impact test shall be submitted in the preliminary and final test reports. Dummies shall be calibrated before and after every NCAP test. Each calibration should be available electronically (in ASCII format) to the COTR if requested. The post-test calibration obtained after the previous test can be used as the pre-test calibration for a subsequent test as long as the dummy will be used in a frontal test within 8 weeks of that calibration. In the event that a body region exceeds the performance standards required by FMVSS 208, that region on the ATD must be recalibrated. The calibrations and calibration check shall be submitted with the final report. All electronic data collected for all dummy calibrations must be saved and retained up to five years from the test date.
- G. Dummy positioning procedures are detailed in **Appendix F**.
- H. Manufacturer's representatives will be afforded the opportunity to take measurements of the dummies' positions after the dummy positioning procedures are complete. Any deviation from this procedure must be approved by the COTR.
- I. It is recommended that dummies are rotated from one test to another. For example, if two 5<sup>th</sup> female dummies and two 50<sup>th</sup> male dummies have been furnished to the contractor for NCAP testing, the driver and passenger dummies from the previous test will become the auxiliary set. If more than two of each type of dummy is furnished to the contractor, they should be rotated in an analogous manner.
- J. Document the final positions of the dummy after it is seated in the test vehicle by taking the following measurements (accurate to  $\pm 3\text{mm}$ ). Record measurements on the applicable data sheet.

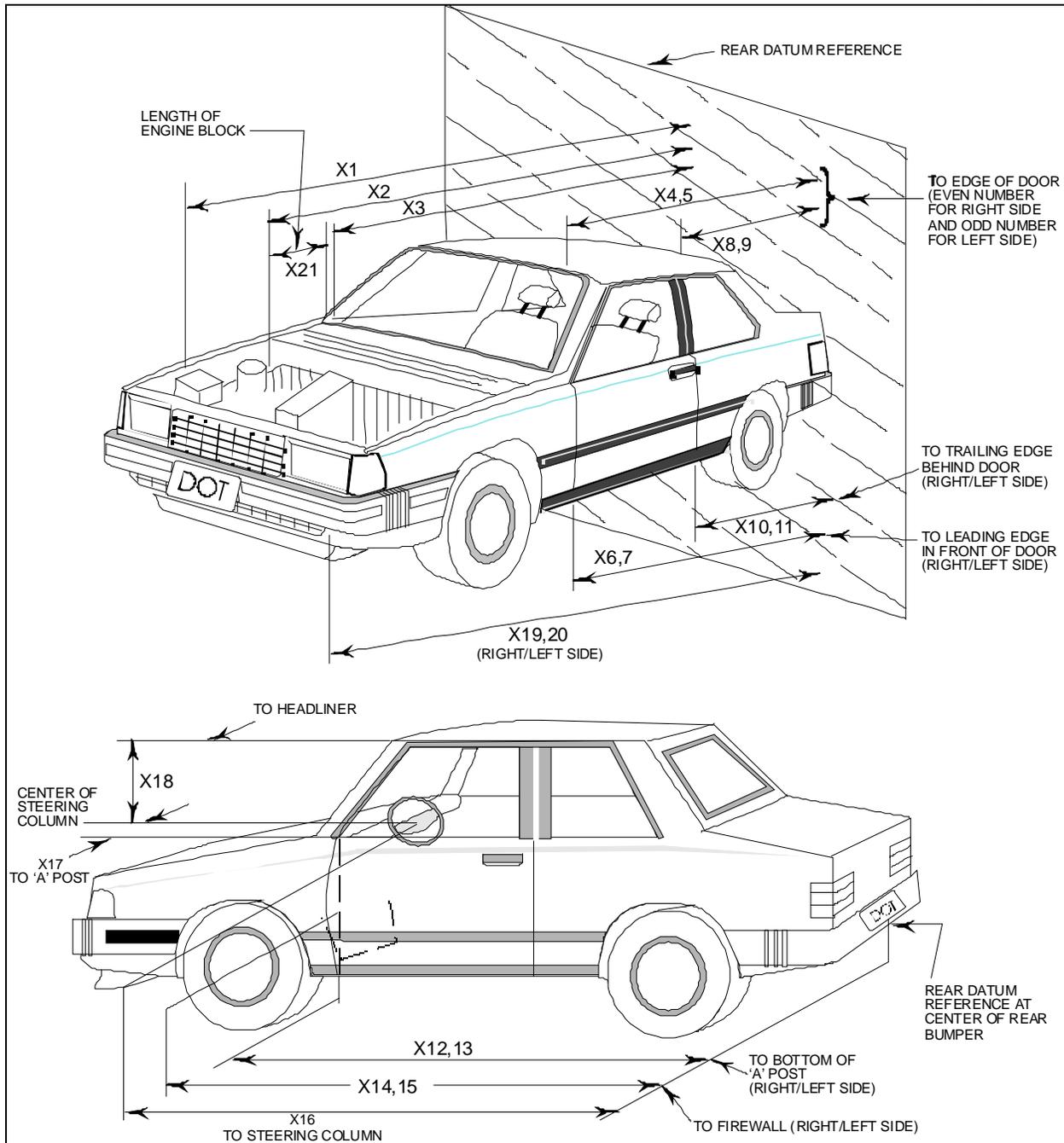
### 11.3 LOAD CELL BARRIER PREPARATION

The fixed barrier shall be instrumented with load cells as seen in **Appendix P** or as per any barrier configuration provided to the contractor by NHTSA.

### 11.4 VEHICLE MEASUREMENTS

#### A. EXTERIOR VEHICLE MEASUREMENTS

1. Establish a fixed reference plane that is perpendicular to the vehicle's longitudinal centerline, as shown in **Figure 9)**
2. Prior to the test, with the vehicle in the "As Tested" configuration, measure and record the dimensions from the fixed reference plane as specified in the applicable data sheet.
3. Post-test, place the vehicle on a flat, level surface. Inflate the test vehicle's tires to maximum cold pressure found on tire placard.
4. Take the same measurements as in step 2. Record on the applicable data sheet.
5. Compute the difference between the measurements taken in steps 2 and 4 and record on the applicable data sheet.

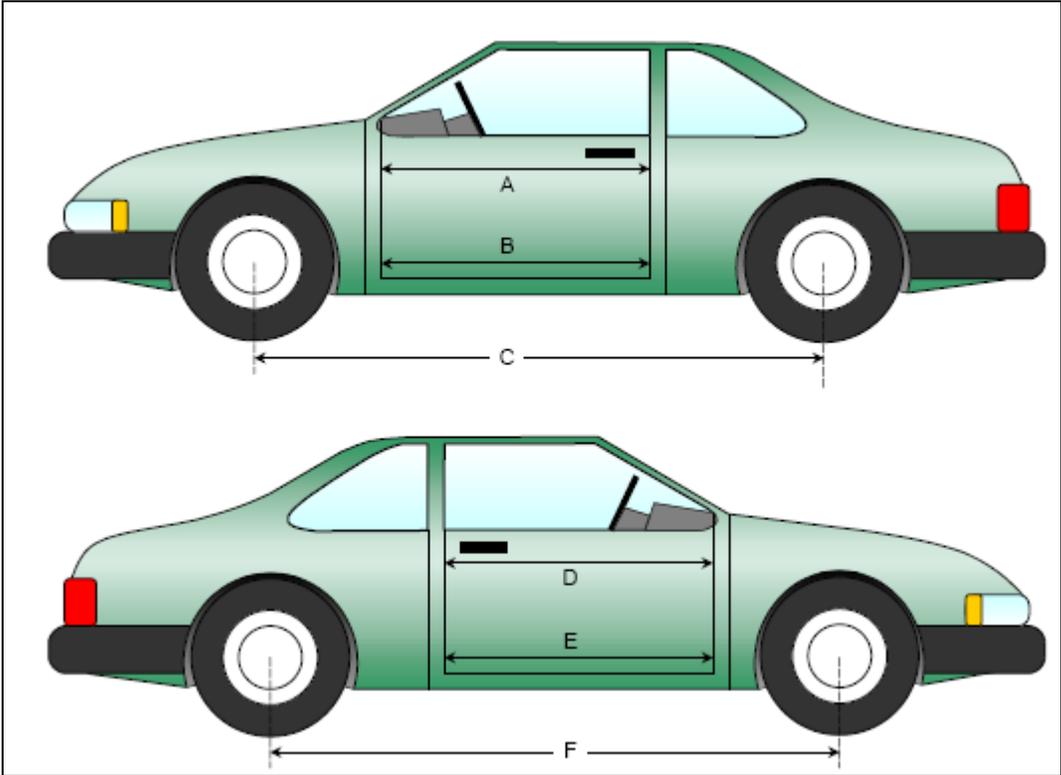


**Figure 7 - Exterior Vehicle Measurements**

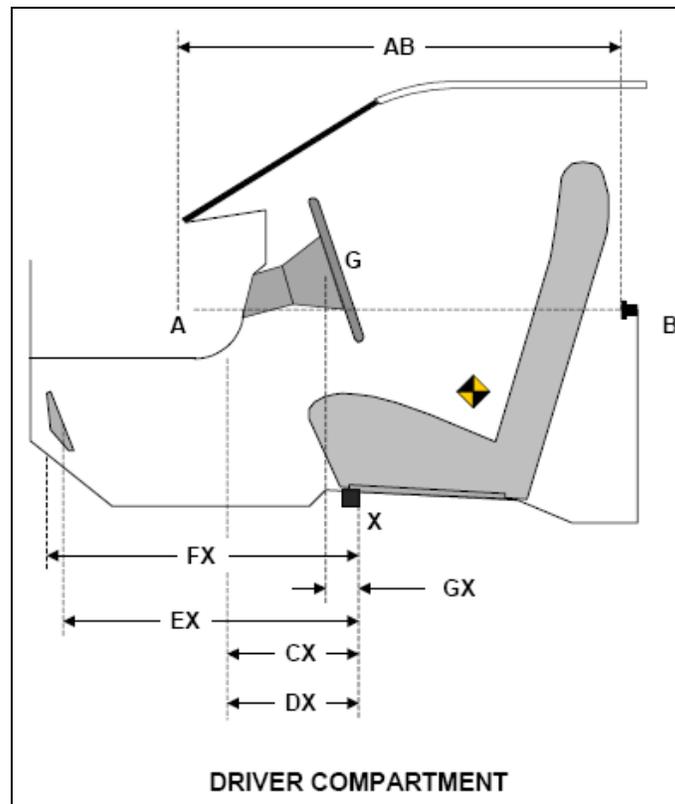
**B. VEHICLE INTRUSION MEASUREMENTS**

1. Prior to the test, record the Door Opening Width, Wheelbase, and Driver Compartment measurements, as shown in **Figures 8** and **9** and on the applicable data sheets.
2. Post-test, repeat the measurements taken in step 1 and record on the data sheets.
3. Compute the difference between the measurements taken in steps 1 and 2. Record

these values on the applicable data sheets.



**Figure 8 - Door Opening Width and Wheelbase Measurements**



**Figure 9 - Driver Compartment Measurements**

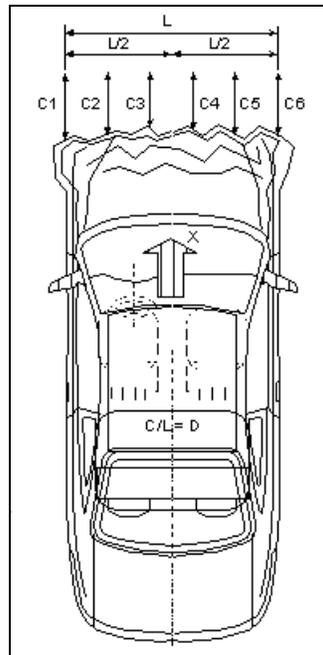
**C. VEHICLE CRUSH MEASUREMENTS**

1. Prior to the test, record L and C1 through C6 as shown in **Figure 10** on the applicable data sheet. L is the damage width, which is found by taking the measurement from bumper corner to bumper corner. Points C1 through C6 can be found by dividing L by 5 equal lengths.
2. Post-test, repeat the measurements taken in step 1 and record.
3. Compute the difference between the measurements taken in steps 1 and 2. Record on the applicable data sheet.

**NOTE: When computing the Collision Deformation Classification:**

Flat frontal =  $12FDEW\mathbf{X}$ ,

where the value for  $\mathbf{X}$  is calculated by taking the longitudinal distance from the tip of the front of bumper to base of the windshield and dividing it into 5 equal zones, with Zone 1 beginning at the bumper. Whatever zone the maximum longitudinal crush reaches into is the number that is reported for  $\mathbf{X}$ . Typically it will be zone “2”, “3”, or “4” in a frontal NCAP test.



**Figure 10 - Vehicle Crush Profile Measurements**

#### D. FMVSS 301/305 STATIC ROLLOVER TESTING

Record the details from the FMVSS 301 static rollover fuel system integrity test on Data Sheets 15 and 16 in **Appendix N**. Electric vehicles evaluated under FMVSS 305 require the contractor to submit a test report under the separate “Laboratory Test Procedure for the New Car Assessment Program Indicant Test for FMVSS No. 305.”

#### E. ELECTRONIC DATA RECORDER (EDR) REMOVAL

Immediately following the test, the contractor shall also remove the Event Data Recorder (EDR) for the vehicle 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.

### 11.5 *ELECTROMAGNETIC INTERFERENCE*

The laboratory shall take all necessary precautions to ensure electromagnetic interference with the test data does not occur. The following vehicle procedures shall be included in those adopted by the laboratory:

- A. Ground the head, thorax, and both femurs of the anthropomorphic test devices. This is accomplished by connecting the four components with a wire. A single wire then exits the dummy and is attached to a grounding block on the vehicle. Connect the grounding block to earth ground. The actual wire size and connections are left to the laboratory based on the system it uses.

## 12. TEST DATA DISPOSITION

The Contractor shall make all crash test data available within two hours of the crash test event if so requested by NHTSA personnel. Under no circumstances shall this data be furnished to non-NHTSA personnel. The Contractor shall analyze the preliminary test results as directed by the COTR.

### 12.1 TEST DATA LOSS

#### A. INVALID TEST DESCRIPTION

The Part 572E and Part 572O 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 35 mph (56 km/h) frontal barrier impact tests for evaluation against FMVSS No. 208 injury criteria and the visual record of dummy kinematics are absolutely essential to NCAP. An invalid NCAP test is one which does not conform precisely to all requirements and/or 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 and specifications of the NCAP Laboratory Test Procedure and Statement of Work applicable to the test, by telephone, within 24 hours of the test and send written notice to the COTR within 48 hours of the test completion.

#### C. RETEST NOTIFICATION

The COTR 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 COTR that a retest is required.

#### D. WAIVER OF RETEST

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

#### E. TEST VEHICLE

NHTSA shall furnish only one vehicle for each test ordered. The Contractor shall furnish the test vehicle required for the retest if it is determined that the contractor is at fault. The retest vehicle shall be equipped as the original vehicle. The original vehicle used in the invalid test shall remain the property of NHSTA, and the retest vehicle shall remain

the property of the Contractor. The Contractor shall retain the retest vehicle for a period not exceeding 180 days if it fails any of the test criteria. If the retest vehicle passes the test, the Contractor may dispose of it upon notification from the COTR that the test report has been accepted.

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### **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 SHALL 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 SPEED TOLERANCE, VEHICLE SEAT CUSHION AND BACK POSITIONING, DUMMY POSITIONING, CORRECT LAP AND SHOULDER BELT POSITIONING, AND TEST DATA ACQUISITION, REDUCTION, AND PROCESSING.**

**THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR OBTAINING USABLE DATA FROM ALL PRIMARY CHANNELS FROM EACH OF THE TWO PART 572 TEST DUMMIES PLACED IN EACH VEHICLE FRONT OUTBOARD DESIGNATED SEATING POSITION (DSP). FAILURE TO PRODUCE SUCH DATA SHALL ALSO BE AT THE EXPENSE OF THE CONTRACTOR AND SHALL INCLUDE VEHICLE REPLACEMENT AND RETEST. 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.**

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#### **F. TEST REPORT**

No test report is required for any test which is determined to be invalid unless NHTSA specifically decides, in writing, to require the Contractor to submit such report. The test data from the invalid test must be safeguarded until the data from the retest has been accepted by the COTR. The report and other required deliverables for the retest vehicle are required to be submitted to the COTR within 2 weeks after completion of the retest. Invalidated test reports will not be publicly released.

#### **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 insure that no data is lost or rendered useless. If some non-critical data (such as camera failure, etc.) and critical data (acceleration and load data) are not obtained for the crash test and the test is accepted by the Agency, the Agency will not pay for the missing or lost data.

12.2 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. 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's   | 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 onboard 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 pre-filtered and should be submitted at a class that is higher

than Class 1000. It 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 onto permanent storage media 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 the most recent version of SAE Recommended Practice J211-1 “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's program manager or engineer 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 to NHTSA.
- I. Reported injury measures in test report shall be made in accordance with ASTM E29-06b, “Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.”
- J. FILTERING REQUIREMENTS:

|                         | Filter Class | Cut-off Frequency |
|-------------------------|--------------|-------------------|
| Head Acceleration       | 1000         | 1650              |
| Neck Forces             | 1000         | 1650              |
| Pelvic Acceleration     | 1000         | 1650              |
| Foot Acceleration       | 1000         | 1650              |
| Chest Acceleration      | 180          | 300               |
| Chest Compression       | 600          | 1000              |
| Femur Forces            | 600          | 1000              |
| Neck Moments            | 600          | 1000              |
| Tibia Forces            | 600          | 1000              |
| Tibia Moment            | 600          | 1000              |
| Nij                     | 600          | 1000              |
| Vehicle Acceleration    | 60           | 100               |
| Load Cell Barrier Loads | 60           | 100               |
| Seat Belt Loads         | 60           | 100               |

- K. As stated previously, the minimum sampling rate requirement is 10,000 samples per second per channel. The Contractor must meet all the requirements in the NHTSA “Data Tape Reference Guide” which is available from the following organization:

U.S. Department of Transportation  
 National Highway Traffic Safety Administration  
 Office of Crashworthiness Standards  
 1200 New Jersey Ave SE  
 Washington, DC 20590

- L. Or search NHTSA’s website for the most updated version of the Data Tape Reference Guide. 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.

- M. Algorithms that are used to calculate the HIC, Nij, 3 millisecond clips of a waveform, and to digitally filter the Class 1000 data collected from the tests, are on the NHTSA web site ([www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)).

Any questions pertaining to the algorithms should be directed to the following organization:

National Highway Traffic Safety Administration  
 Office of Crashworthiness Research  
 Safety Systems Engineering and Analysis Division  
 1200 New Jersey Ave. SE  
 Mail Code: NVS-321  
 Washington, DC 20590  
 Telephone No.: 202-366 4850

**12.3 RECOMMENDED DATA TRACE ORDER**

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

| <b>DRIVER TRACES</b>                 |
|--------------------------------------|
| Head x ,y ,z Acceleration Primary    |
| Head x ,y ,z Acceleration Redundant  |
| Neck x, y, z Force                   |
| Neck x, y, z Moment                  |
| Chest x ,y ,z Acceleration Primary   |
| Chest x ,y ,z Acceleration Redundant |
| Chest Compression                    |
| Pelvic x ,y ,z Acceleration          |

|   |
|---|
| Left Femur Force                            |
| Right Femur Force                           |
| Left Femur Force Redundant (IF EQUIPPED)    |
| Right Femur Force Redundant (IF EQUIPPED)   |
| Left Leg Upper Tibia Moment x               |
| Left Leg Upper Tibia Moment y               |
| Left Leg Upper Tibia Force z (IF EQUIPPED)  |
| Left Leg Lower Tibia Moment x               |
| Left Leg Lower Tibia Moment y               |
| Left Leg Lower Tibia Force z                |
| Right Leg Upper Tibia Moment x              |
| Right Leg Upper Tibia Moment y              |
| Right Leg Upper Tibia Force z (IF EQUIPPED) |
| Right Leg Lower Tibia Moment x              |
| Right Leg Lower Tibia Moment y              |
| Right Leg Lower Tibia Force z               |
| Left Ankle x , z Acceleration               |
| Left Foot z Acceleration                    |
| Right Ankle x , z Acceleration              |
| Right Foot z Acceleration                   |
| Lap Belt Force                              |
| Shoulder Belt Force                         |

|  |
|--|
| <b>PASSENGER TRACES (same order as driver)</b> |
|--|

|                                     |
|-------------------------------------|
| <b>VEHICLE</b>                      |
| Left Rear Acceleration x Primary    |
| Right Rear Acceleration x Primary   |
| Engine Top Acceleration             |
| Engine Bottom Acceleration          |
| Left Rear Acceleration z            |
| Right Rear Acceleration z           |
| Left Rear Acceleration x Redundant  |
| Right Rear Acceleration x Redundant |

|                          |
|--------------------------|
| <b>LOAD CELL BARRIER</b> |
| LCB A1 -A9               |
| LCB B1 -A9               |
| LCB C1 -A9               |
| LCB D1 -A9               |

#### *12.4 PERFORMANCE REQUIREMENTS – NOTIFICATION OF TEST RESULTS*

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 N, Test Deliverables and Report Guidelines**.

#### *12.5 NCAP TEST DELIVERABLES*

Required deliverables for each test are discussed in **Appendix N, Test Deliverables and Report Guidelines**. A Schedule of Deliverables is also provided in that location.

#### *12.6 DATA RETENTION BY THE CONTRACTOR*

The Contractor shall retain reproducible copies of all data tapes, high-speed and real-time digital videos, digital photographs, and Form No. 1 manufacturer information for at least five (5) years (at no extra cost to the NHTSA).

The tested vehicles, 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.

#### *12.7 DATA AVAILABILITY TO THE PUBLIC*

The Contractor shall provide interested parties with copies of the test report, test CDs or DVDs, test data tapes, 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**  
**PART 572E (50<sup>th</sup> Male) DUMMY PERFORMANCE**  
**CALIBRATION TEST PROCEDURE**

**APPENDIX A**  
**PART 572 SUBPART E DUMMY PERFORMANCE CALIBRATION**  
**PROCEDURE**

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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 Crashworthiness Standards) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart E 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 DIMENSIONS
- B. HEAD DROP TEST (572.32)
- C. NECK FLEXION TEST (572.33)
- D. NECK EXTENSION TEST (572.33)
- E. THORAX IMPACT TEST (572.34)
- F. FEMUR IMPACT TESTS (572.35)
- G. HIP JOINT-FEMUR FLEXION (572.35)

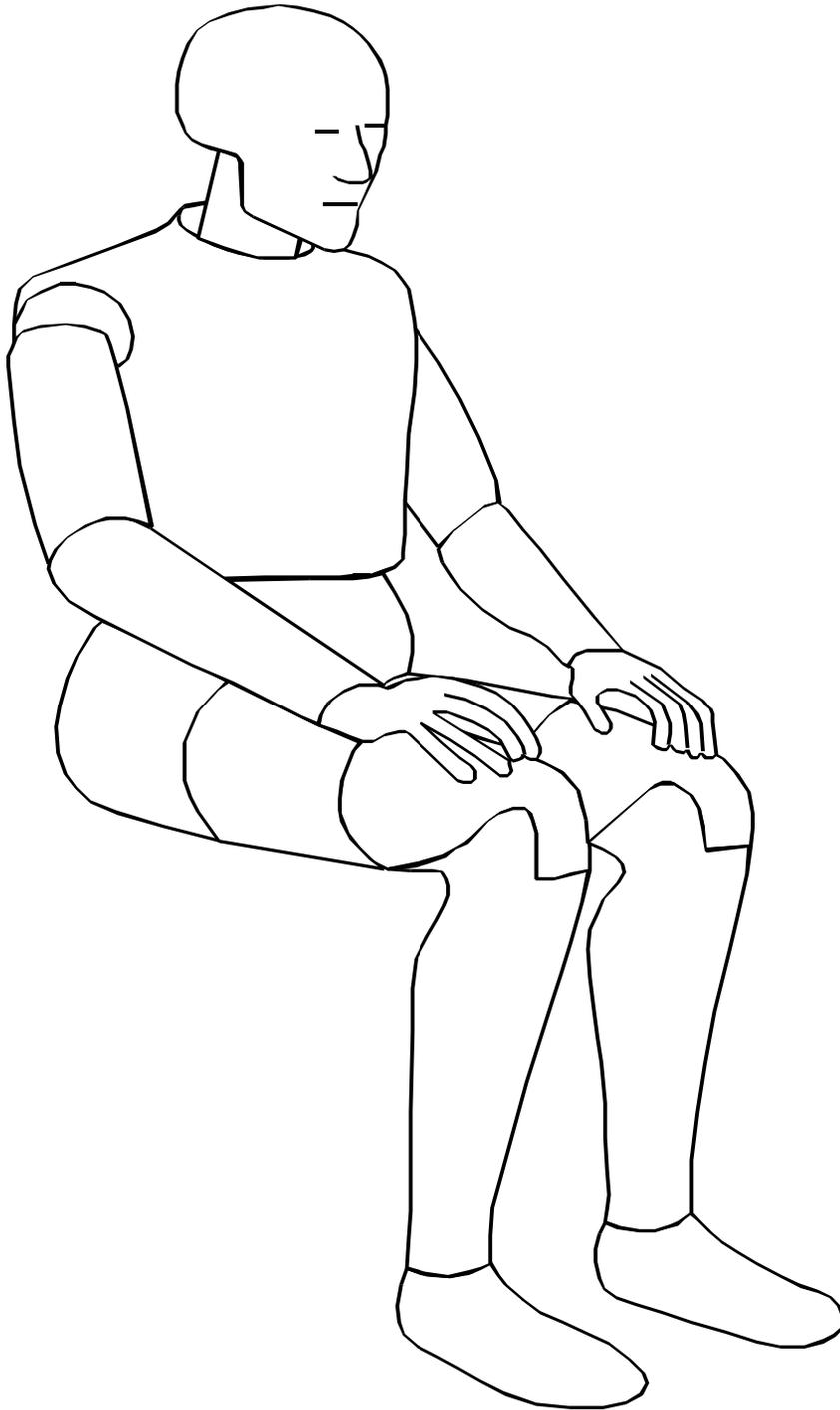
This laboratory procedure for the calibration of Part 572, Subpart E dummies must be used by National Highway Traffic Safety Administration (NHTSA) contract laboratories performing NCAP testing for the Office of Crashworthiness Standards (OCWS).

## 2. GENERAL REQUIREMENTS

The Code of Federal Regulations (49CFR), Parts 571 and 572, was amended to adopt the Hybrid III, 50th Percentile Dummy as the means of determining a vehicle's conformance to the performance requirements of FMVSS 208. This same dummy is used for NCAP testing. Each Part 572, Subpart E dummy used in an NCAP test must meet the specifications and performance criteria of Part 572 before and after each vehicle test in order to be an acceptable test tool.

The Part 572, Subpart E Hybrid III 50th Percentile Dummy consists of components and assemblies specified in the drawing and specifications package which is available from Reprographics Technologies, 9000 Virginia Manor, Beltsville, MD 20705, telephone - (301) 419-5069.

# PART 572E TEST DUMMY



*FIGURE 1A*

### 3. SECURITY

All NHTSA Part 572, Subpart E 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 maintaining the NCAP test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart E dummy calibration tests before and after each vehicle crash usage.

No information concerning the Part 572E 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 E dummies are being calibrated as test tools to be used in a vehicle test to determine compliance with the requirements of NCAP. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. 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. All calibration test data for each particular Part 572, Subpart E dummy will be sent to the COTR with each test report.

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

## **7. GOVERNMENT FURNISHED PROPERTY (GFP)**

P572 test dummies will be furnished to the contract laboratory by the OCWS. 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 (Section 15, Data Sheets) 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 still photographs (color prints properly focused for clear images, no more than two (2) per 8.5"x11" sheet) of post test damage resulting from the vehicle crash test.

## **10. DEFINITIONS**

NONE

## 11. PRETEST REQUIREMENTS

### 11.1 TRANSDUCER REQUIREMENTS

The contractor shall provide and install the following instrumentation to the GFP dummies (excluding chest displacement transducer).

- A. HEAD – The head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing 78051-136, revision A and be mounted in the head as shown in drawing 78051-61X, March 28, 1997, and in the assembly shown in drawing 78051-218, revision T. (572.36(c))

Three Endevco 7231C-750 accelerometers with 1% Transverse Sensitivity shall be mounted in the head cavity to measure orthogonal accelerations (Ax, Ay, Az) at the center of gravity (CG) of the head assembly.

- B. NECK – The neck transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 83-5001-008 or C-1709 and be mounted for testing as shown in drawing 79051-63, revision W, and in the assembly shown in drawing 78051-218, revision T. (572.36(d))

- C. CHEST – The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing 78051-136, revision A and be mounted as shown with adaptor assembly 78051-116, revision D for assembly into 78051-218, revision T. The chest accelerometers are not required for dummy calibration testing but are required for NCAP testing. Three Endevco 7231C-750 accelerometers with 1% Transverse Sensitivity shall be mounted in the chest cavity to measure orthogonal accelerations (Ax, Ay, Az) at the CG of the chest assembly. (572.36(e))

The chest deflection transducer shall have the dimensions and response characteristics specified in drawing 78051-342, revision A (Bourns Potentiometer Model 6638S-432-102, or alternate Vernitech Potentiometer Model 81422A) and be mounted in the chest deflection transducer assembly 78051-317, revision A for assembly into 78051-218, revision T. (572.36(f))

- D. LEGS -- The single axis femur force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 78051-265 (GSE Model 2430) and be mounted in assemblies 78051-46 and -47 for assembly into 78051-218, revision T. The femur transducers are not required for calibration of the dummy but are required for NCAP testing. (572.36(h))

- E. TEST FIXTURE – The neck pendulum, thorax and knee probe accelerometers shall have the dimensions and characteristics of Endevco Model 7231C. (572.36(g))

## 11.2 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. (572.36(k))

- B. 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 will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1 MAR95, "Instrumentation for Impact Test," with channel classes as follows: (572.36(i))

1. Head acceleration – Class 1000 (572.36(i)(1))
2. Neck force – Class 1000 (572.36(i)(2)) (For calculation of the moment about the occipital condyle, use filter class 600 for the neck force)
3. Neck moments – Class 600 (572.36(i)(3))
4. Neck pendulum acceleration – Class 60 (572.36(i)(4))
5. Neck rotation transducers - Class 60
6. Thorax and thorax pendulum acceleration – Class 180 (572.36(i)(5))
7. Thorax deflection - Class 180 (572.36(i)(6))
8. Knee pendulum acceleration – Class 600(572.36(i)(7))
9. Femur force – Class 600 (572.36(i)(8))
10. Hip flexion – Class 60

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

### 11.3 THORAX IMPACTOR PROBE (572.36(a))

- A. The test probe for thoracic impacts 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))

### 11.4 KNEE IMPACTOR PROBE

- A. The test probe for thoracic impacts is a 3- inch diameter cylinder weighing 11 pounds including instrumentation. (572.36(b))
- B. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has an edge radius of 0.02 inches. (572.36(b))
- 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(b))

TABLE 1A  
**SIGN CONVENTIONS FOR  
 PART 572 SUBPART E TEST DUMMIES**

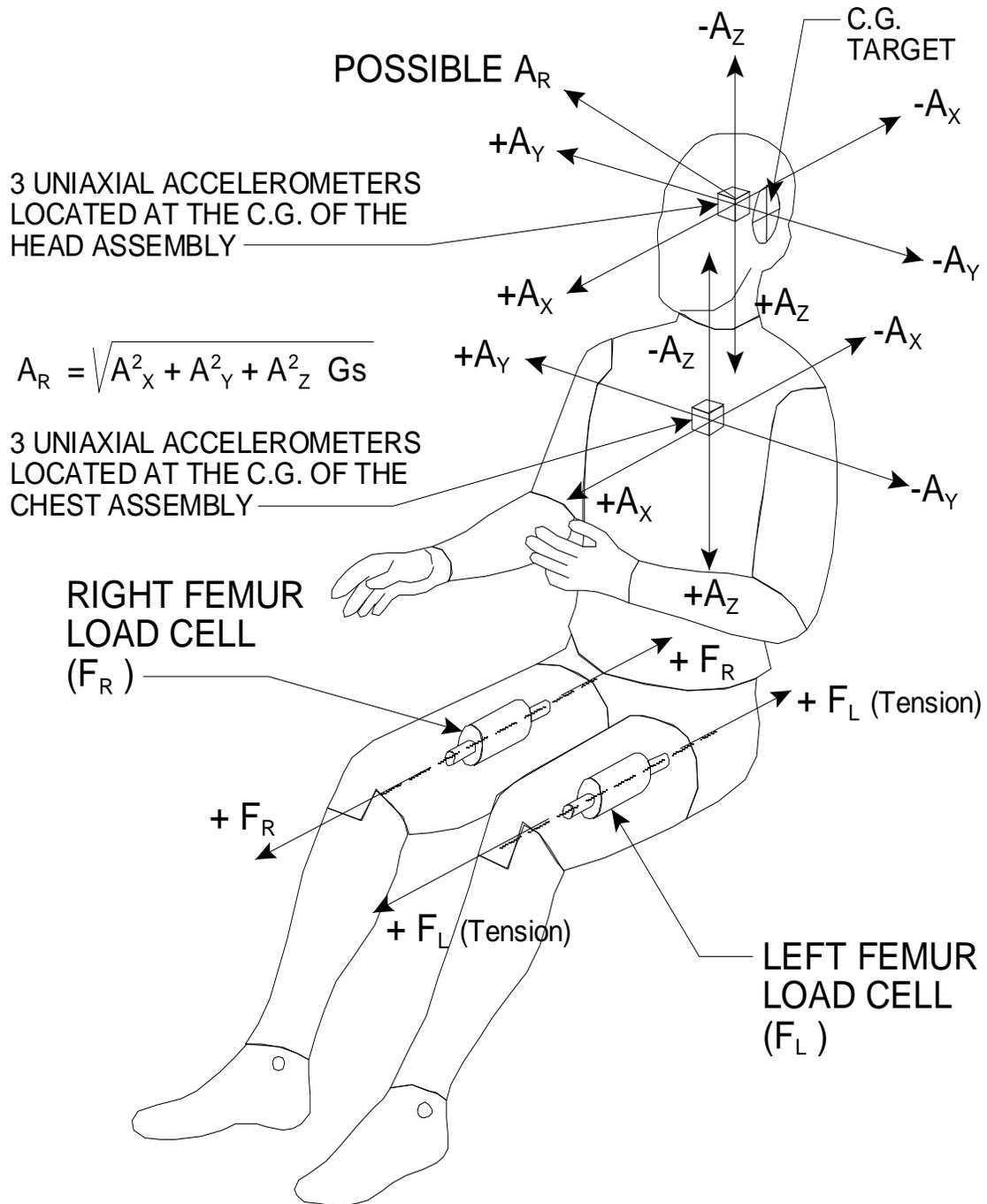


FIGURE 2A

| <b>SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS</b>  |   |
|---|---|
| <b>BODY SEGMENT —<br/>MEASURED FORCE</b>  | <b>POSITIVE OUTPUT DIRECTION</b>  |
| NECK<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW)  | HEAD REARWARD OR CHEST FORWARD<br>HEAD LEFTWARD, CHEST RIGHTWARD<br>HEAD UPWARD, CHEST DOWNWARD<br><br>LEFT EAR TOWARD LEFT SHOULDER<br>CHIN TOWARD STERNUM<br>CHIN TOWARD LEFT SHOULDER  |
| FEMUR<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW) | KNEE UPWARD, UPPER FEMUR DOWNWARD<br>KNEE RIGHTWARD, UPPER FEMUR LEFTWARD<br>KNEE FORWARD (TENSION), PELVIS REARWARD<br><br>KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE UPWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY |
| KNEE CLEVIS - FZ AXIAL  | TIBIA DOWNWARD (TENSION), FEMUR UPWARD  |
| UPPER TIBIA<br>MX MOMENT<br>MY MOMENT   | ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD  |
| LOWER TIBIA<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT<br>MY MOMENT                             | ANKLE FORWARD, KNEE REARWARD<br>ANKLE RIGHTWARD, KNEE LEFTWARD<br>ANKLE DOWNWARD (TENSION), KNEE UPWARD<br><br>ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD   |
| CHEST DISPLACEMENT  | CHEST COMPRESSED - NEGATIVE   |
| KNEE SHEAR DISPLACEMENT   | PUSH ON FRONT OF TIBIA - NEGATIVE   |

**NOTE:** DIRECTIONS ARE DEFINED IN RELATION TO A SEATED DUMMY

## 11.5 GENERAL TEST CONDITIONS

- A. Surfaces of dummy components are not painted unless otherwise specified. (572.36(n))
- B. Dummy performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise specified. (572.36(m))
- C. Dummy performance tests are conducted at any temperature from 69°F to 72°F unless otherwise specified and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours.
- D. Dummy limb joints are set at 1 g, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2 Gs throughout the range of limb motion. (572.36(l))
- E. Dummies will be clothed for the thorax calibration tests with the exception of the shoes being removed.

## 12. CALIBRATION TEST EXECUTION

Complete the Data Sheets in section 15.

## 13. 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.

## 14. REPORTS

### 14.1 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 OCWS.

## 14.2 FINAL PERFORMANCE CALIBRATION REPORTS

### 14.2.1 COPIES

A report containing the pre-test calibration and post test calibration verification data for each Part 572, Subpart E dummy used in the NCAP test shall be submitted with the final test report for the vehicle tested.

Contractors are required to PROOF READ all Final 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.

### 14.2.2 REQUIREMENTS

Performance calibration report Table of Contents shall include the following:

- A. Section 1 — Purpose of Calibration Test
- B. Section 2 — Calibration Data Summary
- C. Section 3 — Test Data
- D. Section 4 — Test Equipment List and Calibration Information
- E. Section 5 — Photographs (if applicable)

The test data for each dummy will be presented in separate sections. Each section shall contain a title page, test results summary and the test data. The title page shall include the dummy's serial number and the manufacturer's name. It will also indicate whether the calibration data is pre or post test. The test results sheets will provide a summary of each test and describe any damage, failures and/or corrective action taken. The test data shall include the pass/fail data sheets, the time histories for each data channel used to determine the pass or fail status, and instrumentation calibration data sheets.

### 14.2.3 FIRST PAGE

#### FRONT COVER

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

- A. Final Report Title and Subtitle such as

DUMMY PERFORMANCE CALIBRATION  
IN SUPPORT OF  
NEW CAR ASSESSMENT PROGRAM (NCAP) TESTING

- B. Contractor's Name and Address such as



ABC TESTING LABORATORIES, INC.  
405 Main Street  
Detroit, Michigan 48070

**NOTE:** DOT SYMBOL WILL BE PLACED BETWEEN ITEMS B AND C

- C. Date of Final Performance Calibration Report completion
- D. The sponsoring agency's name and address as follows

DOT / NHTSA  
Office of Crashworthiness Standards

1200 New Jersey Ave, SE

W43-404 / NVS-110

Washington, DC 20590

**15. DATA SHEETS**

**DATA SHEET A1**  
**DUMMY DAMAGE CHECKLIST (50<sup>th</sup> Male)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

This check sheet is completed as part of the post test calibration verification.

Perform general cleaning.

| <b>Dummy Item</b>           | <b>Inspect for</b>   | <b>Comments</b> | <b>Damaged</b> | <b>OK</b> |
|-----------------------------|--|-----------------|----------------|-----------|
| Outer skin                  | Gashes, rips, cracks   |                 |                |           |
| Head                        | Ballast secure   |                 |                |           |
|                             | General appearance   |                 |                |           |
| Neck                        | Broken or cracked rubber                                     |                 |                |           |
|                             | Upper neck bracket firmly attached to the lower neck bracket |                 |                |           |
|                             | Looseness at the condyle joint                               |                 |                |           |
|                             | Nodding blocks cracked or out of position                    |                 |                |           |
| Spine                       | Broken or cracks in rubber.                                  |                 |                |           |
| Ribs                        | Broken or bent ribs  |                 |                |           |
|                             | Broken or bent rib supports                                  |                 |                |           |
|                             | Damping material separated or cracked                        |                 |                |           |
|                             | Rubber bumpers in place                                      |                 |                |           |
| Chest Displacement Assembly | Bent shaft   |                 |                |           |
|                             | Slider arm riding in track                                   |                 |                |           |
| Transducer leads            | Torn cables  |                 |                |           |

| Dummy Item              | Inspect for                           | Comments | Damaged | OK |
|-------------------------|---------------------------------------|----------|---------|----|
| Accelerometer Mountings | Head mounting secure                  |          |         |    |
|                         | Chest mounting secure                 |          |         |    |
| Knees                   | Skin condition                        |          |         |    |
|                         | Insert (do not remove)                |          |         |    |
|                         | Casting                               |          |         |    |
| Limbs                   | Normal movement and adjustment        |          |         |    |
| Knee Sliders            | Wires intact                          |          |         |    |
|                         | Rubber returned to "at rest" position |          |         |    |
| Pelvis                  | Broken                                |          |         |    |
| Other                   |                                       |          |         |    |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Describe the repair or replacement of parts:

Checked by

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET A2**  
**EXTERNAL MEASUREMENTS (50<sup>th</sup> Male)**  
 (Procedures for Disassembly, Inspection and Assembly of the Hybrid III Dummy,  
 Appendix A)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration  
 Post test calibration verification

1. Remove the dummy's chest jacket and the abdominal insert.
2. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in Figure 3A. The seating surface is at least 406 mm (16 in) wide and 406 mm (16 in) in depth 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.
3. Remove the four socket head cap screws that attach the lumbar spine to the thoracic spine. Lift the upper torso off of the lower torso. Check the torque on the two spine cables. The torque should be 1.2 – 1.4 NM (11 – 12 in-lbs).

**NOTE: At this point the thorax is to be inspected for damage. The thorax displacement transducer may be removed for calibration if required (pretest calibration only). Extreme caution to be used so as not to damage the instrumentation cables.**

4. Reassemble the upper torso to the lower torso.
5. Secure the dummy to the test fixture so that the rear surfaces of the upper thorax and buttock are tangent or as near tangent as possible to the rear vertical surface of the fixture and the dummy's midsagittal plane is vertical.
6. Position the dummy's H-point so it is  $3.4 \pm 0.1$  in above the horizontal seating surface and  $5.4 \pm 0.1$  in forward of the rear vertical surface of the fixture. (Note: the H-point is located 1.83 in. forward and 2.57 in. downward from the center of the pelvic angle reference hole in the lumbar-pelvic adaptor.)
7. Extend the dummy's neck so that the base of the skull is level both fore-and-aft and side-to-side, within 0.5 degrees. The rear surface of the skull cap should be  $1.7 \pm 0.1$  in. from the vertical surface of the test fixture. A strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.
8. Position the upper and lower legs parallel to the midsagittal plane so the centerline between the knee pivot and the ankle pivot is vertical.
9. Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.
10. Position the upper arms downward vertically so the centerline between the shoulders and elbow pivots is parallel to the rear vertical surface of the fixture.

- \_\_11. Position the lower arms horizontally so the centerline between the elbow and wrist pivots is parallel to the seat surface.
- \_\_12. Record the dimensions listed in the following table, except for dimension Y and Z (reference figure 3A).
- \_\_13. Install the abdominal insert and chest jacket. Reposition the dummy on the test fixture. The head need not be level as previously specified.
- \_\_14. Mark the locations AA and BB, and record the dimensions Y and Z, as specified in the table and figure 3A.

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Signature

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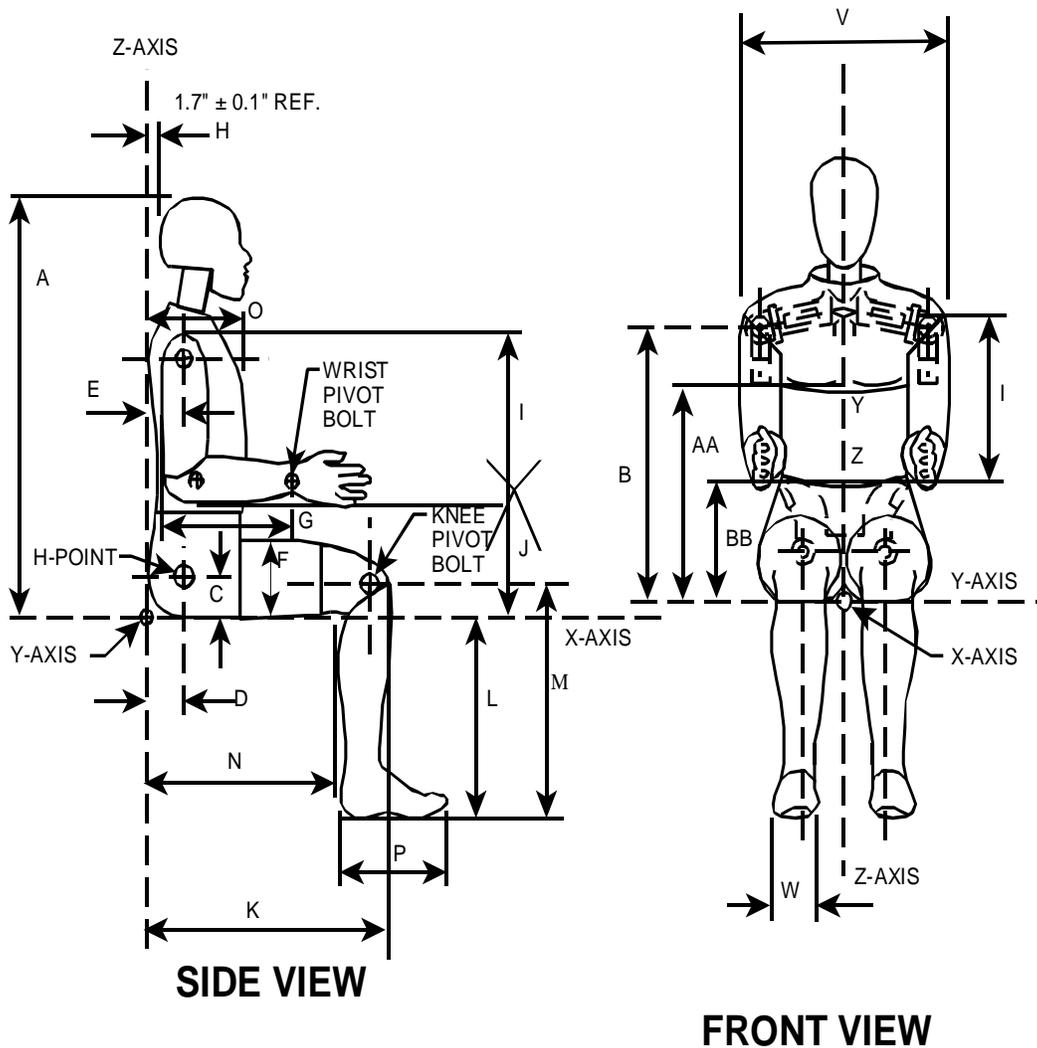
Date

| HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS |                                |  |                             |                    |
|---|--------------------------------|--|-----------------------------|--------------------|
| DIMENSION   | DESCRIPTION                    | DETAILS  | ASSEMBLY DIMENSION (inches) | ACTUAL MEASUREMENT |
| A   | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.  | 34.6-35.0                   |                    |
| B   | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.   | 19.9-20.5                   |                    |
| C   | H-POINT HEIGHT                 | Reference  | 3.3-3.5                     |                    |
| D   | H-POINT LOCATION FROM BACKLINE | Reference  | 5.3-5.5                     |                    |
| E   | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.   | 3.3-3.7                     |                    |
| F   | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.  | 5.5-6.1                     |                    |
| G   | BACK OF ELBOW TO WRIST PIVOT   | back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots   | 11.4-12.0                   |                    |
| H   | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)   | 1.6-1.8                     |                    |
| I   | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 13.0-13.6                   |                    |
| J   | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.   | 7.5-8.3                     |                    |
| K   | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.   | 22.8-23.8                   |                    |
| L   | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.   | 16.9-17.9                   |                    |
| M   | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.   | 19.1-19.7                   |                    |
| N   | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 17.8-18.8                   |                    |

| HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued |   |   |           |                    |
|--|---|---|-----------|--------------------|
| DIMENSION  | DESCRIPTION   | DETAILS   |           | ACTUAL MEASUREMENT |
| O  | CHEST DEPTH WITHOUT JACKET                                | Measured 16.9-17.1 in. above seat surface         | 8.4-9.0   |                    |
| P  | FOOT LENGTH   | Tip of toe to rear of heel                        | 9.9-10.5  |                    |
| V  | SHOULDER BREADTH  | Outside edges of right and left shoulder clevises | 16.3-17.2 |                    |
| W  | FOOT BREADTH  | The widest part of the foot                       | 3.6-4.2   |                    |
| Y  | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 |                    |
| Z  | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 |                    |
| AA   | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference   | 16.9-17.1 |                    |
| BB   | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference   | 8.9-9.1   |                    |

**NOTE:** THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

# EXTERNAL DIMENSIONS SPECIFICATIONS



**NOTE:** Figure is referenced to the erect seated position. The curved lumbar does not allow the Hybrid III to be positioned in a perfect erect attitude. (REF: S572.31(A)(6))

FIGURE 3A

# EXTERNAL DIMENSIONS TEST SETUP

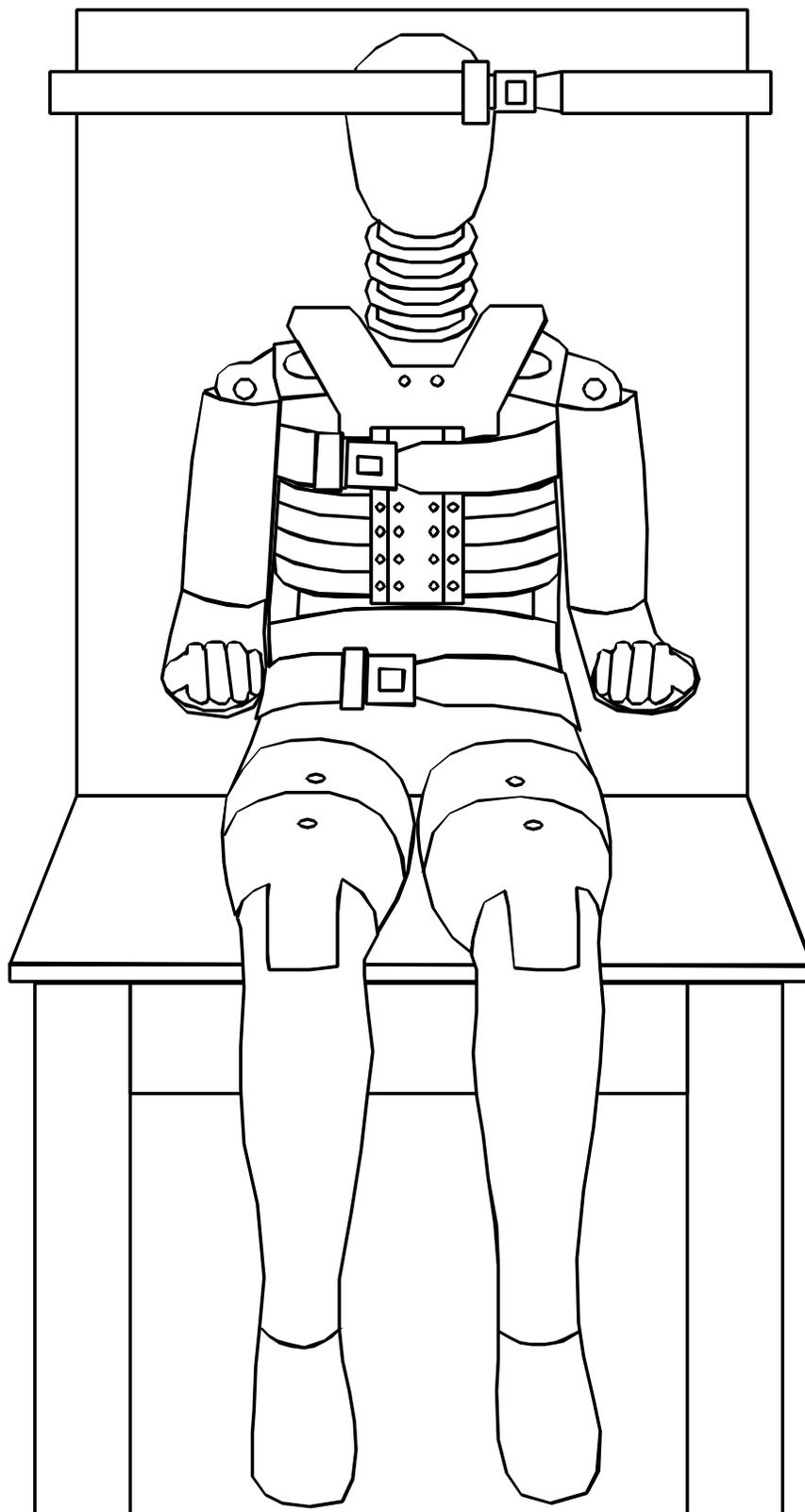


FIGURE 4A

# EXTERNAL DIMENSIONS TEST SETUP

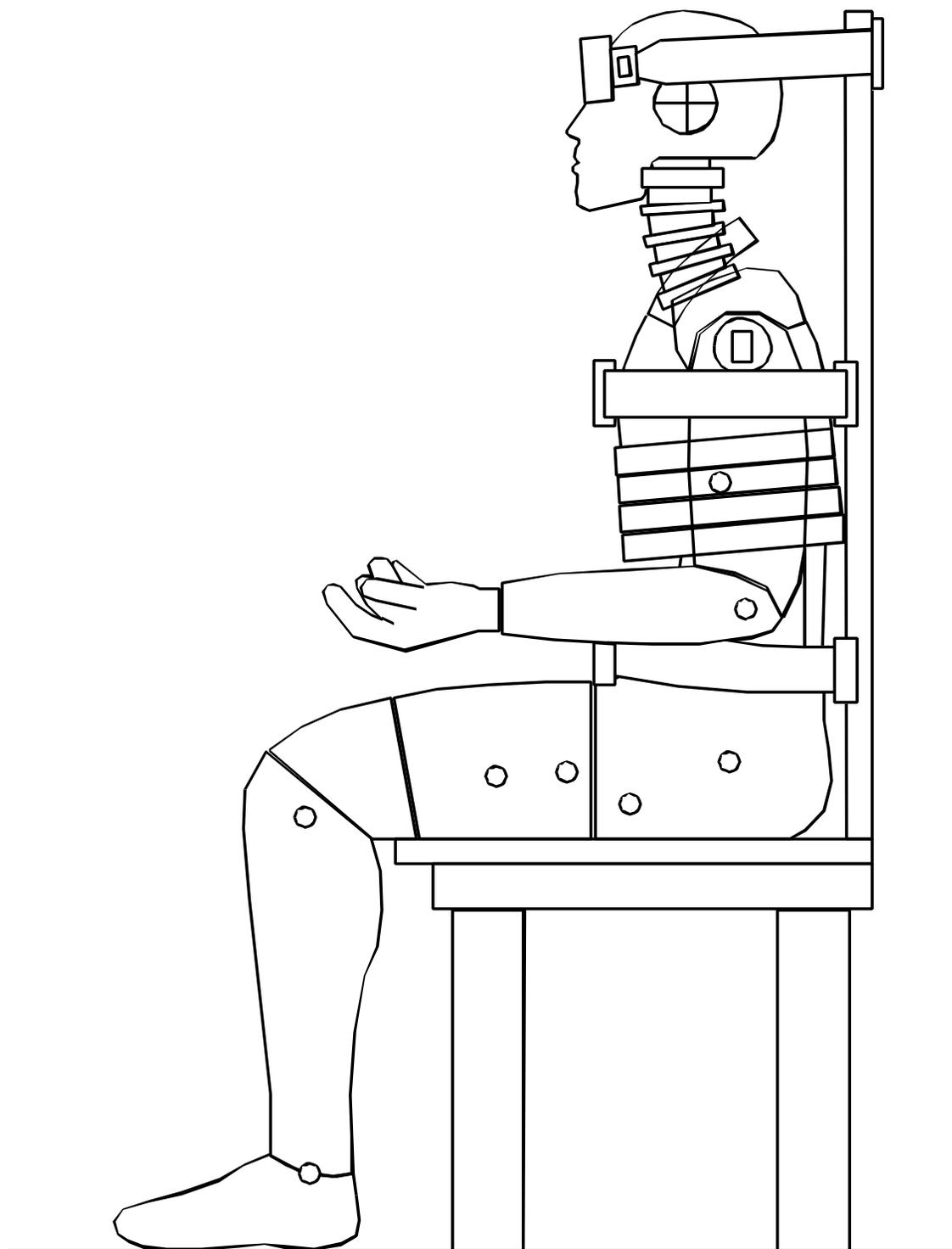


FIGURE 5A

**DATA SHEET A3**  
**HEAD DROP TEST (572.32) (50<sup>th</sup> Male)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

1. It has been at least 3 hours since the last head drop. (572.32(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))
3. Torque the skull cap screws to 160 lbf-in.
4. Accelerometers and their respective mounts are smooth and clean.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(i))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.32(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- \_\_10. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))

Record the actual distance \_\_\_\_\_

**NOTE: The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.**

- \_\_11. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.

Record the right side distance \_\_\_\_\_

Record the left side distance \_\_\_\_\_

- \_\_12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.32(c)(4))

Record actual micro finish \_\_\_\_\_

- \_\_13. The impact surface is rigidly supported. (572.32(c)(4))

- \_\_14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)

Record thickness \_\_\_\_\_

Record width \_\_\_\_\_

Record length \_\_\_\_\_

- \_\_15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

- \_\_16. Complete the following table using channel class 1000 data. (572.36(i)):

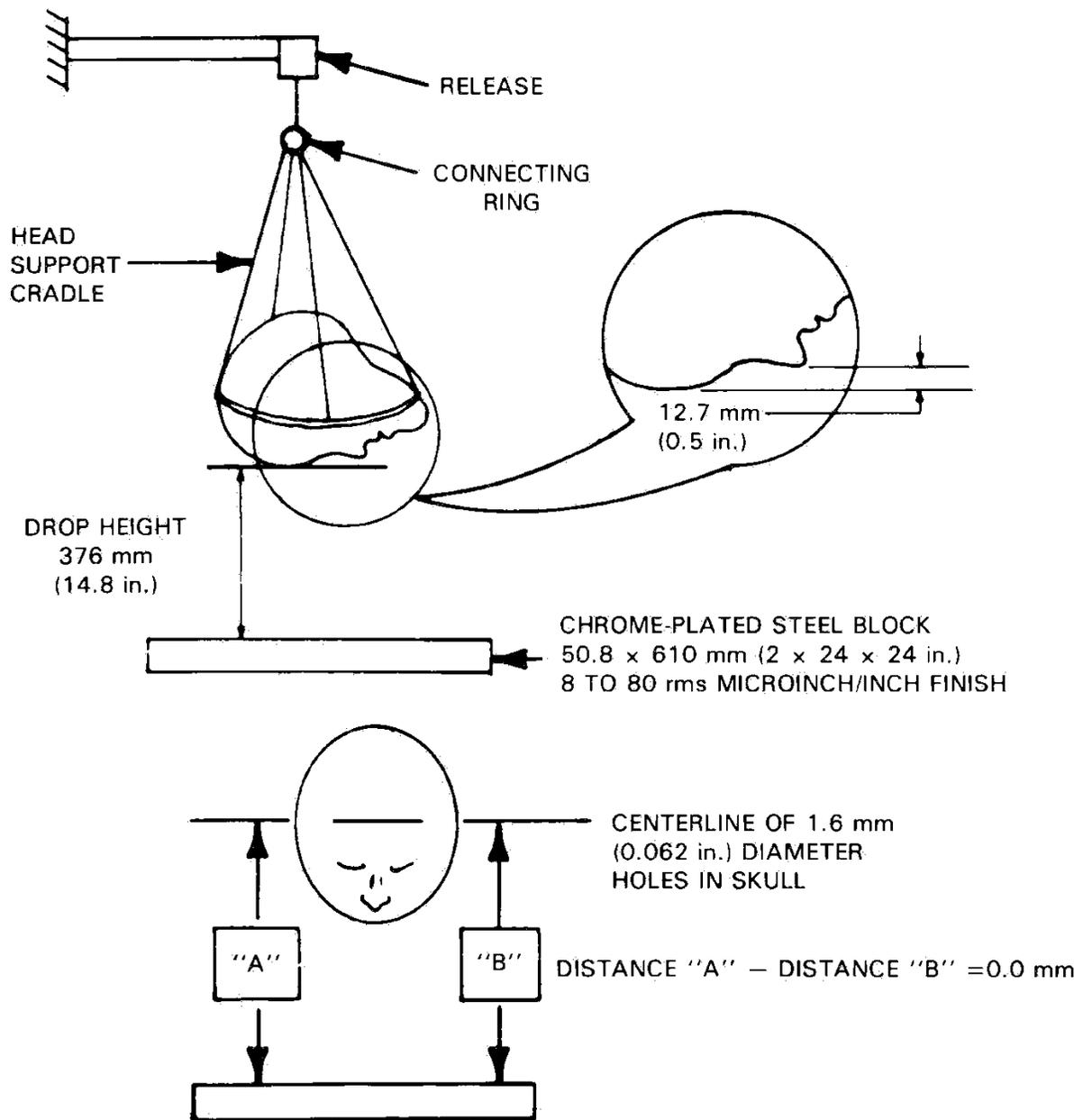
| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $225 \text{ g} \leq x \leq 275 \text{ g}$        |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          |        |

- \_\_17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**TEST SET-UP SPECIFICATIONS**



NOTE: TOLERANCE ON TEST SETUP DIMENSIONS  $\pm 1$  mm (0.04 in.)

FIGURE 6A

# HEAD DROP TEST SETUP

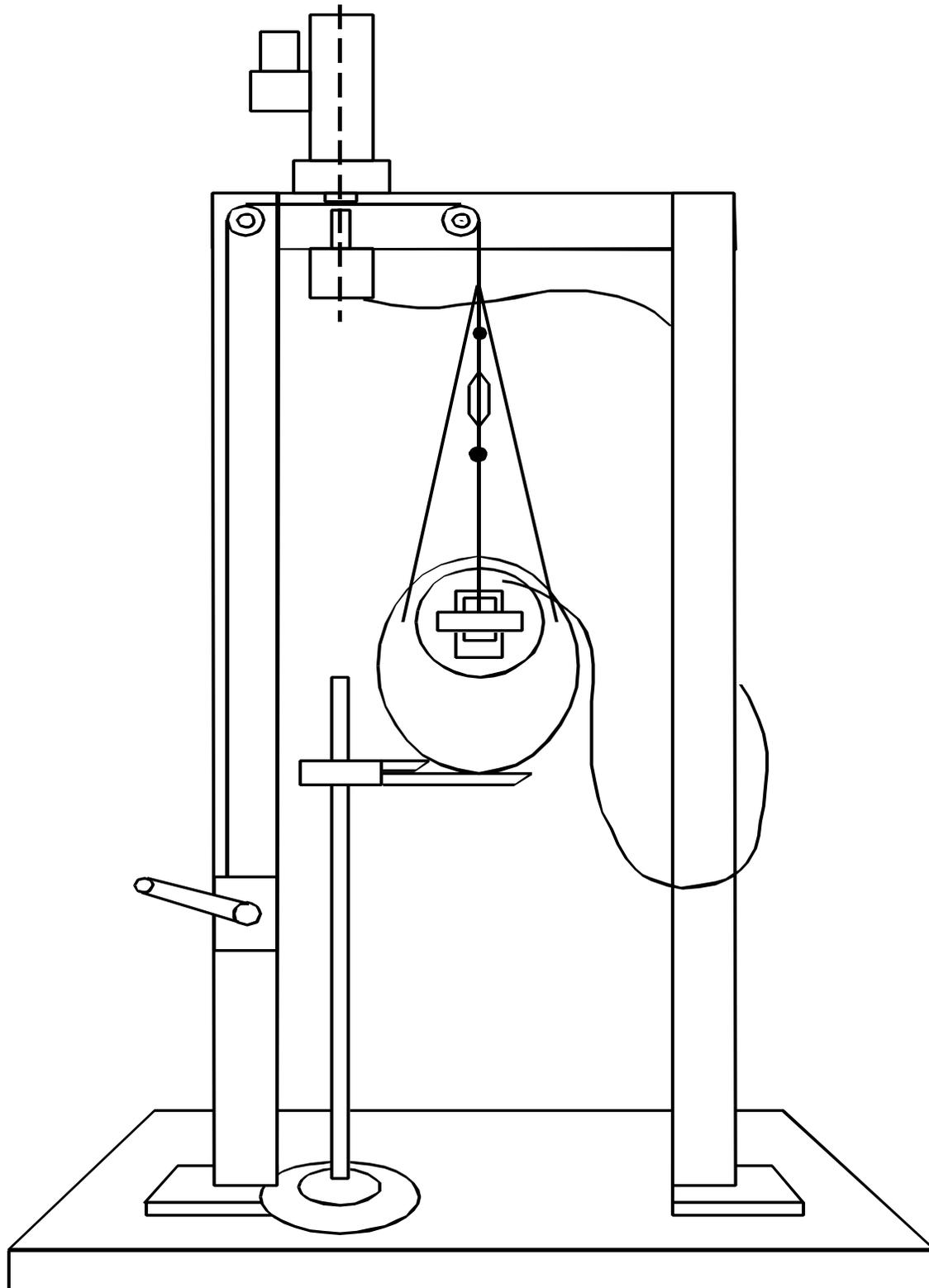


FIGURE 7A

**DATA SHEET A4**  
NECK FLEXION TEST (572.33) (50<sup>th</sup> Male)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

- \_\_1. It has been at least 30 minutes since the last flexion test. (572.36(m))  
 \_\_ N/A, ONLY one neck test performed
- \_\_2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))
- \_\_3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore “A” type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_6. Pre-test calibration neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))
- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

- \_\_8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- \_\_10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- \_\_11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

\_\_13. Complete the following table:

Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))

| Parameter   | Specification  | Result                  |
|---|--|-------------------------|
| Pendulum impact speed   | $22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$     |                         |
| Pendulum<br>Deceleration<br>Versus Time<br>Pulse                        | @ 10ms   | $22.5 \leq g \leq 27.5$ |
|   | @ 20 ms  | $17.6 \leq g \leq 22.6$ |
|   | @30ms  | $12.5 \leq g \leq 18.5$ |
|   | Above 30 ms  | 29 g maximum            |
| First Pendulum Decay to 5g  | $34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$                  |                         |
| Plane D Rotation  | $64^\circ \leq \text{max. rotation} \leq 78^\circ$                   |                         |
|   | $57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$ |                         |
| Time for Plane D Rotation to<br>Cross $0^\circ$ During First Rebound    | $113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$                |                         |
| Maximum Moment  | $65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$        |                         |
|   | $47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$   |                         |
| Time of first decay to 0 lbf-ft<br>Positive Moment Decay**<br>(Flexion) | $97 \text{ ms} \leq \text{time} \leq 107\text{ms}$                   |                         |

\*Moment about the occipital condyle =  $M_y - (0.058 \text{ ft} \times F_x)$  (572.33(b)(1)(ii))

$M_y$  = Moment in lbf-ft measured by the transducer

$F_x$  = Force, in lbf measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

\_\_14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET A5**  
NECK EXTENSION TEST (572.33) (50<sup>th</sup> Male)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive extension tests are necessary)

- \_\_1. It has been at least 30 minutes since the last extension test. (572.36(m))  
 \_\_ N/A, ONLY one neck test performed
- \_\_2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))
- \_\_3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))  
 Record the maximum temperature \_\_\_\_\_ Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_ Record the minimum humidity \_\_\_\_\_
- \_\_4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))
- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- \_\_8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- \_\_10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- \_\_11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/s as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- \_\_13. Complete the following table:

Neck Extension Test Results (572.33(b)(2) &amp; (572.33(c)(4))

| Parameter   | Specification                                   | Result                    |
|---|---|---------------------------|
| Pendulum impact speed   | 19.5 ft/sec $\leq$ speed $\leq$ 20.3 ft/sec     |                           |
| Pendulum Deceleration versus time pulse                             | @ 10ms  | 17.2 $\leq$ g $\leq$ 21.2 |
|   | @ 20 ms   | 14 $\leq$ g $\leq$ 19     |
|   | @30ms   | 11.0 $\leq$ g $\leq$ 16.0 |
|   | Above 30 ms                                     | 22 g maximum              |
| First Pendulum Decay to 5g  | 38 ms $\leq$ time $\leq$ 46 ms                  |                           |
| Plane D Rotation  | 81° $\leq$ max. rotation $\leq$ 106°            |                           |
|   | 72 ms $\leq$ time of max. rotation $\leq$ 82 ms |                           |
| Time for Plane D Rotation to Cross 0° During First Rebound          | 147 ms $\leq$ time $\leq$ 174 ms                |                           |
| Maximum Moment  | -59 lbf-ft $\leq$ moment $\leq$ -39 lbf-ft      |                           |
|   | 65 ms $\leq$ time $\leq$ 79 ms                  |                           |
| Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension) | 120 ms $\leq$ time $\leq$ 148 ms                |                           |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- \_\_14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**PENDULUM SPECIFICATIONS**

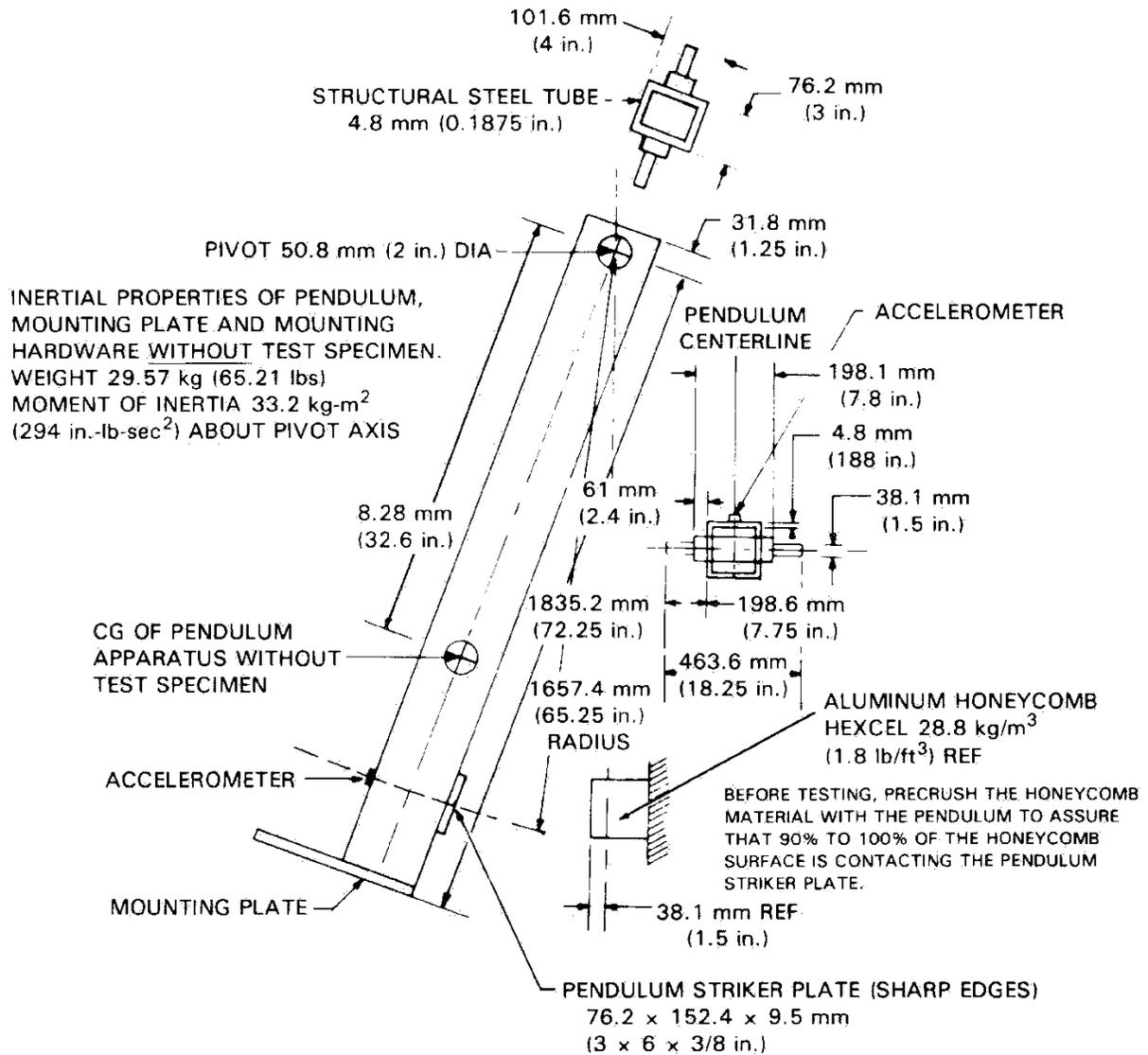
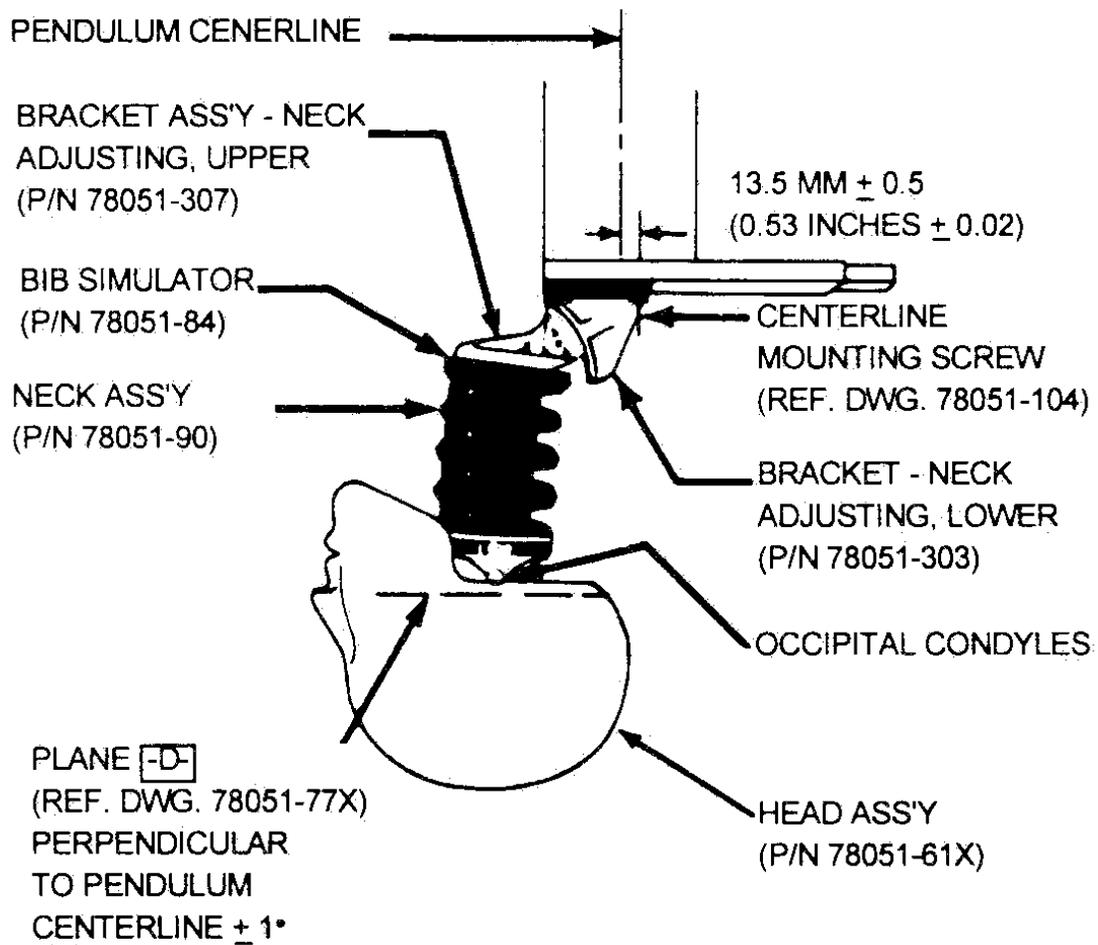


FIGURE 8A

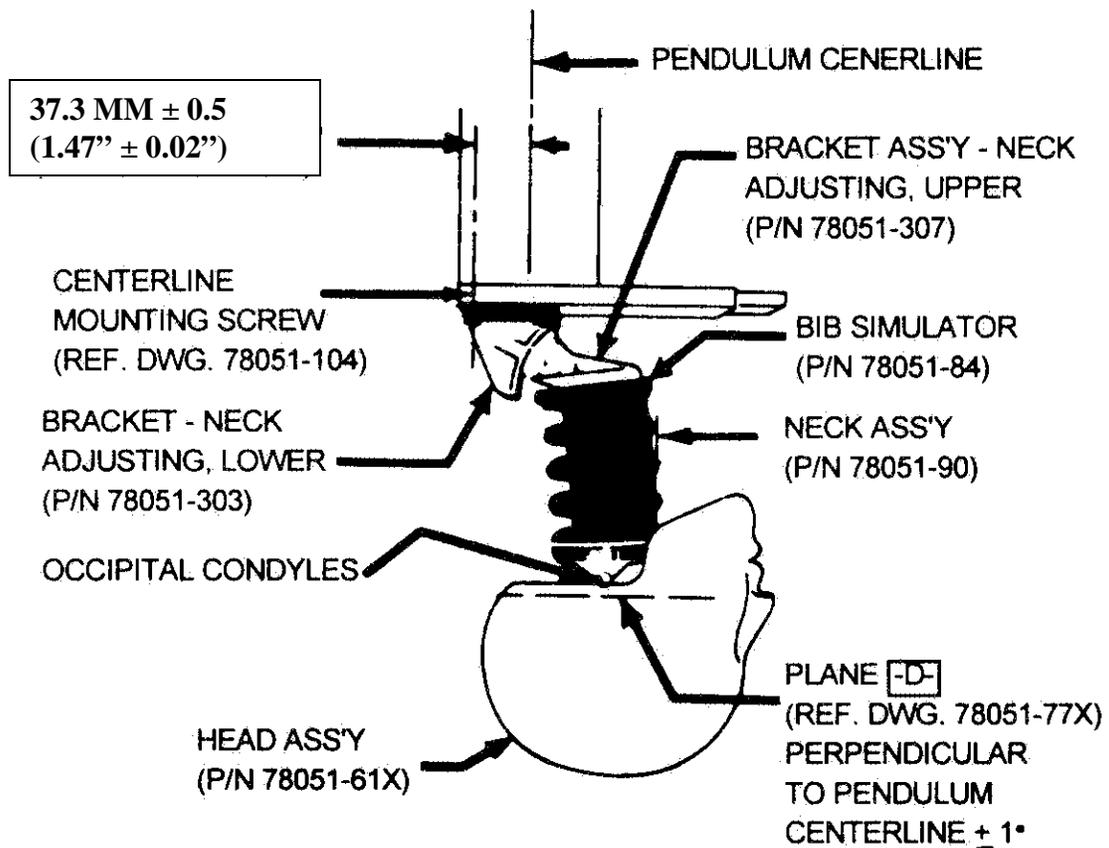
# FLEXION - TEST SET-UP SPECIFICATIONS



NOTE: PENDULUM SHOWN AT TIME ZERO POSITION

FIGURE 9A

## EXTENSION - TEST SET-UP SPECIFICATIONS



NOTE: PENDULUM SHOWN AT TIME ZERO POSITION

FIGURE 10A

# ROTATION TRANSDUCER ASSEMBLY

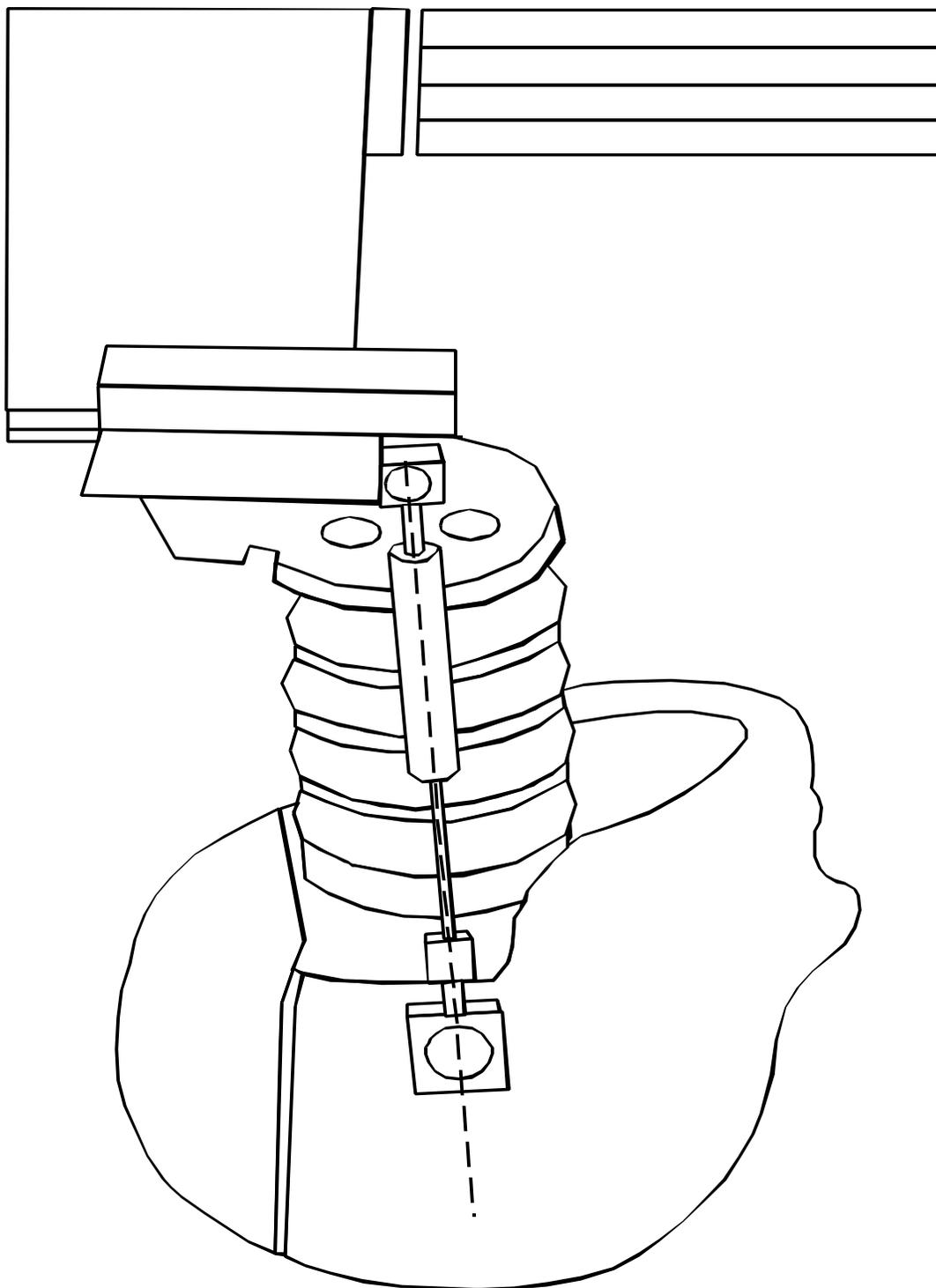


FIGURE 11A

**DATA SHEET A6**  
**THORAX IMPACT TEST (572.34) (50<sup>th</sup> Male)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive thorax impact tests are necessary)

1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 12A.
3. The complete assembled dummy (78051-218) is used (572.34(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. No shoes are worn. (572.34(b))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.34(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (78051-17 thru 78051-22), chest displacement transducer assembly (78051-317) and the rear rib supports (78051-304). Inspect for rib deformation using the chest depth gage (83-5006-007). If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.  
 - No damage  
 - Damage from crash test, no repairs or replacement because this is a post-test calibration verification. Record damage \_\_\_\_\_  
 \_\_\_\_\_  
 - The following repairs or replacement was performed. Record \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))
7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $13^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (78051-532) that inserts

into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2))

- \_\_8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- \_\_9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))
- \_\_10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)
- \_\_11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- \_\_12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- \_\_13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- \_\_14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.
- \_\_15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is  $22 \text{ f/s} \pm 0.4 \text{ f/s}$ . (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

\_\_16. Complete the following table:

Thorax Impact Results (572.34(b))

| Parameter*              | Specification   | Result |
|-------------------------|---|--------|
| Test Probe Speed        | $21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$      |        |
| Chest Compression       | $2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$ |        |
| Peak resistance force** | $1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$   |        |
| Internal Hysteresis***  | $69\% \leq \text{hysteresis} \leq 85\%$                         |        |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

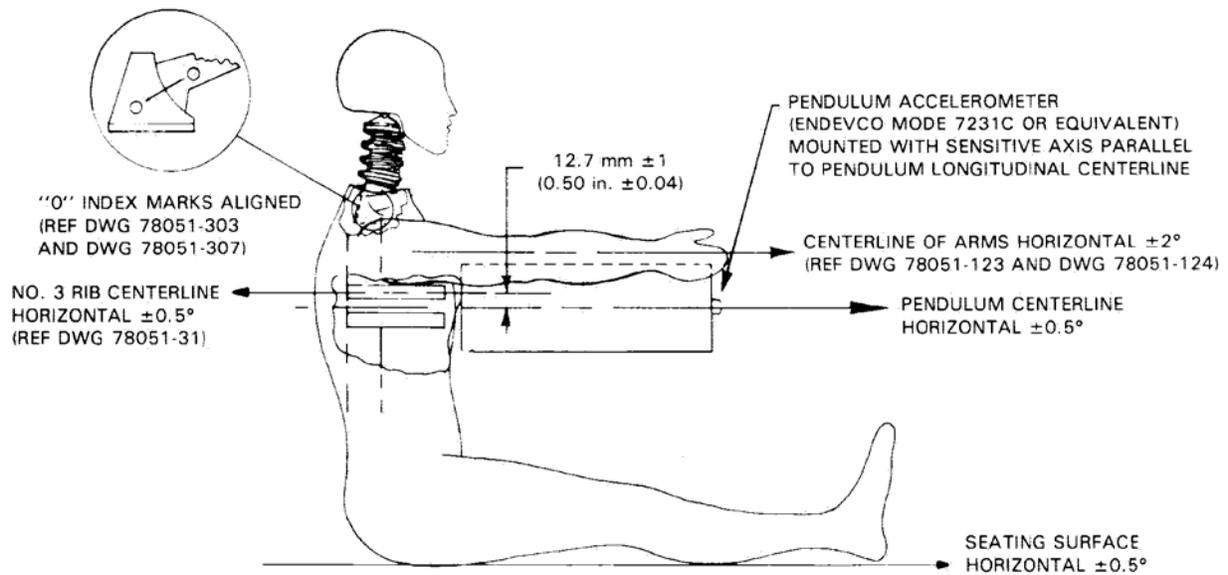
\*\*Force = impactor mass x acceleration (572.34(b))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve.

\_\_17. Plots of chest compression, pendulum acceleration, pendulum speed, and force, follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

TEST SET-UP SPECIFICATIONS

NOTE: A) NO EXTERNAL SUPPORT IS REQUIRED ON THE DUMMY TO MEET SETUP SPECIFICATIONS

B) THE MIDSAGITTAL PLANE OF THE DUMMY IS VERTICAL ( $\pm 1^\circ$ ) AND WITHIN  $2^\circ$  OF THE CENTERLINE OF THE PENDULUM

C) THE MIDSAGITTAL PLANE OF THE DUMMY IS CENTERED ON THE CENTERLINE OF THE PENDULUM WITHIN 3 mm (0.12 in.)

*FIGURE 12A*

## PART 572E HYBRID III THORAX CALIBRATION - HYSTERESIS

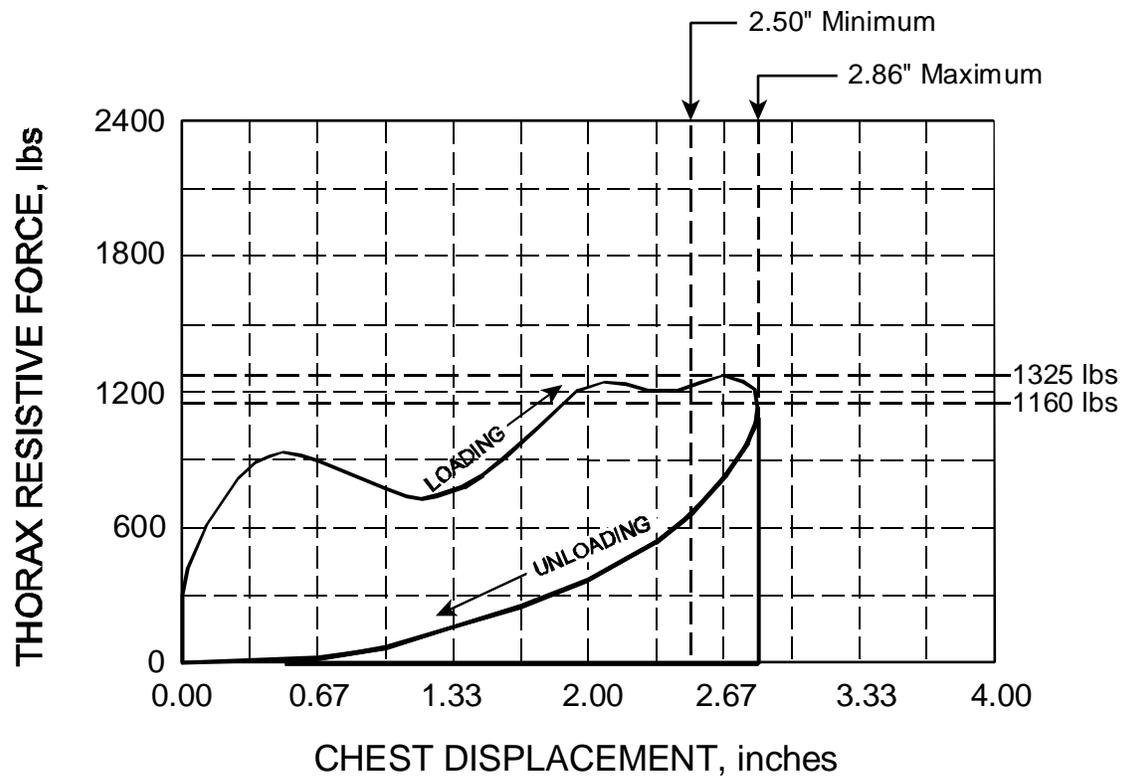


FIGURE 13A

**DATA SHEET A7**  
LEFT KNEE IMPACT TEST (572.35) (50<sup>th</sup> Male)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.36(m))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14A.
3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))
11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification               | Result |
|------------------------|-----------------------------|--------|
| Probe speed            | 6.8 ft/s ≤ speed ≤ 7.0 ft/s |        |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb   |        |

\*Force = impactor mass x deceleration (572.35(b)(1))

\_\_12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET A8**  
**RIGHT KNEE IMPACT TEST (572.35) (50<sup>th</sup> Male)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.36(m))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14A.
3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))
11. Complete the following table:

**Knee Impact Results (572.35(b)(1))**

| Parameter              | Specification               | Result |
|------------------------|-----------------------------|--------|
| Probe speed            | 6.8 ft/s ≤ speed ≤ 7.0 ft/s |        |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb   |        |

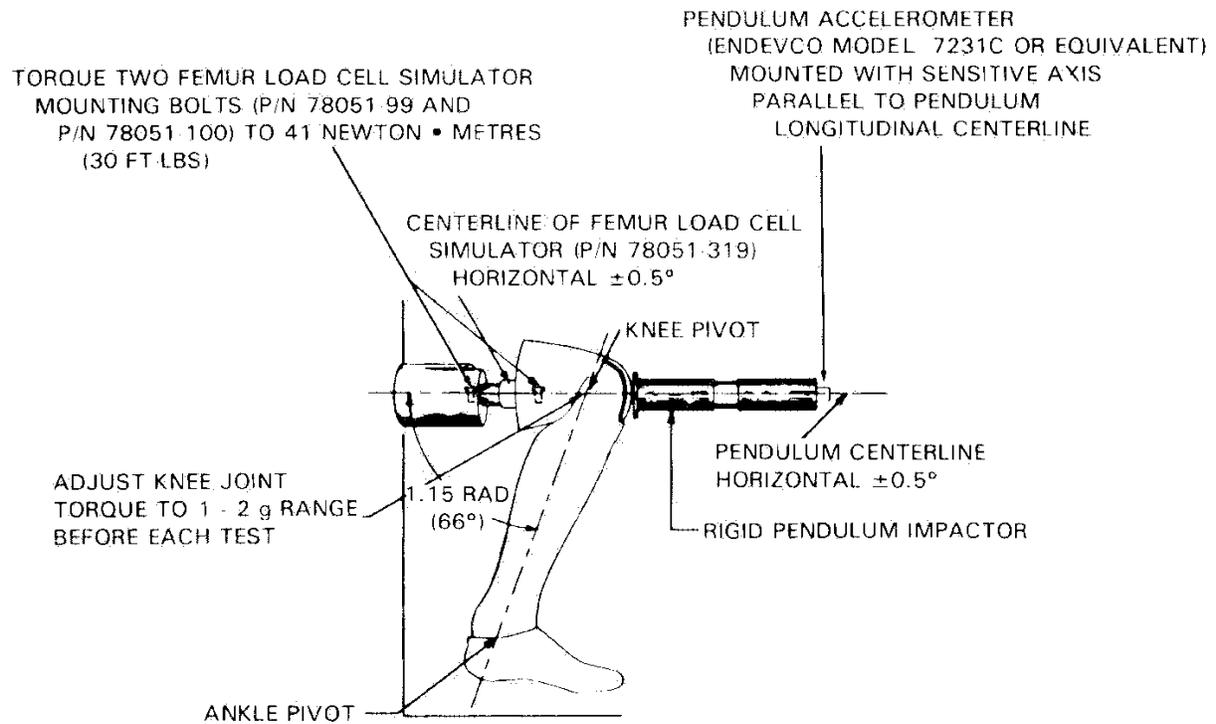
\*Force = impactor mass x deceleration (572.35(b)(1))

\_\_12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**TEST SET-UP SPECIFICATIONS**



*FIGURE 14A*

**DATA SHEET A9**  
**HIP JOINT-FEMUR FLEXION (572.35(c)) (50<sup>th</sup> Male)**

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive hip joint-femur flexion tests are necessary)

- \_\_1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))  
 \_\_ N/A, ONLY one hip joint-femur flexion test performed
- \_\_2. The test fixture conforms to the specifications in Figure 17A.
- \_\_3. Use the assembled dummy (78051-218) except (572.35(c)(2)):  
 \_\_3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)  
 \_\_3.2 remove the abdominal insert (78051-52)  
 \_\_3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- \_\_4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- \_\_6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- \_\_7. Adjust the threaded rods until plane B is horizontal.
- \_\_8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- \_\_9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

\_\_10. Complete the following table:

Left Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification   | Result |
|------------------------------|---|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ |        |
| Femur Torque at $30^{\circ}$ | torque $\leq 70$ ft-lbf                               |        |
| Rotation at 150 lbf-ft       | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     |        |

\_\_11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

\_\_12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the 1/2 in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19). (572.35(c)(2)(iv))

\_\_13. Complete the following table:

Right Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification   | Result |
|------------------------------|---|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ |        |
| Femur Torque at $30^{\circ}$ | torque $\leq 70$ ft-lbf                               |        |
| Rotation at 15 lbf-ft        | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     |        |

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### PELVIC BONE STABLIZER INSERT

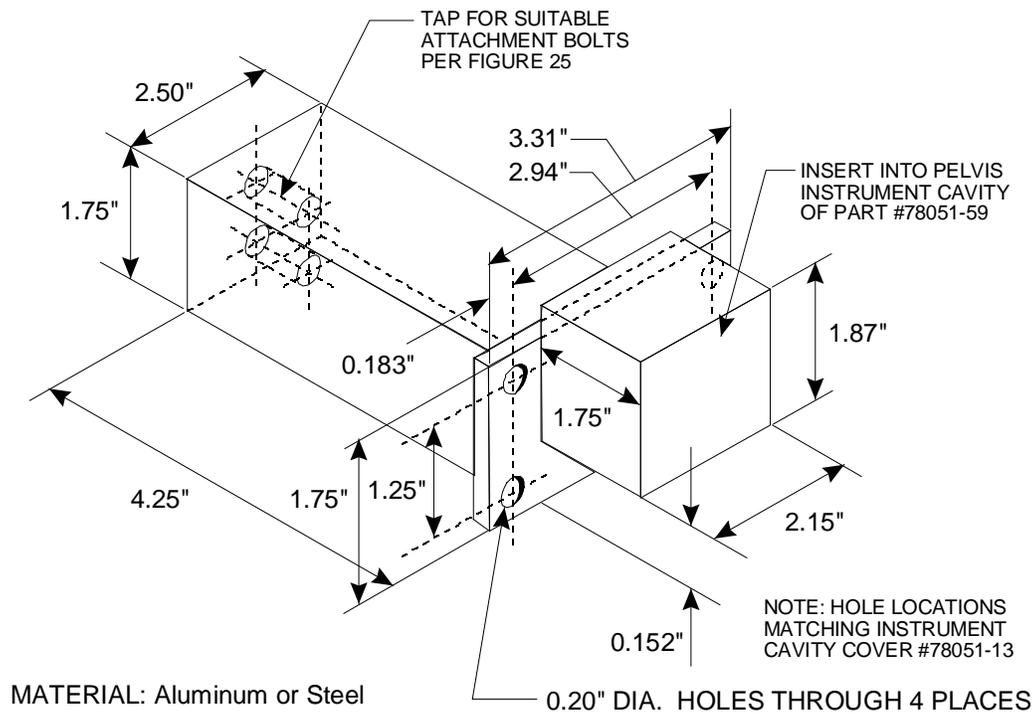


FIGURE 15A

### PELVIS UPPER SUPPORT DEVICE

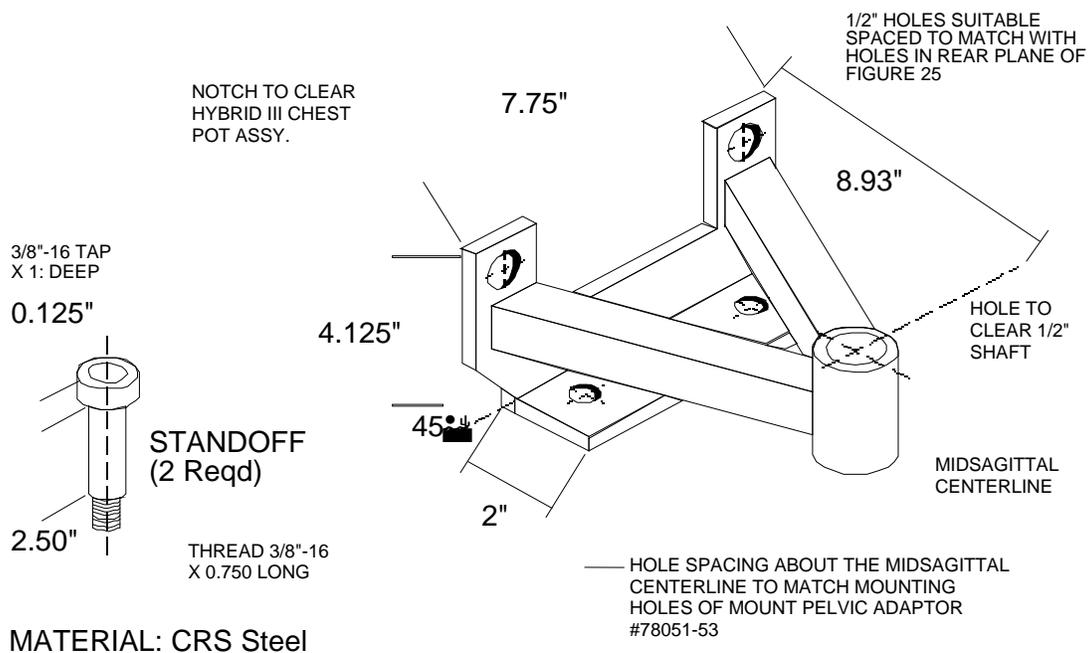


FIGURE 16A

## HIP-JOINT TEST FIXTURE ASSEMBLY

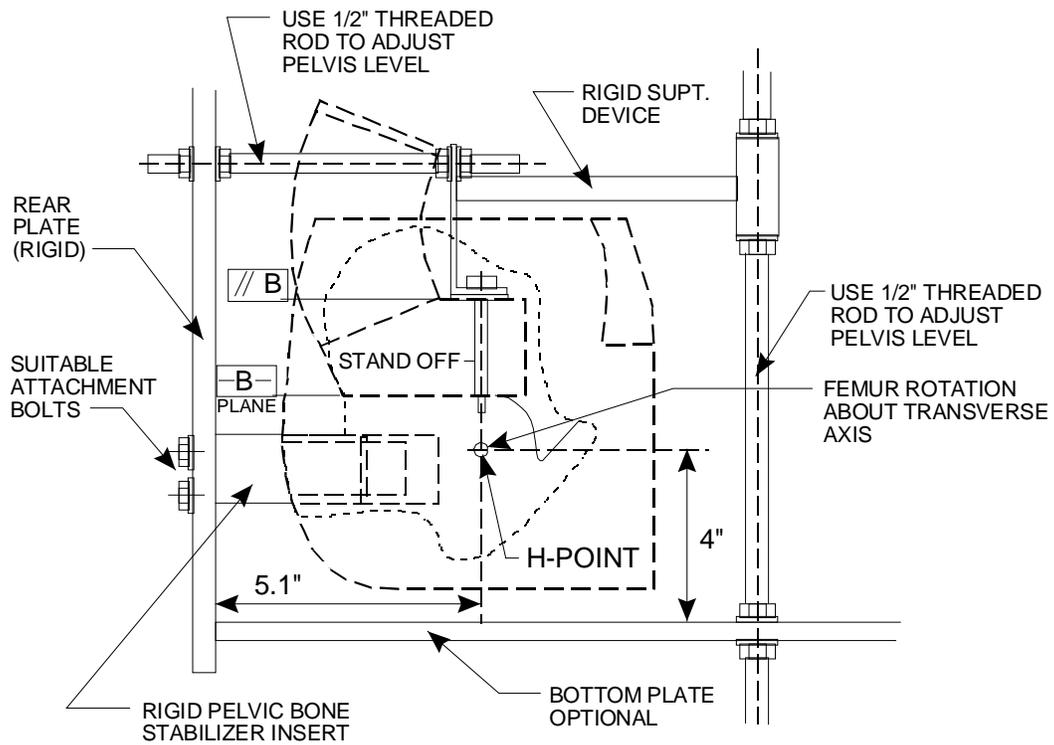


FIGURE 17A

# HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY

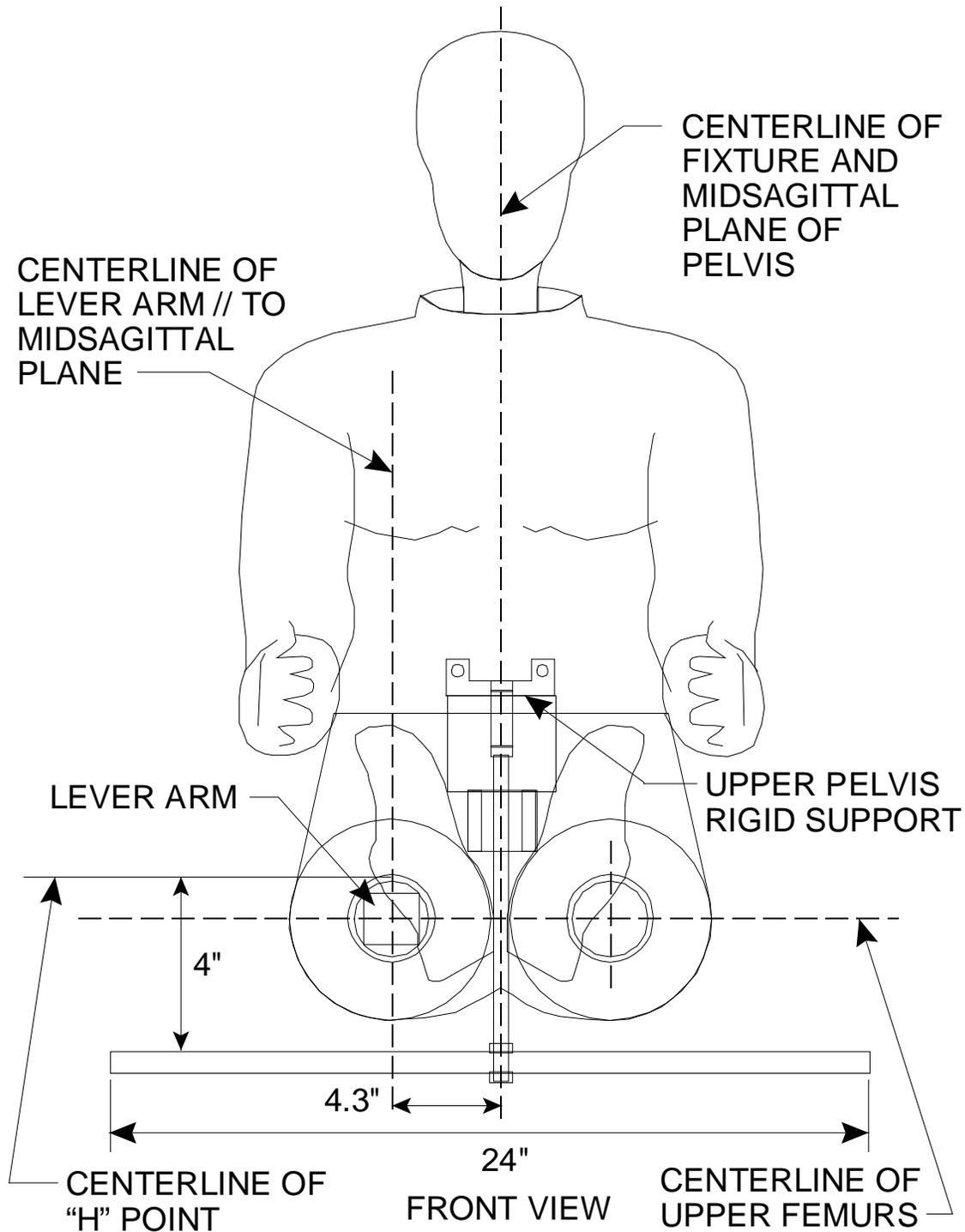


FIGURE 18A

# HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY

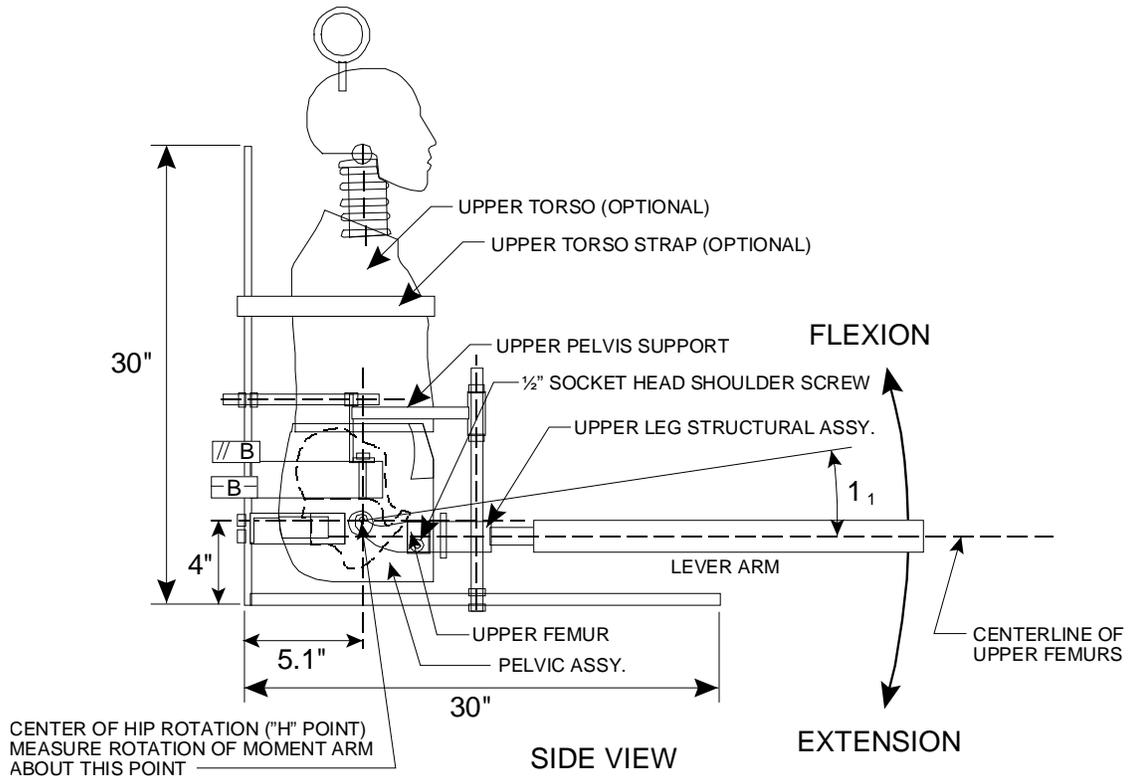


FIGURE 19A

**DATA SHEET A10**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

| LD. NO.                               | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|-----------|------------|--------------------------|--------------------------|
| <i>DUMMY INSTRUMENTATION</i>          |              |           |            |                          |                          |
| <b>HEAD ACCELEROMETERS</b>            |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| NECK TRANSDUCER                       |              |           |            |                          |                          |
| <b>CHEST ACCELEROMETERS</b>           |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| CHEST POTENTIOMETER                   |              |           |            |                          |                          |
| <b>FEMUR LOAD CELLS</b>               |              |           |            |                          |                          |
| (1) RIGHT FEMUR                       |              |           |            |                          |                          |
| (2) LEFT FEMUR                        |              |           |            |                          |                          |
| <b>LABORATORY INSTRUMENTATION</b>     |              |           |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| THORAX PENDULUM ACCELEROMETER         |              |           |            |                          |                          |
| KNEE PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) |              |           |            |                          |                          |

LABORATORY TECHNICIAN: \_\_\_\_\_

## **APPENDIX B**

### **PART 5720 (5<sup>th</sup> PERCENTILE FEMALE) DUMMY PERFORMANCE CALIBRATION TEST PROCEDURE**

**APPENDIX B**  
**PART 572, SUBPART O DUMMY PERFORMANCE CALIBRATION TEST**  
**PROCEDURE**

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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 Crashworthiness Standards) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart O 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 DIMENSIONS (drawing 880105-000-XH pg. 5 of 6, & PADI)
- B. HEAD DROP TEST (572.132)
- C. NECK FLEXION TEST (572.133(b)(1))
- D. NECK EXTENSION TEST 572.133(b)(2)
- E. THORAX IMPACT TEST ((572.134)
- F. TORSO FLEXION (572.135)
- G. KNEE IMPACT TESTS (572.136)

This laboratory procedure for the calibration of Part 572, Subpart O dummies must be used by National Highway Traffic Safety Administration (NHTSA) contract laboratories performing NCAP testing for the Office of Crashworthiness Standards (OCWS).

## 2. GENERAL REQUIREMENTS

The Code of Federal Regulations (49CFR), Parts 571 and 572, was amended to adopt the Hybrid III, 5th Percentile Female Dummy. Each Part 572, Subpart O dummy used in an NCAP test must meet the specifications and performance criteria of Part 572 before and after each vehicle crash test in order to be an acceptable test tool.

The Part 572, Subpart O Hybrid III 5th Percentile Female Dummy consists of components and assemblies specified in the drawing and specifications package which is available from Reprographics Technologies, 9000 Virginia Manor, Beltsville, MD 20705, telephone - (301) 419-5070.

## 3. SECURITY

All NHTSA Part 572, Subpart O test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as a 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 maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart O dummy calibration tests before and after each vehicle test usage.

No information concerning the Part 572, Subpart O 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 O dummies are being calibrated as test tools to be used in NCAP vehicle crash tests. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. In addition, 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. All calibration test data for each particular Part 572, Subpart O dummy will be sent to the COTR with each test report.

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

## **7. GOVERNMENT FURNISHED PROPERTY (GFP)**

Part 572, Subpart O test dummies will be furnished to the contract laboratory by the OCWS. The dummies shall be stored in an upright sitting position with the weight supported by the internal structure of the pelvises. The dummies' heads shall be held upright by using a strap around the chest or the base of the neck so that the neck is not supporting the weight of the dummy. The 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 (as part of the NCAP procedure), which will be included with the dummy calibration, if requested. The COTR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be calibrated by the contractor according to the schedule indicated in the NCAP test procedure.

## **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 as indicated in NCAP test procedure. These calibrations shall be submitted with the final report.

## **9. PHOTOGRAPHIC DOCUMENTATION**

Provide still photographs (color prints properly focused for clear images, no more than two (2) per 8.5"x11" sheet) of post test damage resulting from the vehicle crash test.

## **10. DEFINITIONS**

PADI: Procedures for Assembly, Disassembly, and Inspection

## 11. PRETEST REQUIREMENTS

### 11.1 TRANSDUCER REQUIREMENTS

The contractor shall provide and install the following instrumentation to the GFP dummies (excluding the chest deflection transducer).

- A. HEAD – The head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing SA572-S4 and be mounted in the head as shown in drawing 880105-000 sheet 3 of 6. (572.137(c))

Three accelerometers shall be mounted in the head cavity to measure orthogonal accelerations ( $A_x$ ,  $A_y$ ,  $A_z$ ) at the center of gravity (CG) of the head assembly.

- B. NECK – The upper neck force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S11 and shall be mounted in the head neck assembly as shown in drawing 880105-000, sheet 3 of 6. (572.137(d))

- C. CHEST – The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572-S4 and be mounted in the torso assembly in traxial configuration within the spine box instrumentation cavity as shown drawing 880105-000 sheet 3 of 6. The chest accelerometers are not required for dummy calibration testing but are required for NCAP testing. (572.137(e))

The chest deflection transducer shall have the dimensions and response characteristics specified in drawing SA572-S51 and be mounted to the upper torso assembly as shown in drawings 880105-300 and 880105-000 sheet 3 of 6. (572.137(j))

- D. LEGS -- The single axis femur force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S14 and be mounted in assemblies 880105-560-1 and 880105-560-2. The femur transducers are not required for calibration of the dummy but are required for NCAP testing. (572.137(i))

- E. TEST FIXTURE – The neck pendulum, thorax and knee probe accelerometers shall have the dimensions and characteristics of drawing SA572-S4.

## 11.2 OTHER TRANSDUCER CONDITIONS

- A. TRANSDUCER MOUNTS – The mountings for sensing devices shall have no resonance frequency less than 3 times the frequency range of the applicable channel class. (572.137(o))
- B. TRANSDUCER SIGN CONVENTION - The sign convention for outputs of transducers mounted within the dummy that measure head and chest accelerations, chest deflection and femur loads are located in Figure 1B. For other transducers see SAE J1733DEC94. (572.137(n))
- 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 will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1 MAR95, "Instrumentation for Impact Test," with channel classes as follows: (572.137(m))

|  |  |
|--|--|
| (1) Head acceleration                          | Class 1000 (572.137(m)(1))   |
| (2) Neck force                                 | Class 1000 (572.137(m)(2)(i)) except use<br>Class 600 for calculation of neck moment about the occipital condyle |
| (3) Neck moment                                | Class 600 (572.137(m)(2)(ii))  |
| (4) Neck pendulum acceleration                 | Class 180 (572.137(m)(2)(iii))   |
| (5) Neck rotation transducers                  | Class 60 (572.137(m)(2)(iv))   |
| (6) Thorax and thorax pendulum<br>acceleration | Class 180 (572.137(m)(3)(ii))  |
| (7) Thorax deflection                          | Class 600 (572.137(m)(3)(iii))   |
| (8) Knee pendulum acceleration                 | Class 600 (572.137(m)(6))  |
| (9) Femur force                                | Class 600 (572.137(m)(6))  |

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

## 11.3 THORAX IMPACTOR PROBE (572.137(a))

- A. The test probe for thoracic impacts shall be of rigid metallic construction, concentric about its longitudinal axis.
- B. It shall have a mass of  $13.97 \pm 0.023$  kg ( $30.8 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
- C. It shall have a minimum mass moment of inertia of  $3646$  kg-cm<sup>2</sup> ( $3.22$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.

- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with diameter of  $152.4 \pm 0.25$  mm ( $6.00 \pm 0.01$  in) and a maximum edge radius of 7.6-12.7 mm (0.3-0.5 in).
- E. The impactor is a cylinder with a diameter of 152.4-152.6 mm (6.0-6.1 in) and it is at least 25 mm (1.0 in) long.
- F. 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 axis of the probe.
- G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz.

#### 11.4 KNEE IMPACTOR PROBE (572.137(b))

- A. The test probe for knee impacts shall be of rigid metallic construction, concentric about its longitudinal axis.
- B. It shall have a mass of  $2.99 \pm 0.01$  kg ( $6.6 \pm 0.022$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
- C. It shall have a minimum mass moment of inertia of  $209$  kg-cm<sup>2</sup> ( $0.177$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with a diameter of  $76.2 \pm 0.2$ mm ( $3.00 \pm 0.01$  in) and a maximum edge radius of 7.6-12.7 mm (0.3-0.5 in).
- E. The impactor is a cylinder with a diameter of 76.2 –76.4 mm (3.00 –3.1 in) and it is at least 12.5 mm (1.0 in) long.
- F. 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 axis of the probe.
- G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz.

# SIGN CONVENTIONS FOR PART 572 SUBPART E TEST DUMMIES

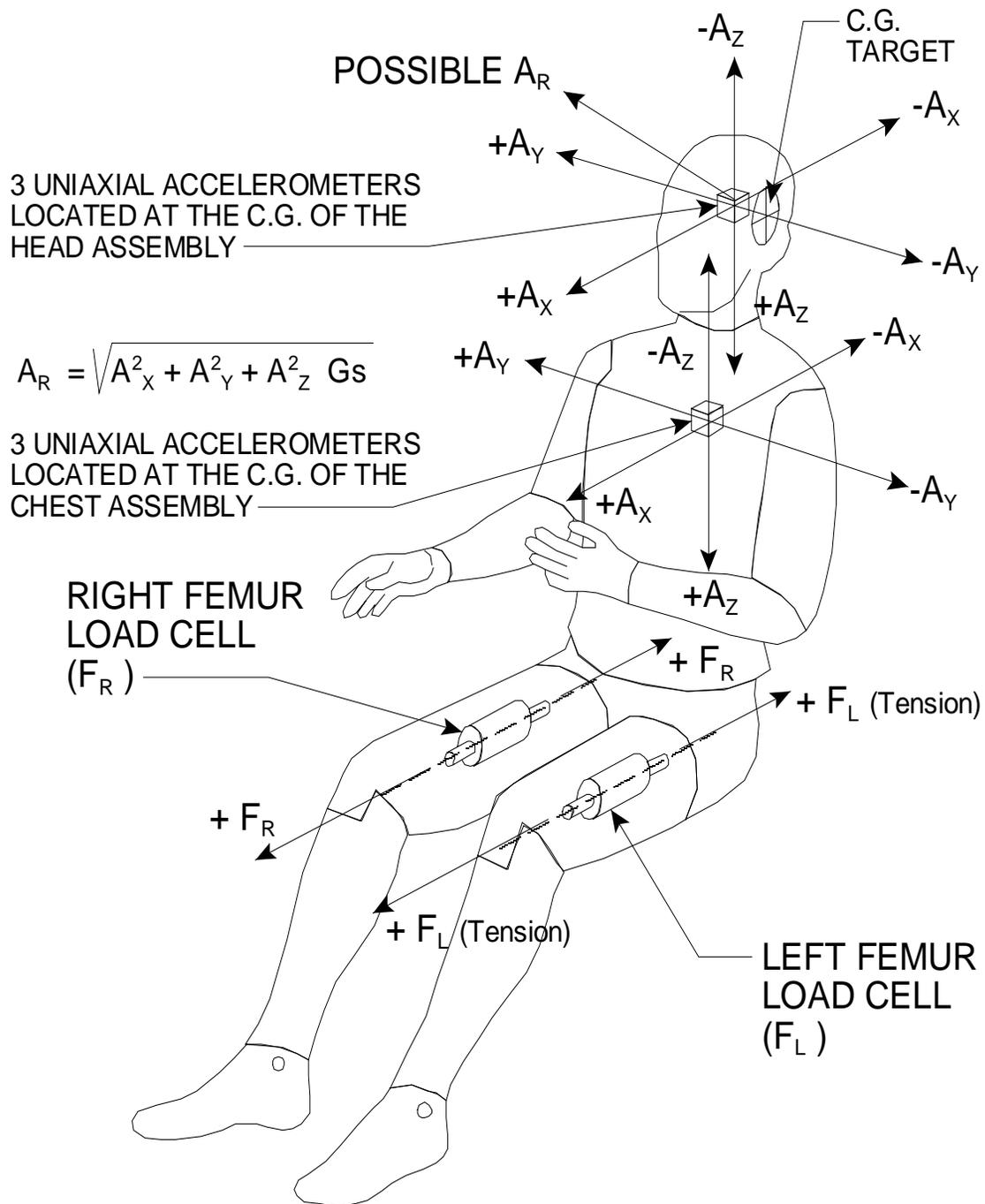


FIGURE 1B

TABLE 1B

| <b>SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS</b>  |   |
|---|---|
| <b>BODY SEGMENT — MEASURED FORCE</b>  | <b>POSITIVE OUTPUT DIRECTION</b>  |
| NECK<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW)  | HEAD REARWARD OR CHEST FORWARD<br>HEAD LEFTWARD, CHEST RIGHTWARD<br>HEAD UPWARD, CHEST DOWNWARD<br><br>LEFT EAR TOWARD LEFT SHOULDER<br>CHIN TOWARD STERNUM<br>CHIN TOWARD LEFT SHOULDER  |
| FEMUR<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW) | KNEE UPWARD, UPPER FEMUR DOWNWARD<br>KNEE RIGHTWARD, UPPER FEMUR LEFTWARD<br>KNEE FORWARD (TENSION), PELVIS REARWARD<br><br>KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE UPWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY |
| KNEE CLEVIS - FZ AXIAL  | TIBIA DOWNWARD (TENSION), FEMUR UPWARD  |
| UPPER TIBIA<br>MX MOMENT<br>MY MOMENT   | ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD  |
| LOWER TIBIA<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT<br>MY MOMENT                             | ANKLE FORWARD, KNEE REARWARD<br>ANKLE RIGHTWARD, KNEE LEFTWARD<br>ANKLE DOWNWARD (TENSION), KNEE UPWARD<br><br>ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD   |
| CHEST DISPLACEMENT  | CHEST COMPRESSED - NEGATIVE   |
| KNEE SHEAR DISPLACEMENT   | PUSH ON FRONT OF TIBIA - NEGATIVE   |

**NOTE:** DIRECTIONS ARE DEFINED IN RELATION TO A SEATED DUMMY

## 11.5 GENERAL TEST CONDITIONS

- A. Surfaces of dummy components are not painted unless otherwise specified. (572.137(r))
- B. Dummy performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise specified. (572.137(q))
- C. Except for neck assembly and thorax assembly testing, the dummy performance tests are conducted at any temperature from 18.9°C (66°F) to 25.6°C (78°F) and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours. For the neck assembly and thorax assembly, the temperature range is 20.6°C (69°F) to 22.2°C (72°F).
- D. Dummy limb joints are set at 1G, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2 Gs throughout the range of limb motion. (572.137(p)) Also see Appendix B of the PADI for guidelines for setting the joints to 1G.
- E. Dummies will be clothed for the thorax calibration tests with a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg (0.30 lb) each. (572.134(c)(1))

## 12. CALIBRATION TEST EXECUTION

Complete the Data Sheets in section 15.

## 13. 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.

## 14. REPORTS

### 14.1 APPARENT NONCONFORMANCE

During calibration verification, 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 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 OCWS.

## 14.2 CALIBRATION DOCUMENTATION

### 14.2.1 COPIES

Copies of the data sheets containing the calibration data for each Part 572, Subpart O dummy used in the vehicle crash test shall be submitted with the final NCAP test report for the vehicle.

Contractors are required to **PROOF READ** all Final 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.

**15. DATA SHEETS****DATA SHEET B1  
DUMMY DAMAGE CHECKLIST**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

This check sheet is completed as part of the calibration verification.

 Perform general cleaning.

| <i>Dummy Item</i>           | <i>Inspect for</i>   | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-----------------------------|--|-----------------|----------------|-----------|
| Outer skin                  | Gashes, rips, cracks   |                 |                |           |
| Head                        | Ballast secure   |                 |                |           |
|                             | General appearance   |                 |                |           |
| Neck                        | Broken or cracked rubber                                     |                 |                |           |
|                             | Upper neck bracket firmly attached to the lower neck bracket |                 |                |           |
|                             | Looseness at the condyle joint                               |                 |                |           |
|                             | Nodding blocks cracked or out of position                    |                 |                |           |
| Spine                       | Broken or cracks in rubber.                                  |                 |                |           |
| Ribs                        | Broken or bent ribs  |                 |                |           |
|                             | Broken or bent rib supports                                  |                 |                |           |
|                             | Damping material separated or cracked                        |                 |                |           |
|                             | Rubber bumpers in place                                      |                 |                |           |
| Chest Displacement Assembly | Bent shaft   |                 |                |           |
|                             | Slider arm riding in track                                   |                 |                |           |
| Transducer leads            | Torn cables  |                 |                |           |

| <i>Dummy Item</i>       | <i>Inspect for</i>                    | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-------------------------|---------------------------------------|-----------------|----------------|-----------|
| Accelerometer Mountings | Head mounting secure                  |                 |                |           |
|                         | Chest mounting secure                 |                 |                |           |
| Knees                   | Skin condition                        |                 |                |           |
|                         | Insert (do not remove)                |                 |                |           |
|                         | Casting                               |                 |                |           |
| Limbs                   | Normal movement and adjustment        |                 |                |           |
| Knee Sliders            | Wires intact                          |                 |                |           |
|                         | Rubber returned to "at rest" position |                 |                |           |
| Pelvis                  | Broken                                |                 |                |           |
| Other                   |                                       |                 |                |           |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Describe the repair or replacement of parts:

Checked by

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET B2**  
**EXTERNAL MEASUREMENTS (5<sup>th</sup> Female)**  
 (See the PADI)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

1. Remove the dummy's chest jacket and the abdominal insert.
2. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in Figure 3B and 4B. The seating surface is at least 406 mm (16 in) wide and 406 mm (16 in) in depth 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.
3. Remove the four 1/4-20 x 5/8 SHCS that attach the lumbar spine to the thoracic spine. Lift the upper torso off of the lower torso. Check the torque on the 2-20 jam nut that attaches to the end of the lumbar spine cable. The torque should be 1.13 – 1.35 NM (10 – 12 in-lbs).

**NOTE:** At this point the thorax is to be inspected for damage. The thorax displacement transducer may be removed for calibration if required (pretest calibration only). Extreme caution must be used so as not to damage the instrumentation cables.

4. Reassemble the upper torso to the lower torso.
5. Secure the dummy to the test fixture so that the button head screws (that attach the top rib to the spine box) and the adapter plate (that connects the upper torso to the lower torso) are against the vertical surface of the fixture. The rear surface of the buttocks now contacts the fixture.
6. Position the dummy's H-point so it is  $83.8 \pm 2.5$  mm ( $3.3 \pm 0.1$  in) above the horizontal seating surface and  $147.3 \pm 2.5$  mm ( $5.8 \pm 0.1$  in) forward of the rear vertical surface of the fixture. (Note: the H-point is located 68.6 mm (2.7 in) forward and 58.4 mm (2.3 in) downward from the center of the square hole in the pelvis.)
7. Extend the dummy's neck so that the base of the skull is level both fore-and-aft and side-to-side, within 0.5 degrees. The rear surface of the skull cap should be  $45.7 \pm 2.5$  mm ( $1.8 \pm 0.1$  in) from the vertical surface of the test fixture. A strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.
8. Position the upper and lower legs parallel to the midsagittal plane so the centerline between the knee pivot and the screw attaching the ankle to the lower tibia is vertical.
9. Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.
10. Position the upper arms downward vertically so the centerline between the shoulders and elbow pivots is parallel to the rear vertical surface of the fixture.

- \_\_11. Position the lower arms horizontally so the centerline between the elbow and wrist pivots is parallel to the seat surface.
- \_\_12. Record the dimensions listed in following table, except for dimension Y and Z (reference figure 2B).
- \_\_13. Install the abdominal insert and chest jacket. Reposition the dummy on the test fixture. The head need not be level as previously specified.
- \_\_14. Mark the locations AA, and BB, and record the dimensions Y, Z, as specified in following table and figure 2B.

---

Signature

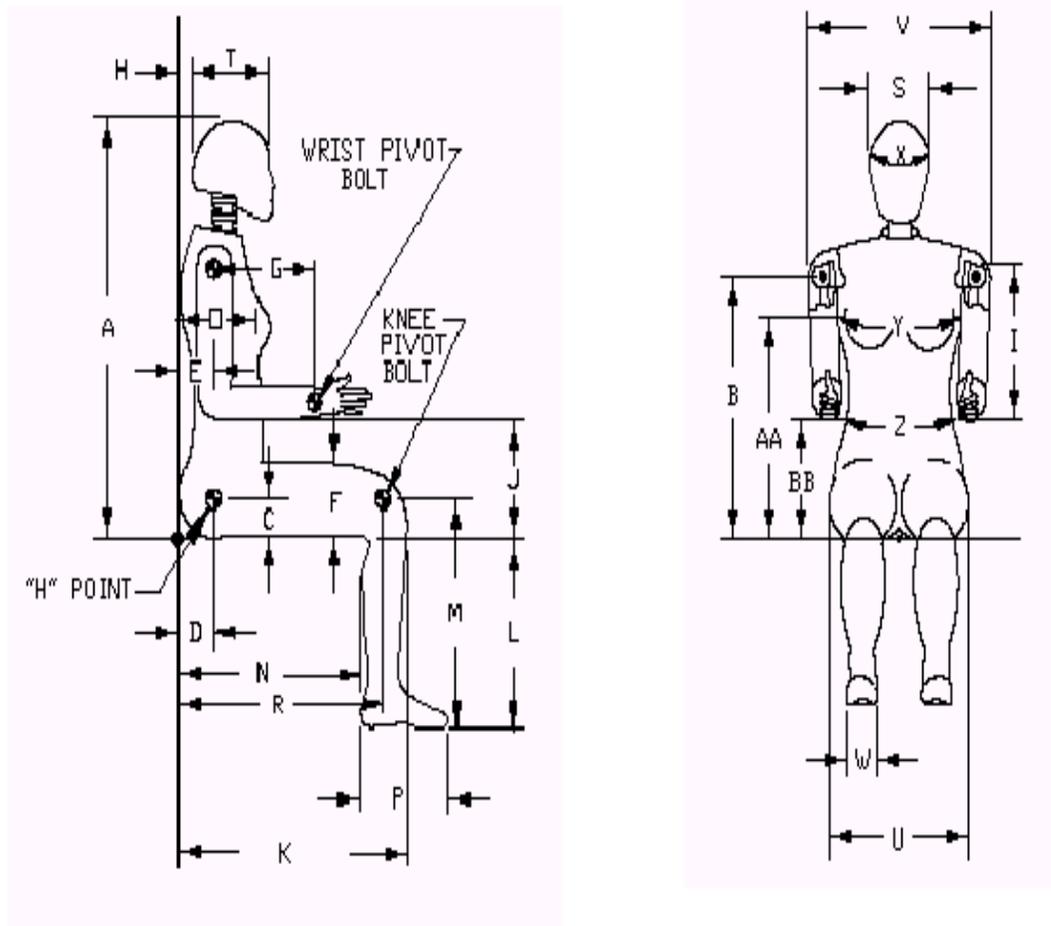
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Date

| HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS  |                                |  |                         |                    |
|--|--------------------------------|--|-------------------------|--------------------|
| DIMENSION  | DESCRIPTION                    | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A  | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.  | 774.7-800.1             |                    |
| B  | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.   | 431.8-457.2             |                    |
| C  | H-POINT HEIGHT                 | Reference  | 81.3-86.3               |                    |
| D  | H-POINT LOCATION FROM BACKLINE | Reference  | 144.8-149.8             |                    |
| E  | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.   | 68.6-83.8               |                    |
| F  | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.  | 119.4-134.6             |                    |
| G  | BACK OF ELBOW TO WRIST PIVOT   | back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots   | 243.9-259.1             |                    |
| H  | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)   | 43.2-48.2               |                    |
| I  | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2             |                    |
| J  | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.   | 182.8-203.2             |                    |
| K  | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.   | 520.7-546.1             |                    |
| L  | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.   | 355.6-376               |                    |
| M  | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.   | 393.7-419.1             |                    |
| N  | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 414-439.4               |                    |
| HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued |                                |  |                         |                    |

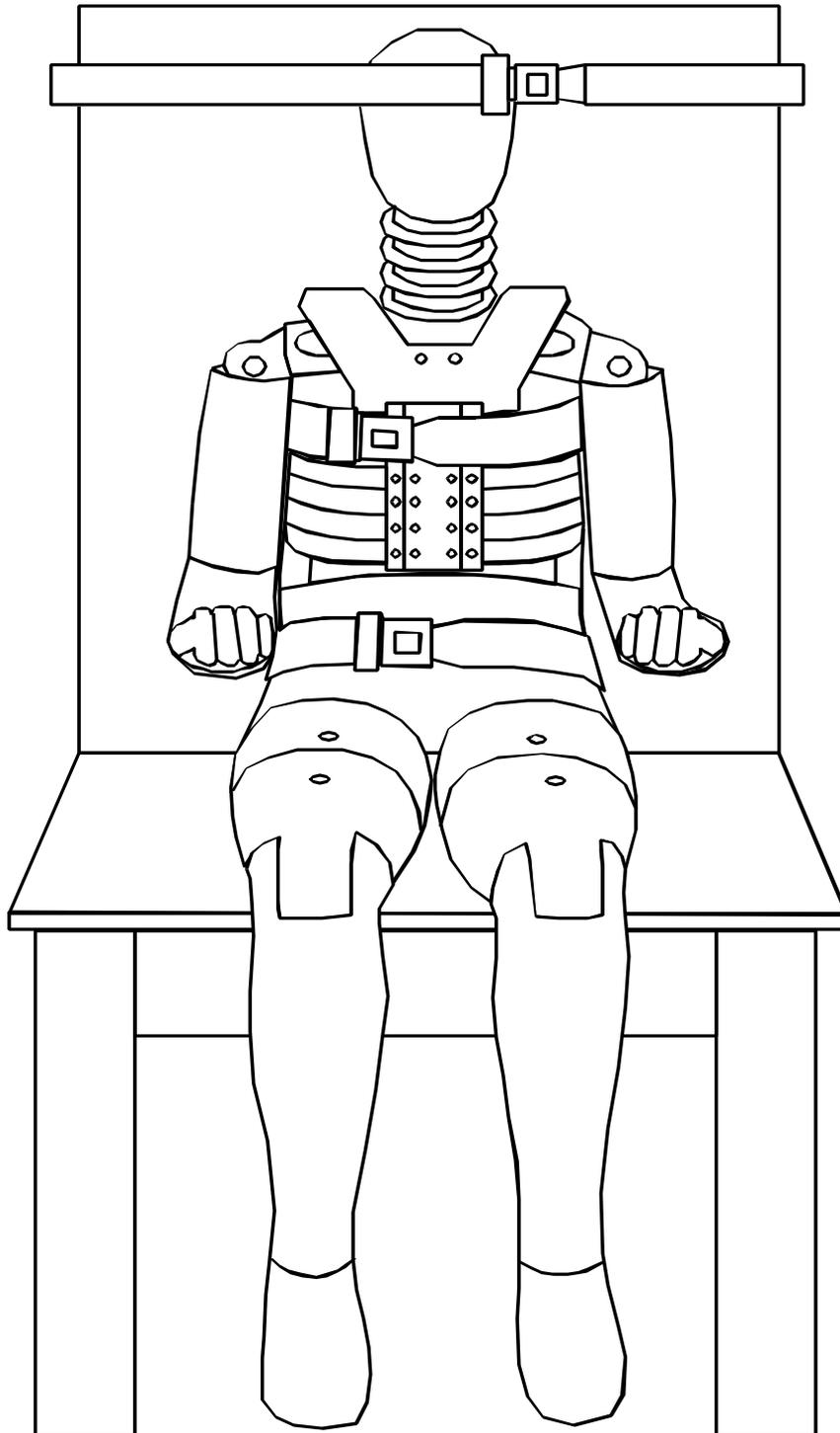
| DIMENSION | DESCRIPTION   | DETAILS   | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
|-----------|---|---|-------------------------|--------------------|
| O         | CHEST DEPTH WITHOUT JACKET                                | Measured $304.8 \pm 5.1$ mm above seat surface          | 175.3-190.5             |                    |
| P         | FOOT LENGTH   | Tip of toe to rear of heal                              | 218.5-233.7             |                    |
| Q         | STANDING HEIGHT   | (THEORETICAL)   | 1501.1                  | N/A                |
| R         | BUTTOCK TO KNEE PIVOT LENGTH                              | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6             |                    |
| S         | HEAD BREADTH  | The widest part of the head                             | 137.1-147.3             |                    |
| T         | HEAD DEPTH  | Back of the head to the forehead                        | 177.8-188               |                    |
| U         | HIP BREADTH   | The widest part of the hip                              | 299.7-314.9             |                    |
| V         | SHOULDER BREADTH  | Outside edges of right and left shoulder clevises       | 350.5-365.7             |                    |
| W         | FOOT BREADTH  | The widest part of the foot                             | 78.8-94                 |                    |
| X         | HEAD CIRCUMFERENCE  | Measured at the point as in dim. "T"                    | 528.3-548.7             |                    |
| Y         | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured $345.4 \pm 12.7$ mm above seat surface         | 850.9-881.3             |                    |
| Z         | WAIST CIRCUMFERENCE                                       | Measured $165.1 \pm 5.1$ mm above seat surface          | 759.5-789.9             |                    |
| AA        | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference   | 332.7-358.1             |                    |
| BB        | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference   | 160.1-170.2             |                    |

**EXTERNAL DIMENSION SPECIFICATIONS**



*FIGURE 2B*

# EXTERNAL DIMENSIONS TEST SETUP



*FIGURE 3B*

# EXTERNAL DIMENSIONS TEST SETUP

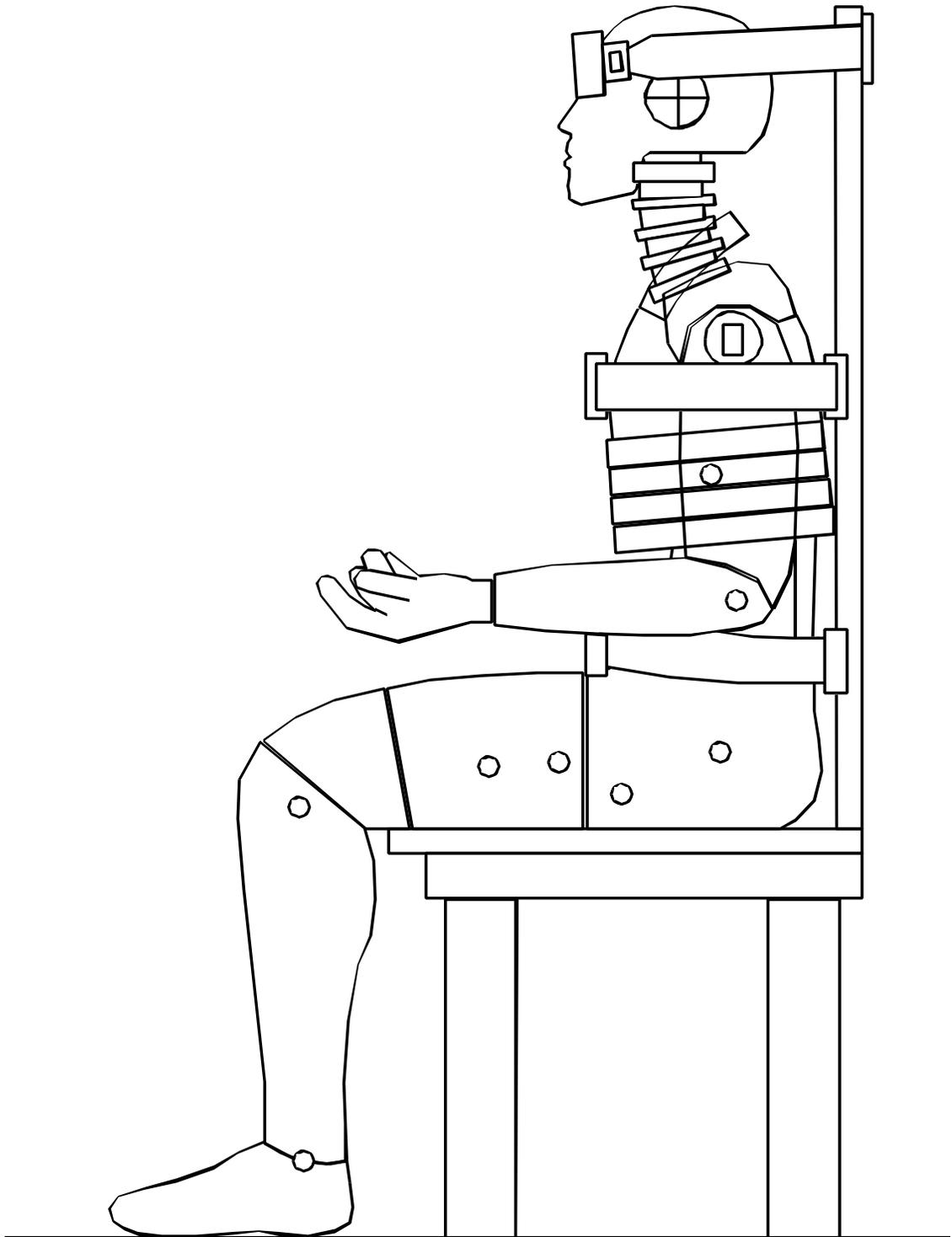


FIGURE 4B

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

- \_\_1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 \_\_ N/A, ONLY one head drop performed
- \_\_2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- \_\_3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- \_\_4. Accelerometers and their respective mounts are smooth and clean.
- \_\_5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- \_\_6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- \_\_7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

- \_\_10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance \_\_\_\_\_

**NOTE: The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.**

- \_\_11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance \_\_\_\_\_  
Record the left side distance \_\_\_\_\_
- \_\_12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish \_\_\_\_\_
- \_\_13. The impact surface is rigidly supported. (572.132(c)(4))
- \_\_14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness \_\_\_\_\_  
Record width \_\_\_\_\_  
Record length \_\_\_\_\_
- \_\_15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- \_\_16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          |        |

- \_\_17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

# HEAD DROP TEST SETUP SPECIFICATIONS

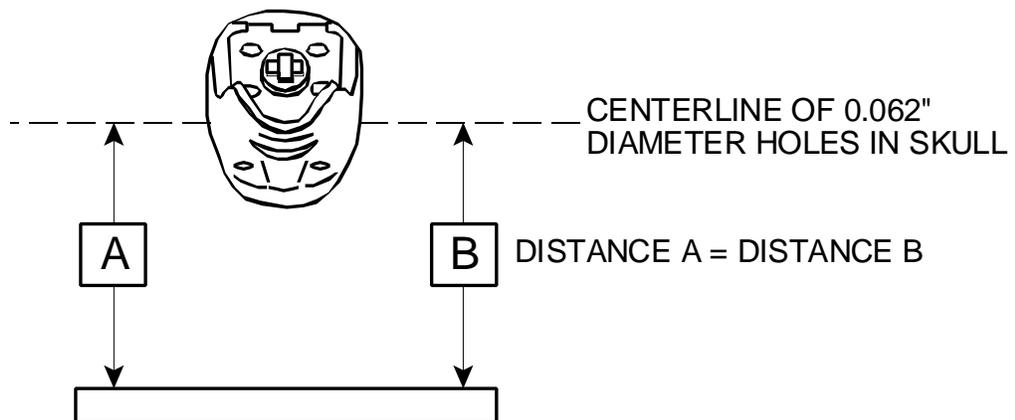
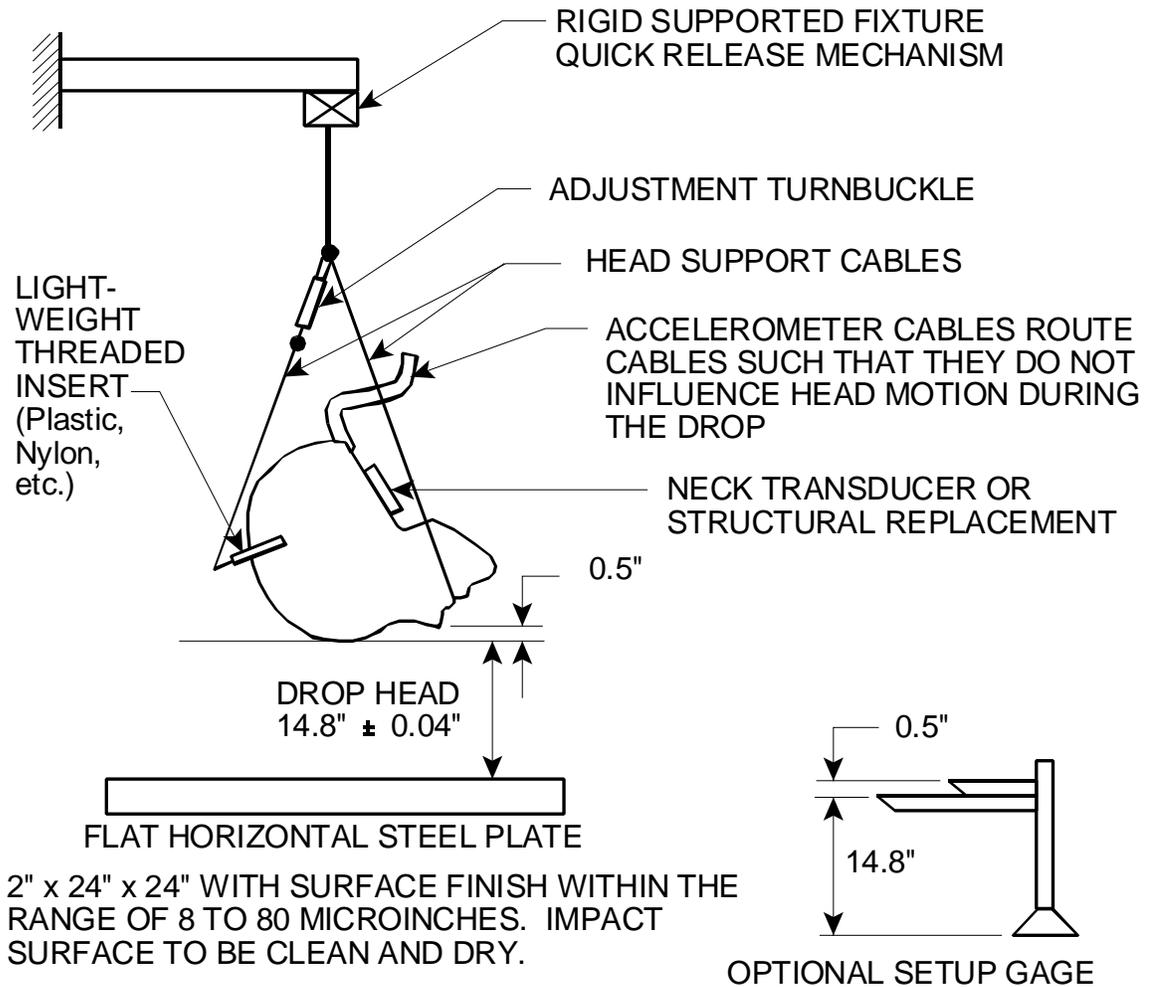


FIGURE 5B

# HEAD DROP TEST SETUP

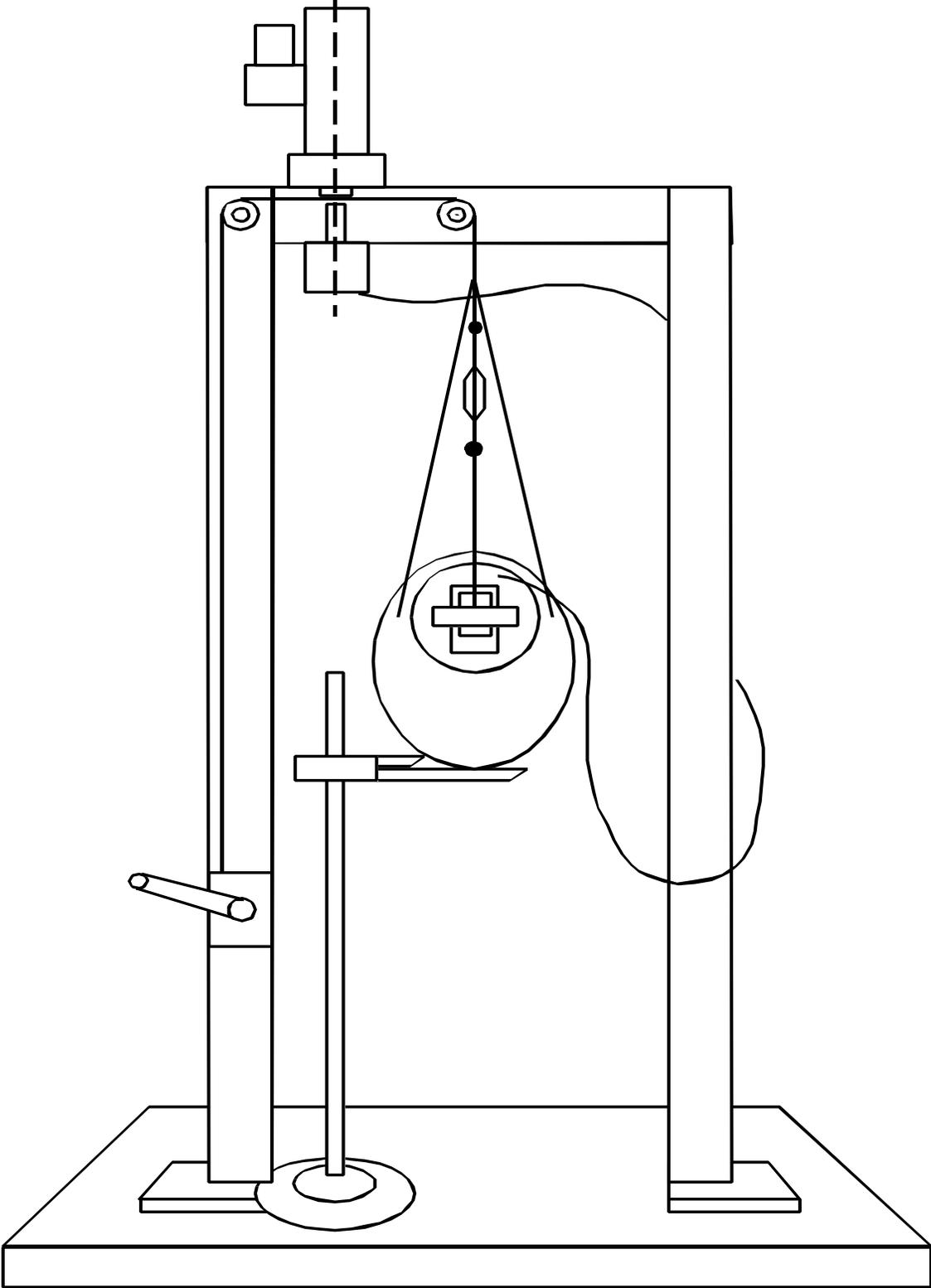


FIGURE 6B

**DATA SHEET B4**  
NECK FLEXION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

- \_\_1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 \_\_ N/A, ONLY one neck test performed
- \_\_2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- \_\_3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- \_\_6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))
- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- \_\_8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- \_\_10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- \_\_11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- \_\_13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) &amp; (572.133(c)(4)(I &amp; ii))

| Parameter  | Specification  | Result   |
|--|--|--|
| Pendulum impact speed                            | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$   |  |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms   | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$ |
|  | @ 20 ms  | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$ |
|  | @30ms  | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$ |
| Plane D Rotation                                 | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$ | ___Nm @<br>___degrees                                |
| Positive Moment Decay**<br>(Flexion)             | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100\text{ms}$   |  |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- \_\_14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive extension tests are necessary)

- \_\_1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 \_\_ N/A, ONLY one neck test performed
- \_\_2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- \_\_3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments.

**NOTE: If the damage resulted 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.**

Record findings and actions: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- \_\_5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI).

Record findings and actions: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- \_\_6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))
- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- \_\_8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- \_\_10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- \_\_11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- \_\_13. Complete the following table:

Neck Extension Test Results (572.133(b)(2) &amp; (572.133(c)(4)(I &amp; ii))

| Parameter  | Specification   | Result   |
|--|---|--|
| Pendulum impact speed                            | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$  |  |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$ |
|  | @ 20 ms   | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$ |
|  | @ 30ms  | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$ |
| Plane D Rotation                                 | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$ | ___Nm @ ___degrees                                   |
| Negative Moment Decay** (Extension)              | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$   |  |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- \_\_14 Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**PENDULUM SPECIFICATIONS**

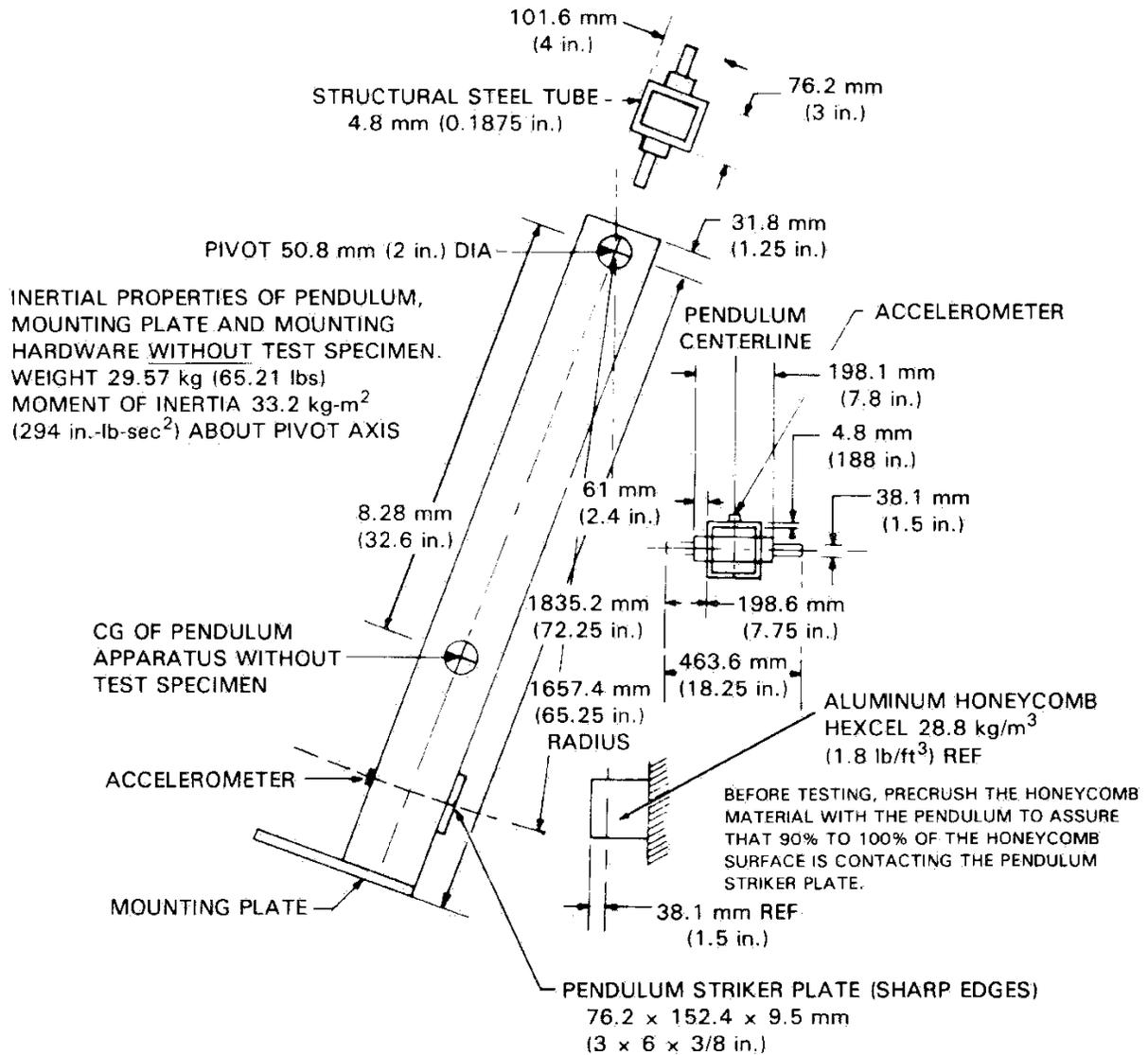


FIGURE 7B

NECK FLEXION TEST SETUP SPECIFICATIONS

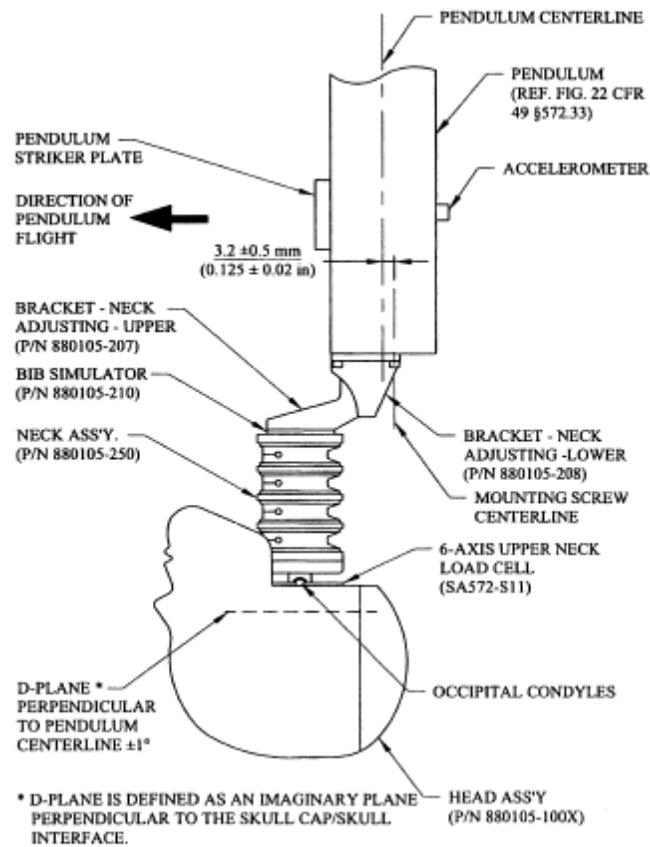
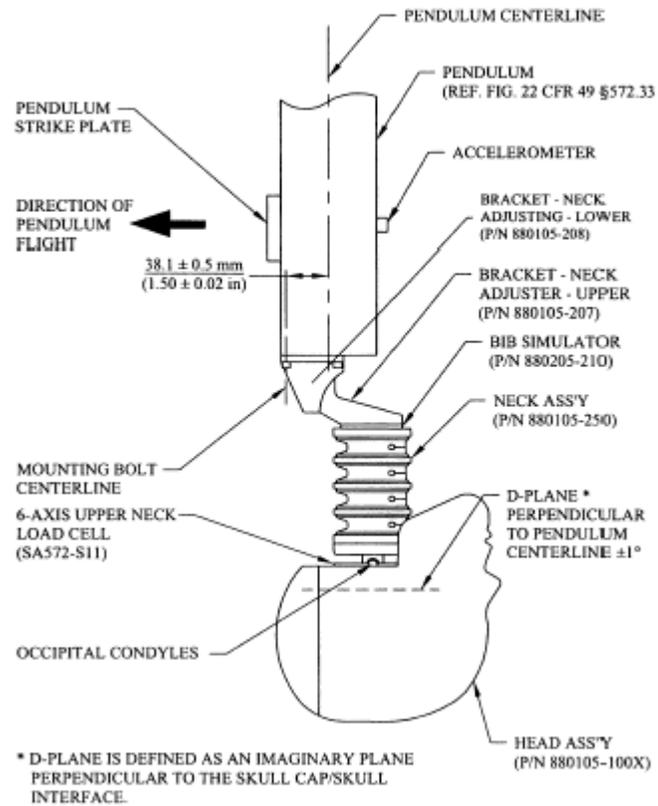


FIGURE 8B

NECK EXTENSION TEST SETUP SPECIFICATIONS



*FIGURE 9B*

# ROTATION TRANSDUCER ASSEMBLY

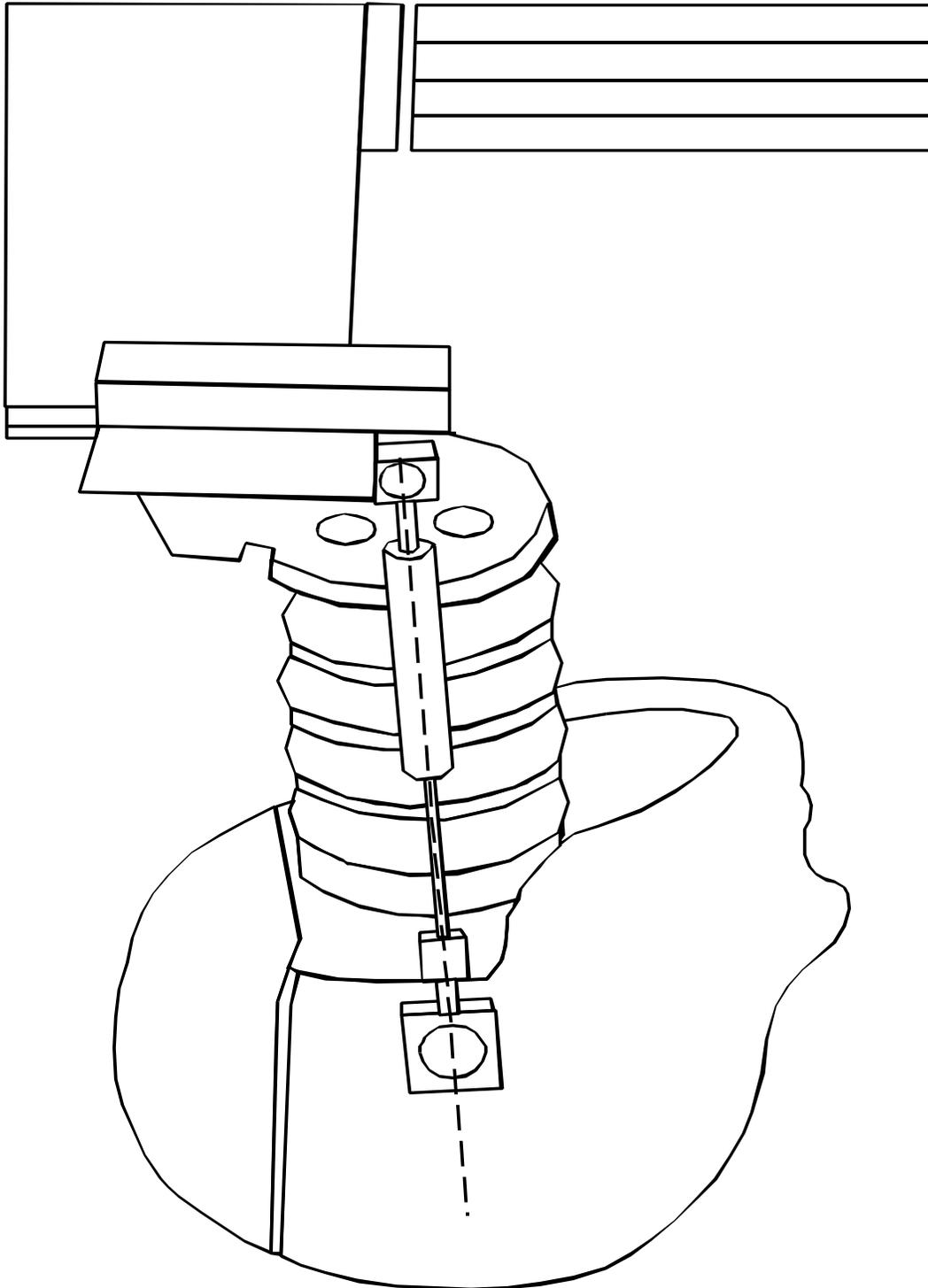


FIGURE 10B

**DATA SHEET B6**  
**THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive thorax impact tests are necessary)

1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 11B.
3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.  
 - No damage  
 - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_  
 \_\_\_\_\_  
 - The following repairs or replacement was performed. Record \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Seat the dummy, (chest skin still removed) without back and arm supports, on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

- \_\_8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- \_\_9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- \_\_10. Align the adjustable neck bracket index marks to the "zero" position.
- \_\_11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- \_\_12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- \_\_13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- \_\_14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- \_\_15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

\_\_16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*  | Specification  | Result |
|---|--|--------|
| Test Probe Speed  | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     |        |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ |        |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        |        |
| Peak force** between 18.0 and 50.0 mm chest compression | Peak force $\leq 4600 \text{ N}$                               |        |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        |        |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

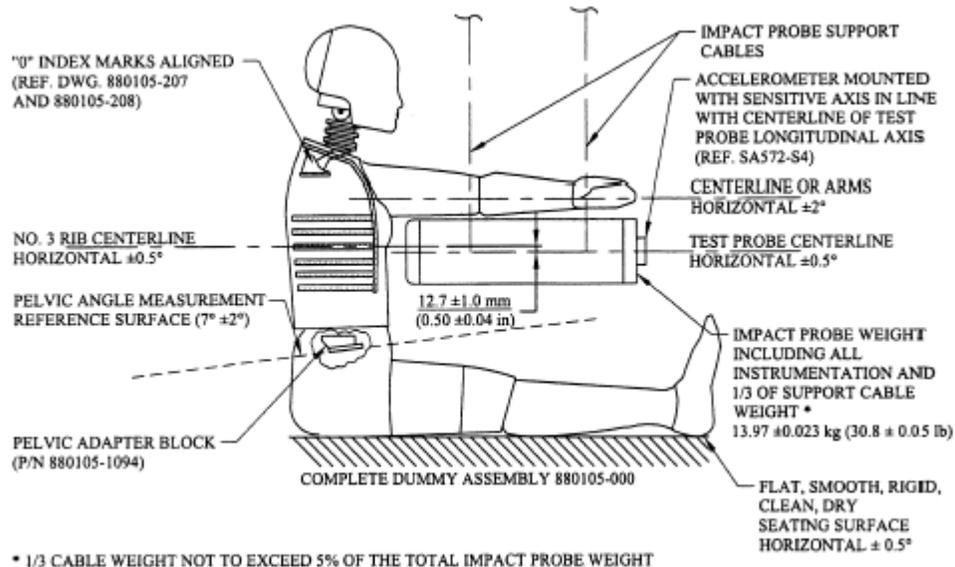
\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

\_\_17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

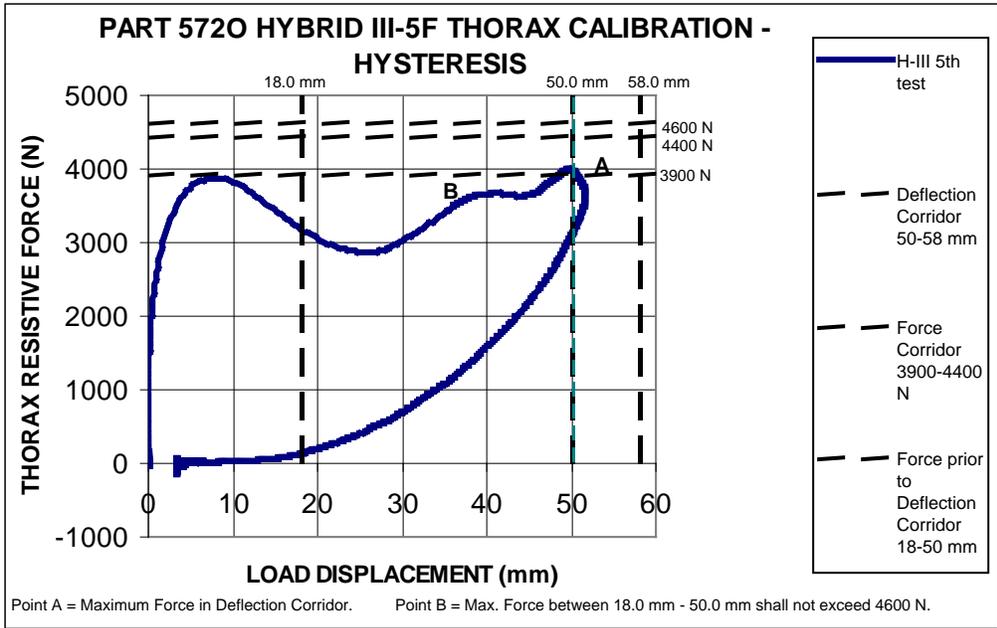
### THORAX IMPACT TEST SETUP SPECIFICATIONS



#### Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of  $13.97 \pm 0.023$  kg ( $30.8 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and their attachments to the impact probe are included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $3646$  kg-cm<sup>2</sup> ( $3.22$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has a flat, continuous, and non-deformable face with diameter of  $152.4 \pm 0.25$  mm ( $6.00 \pm 0.01$  in) and a maximum edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in).
5. The impactor is a cylinder with a diameter of 152.4-152.6 mm (6.0-6.1 in) and it is at least 25 mm (1.0 in) long.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz.

*FIGURE 11B*



*FIGURE 12B*

**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive torso flexion tests are necessary)

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))  
Record the maximum temperature \_\_\_\_\_  
Record the minimum temperature \_\_\_\_\_  
Record the maximum humidity \_\_\_\_\_  
Record the minimum humidity \_\_\_\_\_
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) \_\_\_\_\_
12. Attach the pull cable and the load cell. (572.135(c)(8))

- \_\_13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the angle reference plane is at  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.135(c)(9))
- \_\_14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds. (572.135(c)(10))
- \_\_15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- \_\_16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- \_\_17. Complete the following table:

Torso Flexion Results (572.135(b), 572.135(c)(7), (572.135(c)(9))

| Parameter                         | Specification   | Result |
|-----------------------------------|---|--------|
| Initial ref. plane angle          | Angle $\leq 20^\circ$   |        |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ |        |
| Force at $45^\circ \pm 0.5^\circ$ | $320 \text{ N} \leq \text{force} \leq 390 \text{ N}$          |        |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        |        |

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 Signature

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 Date

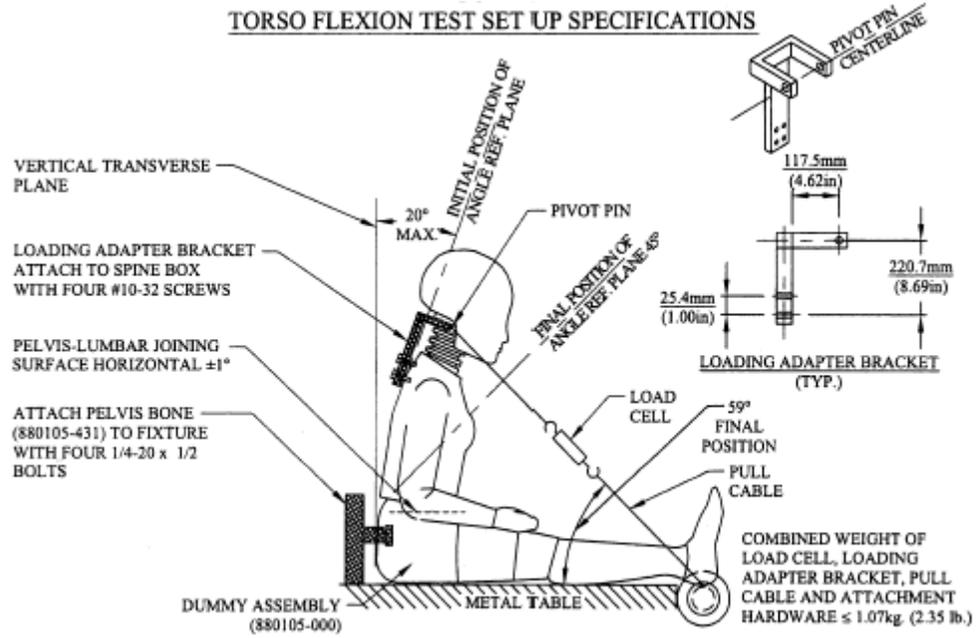


FIGURE 13B

**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14B.
3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

\_\_11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification  | Result |
|------------------------|--|--------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ |        |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     |        |

\*Force = impactor mass x deceleration (572.136(b)(2))

\_\_12. Plots of acceleration versus time and force versus time follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14B.
3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

\_\_11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification  | Result |
|------------------------|--|--------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ |        |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     |        |

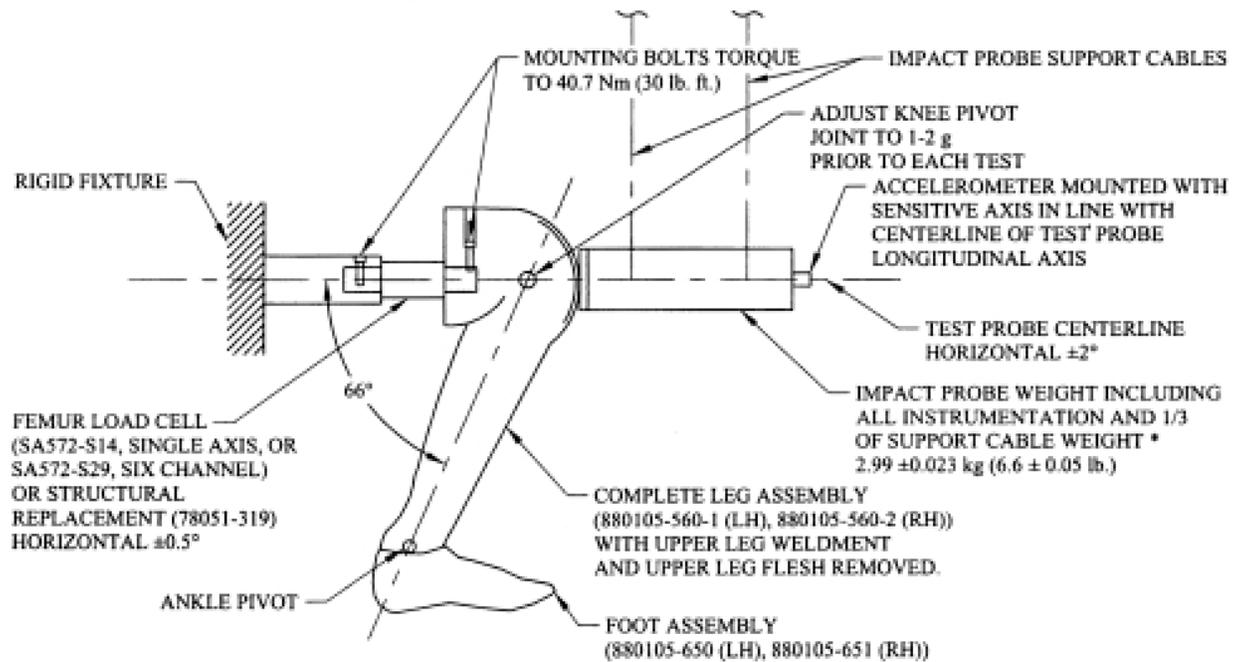
\*Force = impactor mass x deceleration (572.136(b)(2))

\_\_12. Plots of acceleration versus time and force versus time follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### KNEE IMPACT TEST SETUP SPECIFICATIONS



\* 1/3 CABLE WEIGHT NOT TO EXCEED 5% OF THE TOTAL IMPACT PROBE WEIGHT

Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of  $2.99 \pm 0.23$  kg ( $6.6 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and their attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $209$  kg-cm<sup>2</sup> ( $0.177$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with diameter of  $76.2 \pm 0.2$ mm ( $3.0 \pm 0.01$  in) and a maximum edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in).
5. The impactor is a cylinder with a diameter of 76.2-76.4 mm (3.0-3.1 in) and it is at least 12.5 mm (0.5 in) long.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz.

*FIGURE 14B*

**DATA SHEET B10**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

| I.D. NO.                              | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|-----------|------------|--------------------------|--------------------------|
| <b>DUMMY INSTRUMENTATION</b>          |              |           |            |                          |                          |
| <b>HEAD ACCELEROMETERS</b>            |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| NECK TRANSDUCER                       |              |           |            |                          |                          |
| <b>CHEST ACCELEROMETERS</b>           |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| CHEST POTENTIOMETER                   |              |           |            |                          |                          |
| <b>FEMUR LOAD CELLS</b>               |              |           |            |                          |                          |
| (1) RIGHT FEMUR                       |              |           |            |                          |                          |
| (2) LEFT FEMUR                        |              |           |            |                          |                          |
| <b>LABORATORY INSTRUMENTATION</b>     |              |           |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| THORAX PENDULUM ACCELEROMETER         |              |           |            |                          |                          |
| KNEE PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) |              |           |            |                          |                          |

LABORATORY TECHNICIAN: \_\_\_\_\_

## **APPENDIX C**

### **PART 572N (6-YEAR OLD) DUMMY PERFORMANCE CALIBRATION TEST PROCEDURE**

**APPENDIX C**  
**PART 572, SUBPART N DUMMY PERFORMANCE CALIBRATION TEST**  
**PROCEDURE**

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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 Crashworthiness Standards) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart N 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 DIMENSIONS (drawing 127-0000 sheet 5 of 6, & PADI)
- B. HEAD DROP TEST (572.122)
- C. NECK FLEXION TEST (572.123(b)(1))
- D. NECK EXTENSION TEST 572.123(b)(2)
- E. THORAX IMPACT TEST ((572.124)
- F. TORSO FLEXION (572.125)
- G. KNEE IMPACT TESTS (572.126)

This laboratory procedure for the calibration of Part 572, Subpart N dummies must be used by National Highway Traffic Safety Administration (NHTSA) contract laboratories performing NCAP testing for the Office of Crashworthiness Standards (OCWS).

## 2. GENERAL REQUIREMENTS

The Code of Federal Regulations (49CFR), Parts 571 and 572, was amended to adopt the Hybrid III, 6-Year-Old Child Dummy as the means of determining a vehicle's conformance to the performance requirements of FMVSS 208. Each Part 572, Subpart N dummy used in an NCAP test must meet the specifications and performance criteria of Part 572 before and after each vehicle crash test in order to be an acceptable test tool.

The Part 572, Subpart N Hybrid III, 6-Year-Old Child Dummy consists of components and assemblies specified in the drawing and specifications package which is available from Reprographics Technologies, 9000 Virginia Manor Road, Beltsville, MD 20705, telephone - (301) 419-5070.

## 3. SECURITY

All NHTSA Part 572, Subpart N test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as a 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 maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart N dummy calibration tests before and after each vehicle crash usage.

No Information concerning the Part 572, Subpart N 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 N dummies are being calibrated as test tools to be used in NCAP vehicle crash tests. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. In addition, 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. All calibration test data for each particular Part 572, Subpart N dummy will be sent to the COTR with each test report.

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

## **7. GOVERNMENT FURNISHED PROPERTY (GFP)**

Part 572, Subpart N test dummies will be furnished to the contract laboratory by the OCWS. The dummies shall be stored in an upright sitting position with the weight supported by the internal structure of the pelvises. The dummies' heads shall be held upright by using a strap around the chest or the base of the neck so that the neck is not supporting the weight of the dummy. 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 (as part of the NCAP procedure), which will be included with the dummy calibration, if requested. The COTR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be calibrated by the contractor according to the schedule indicated in the NCAP test procedure.

## **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 as indicated in NCAP test procedure. These calibrations shall be submitted with the final report.

## **9. PHOTOGRAPHIC DOCUMENTATION**

Provide still photographs (color prints properly focused for clear images, no more than two (2) per 8.5"x11" sheet) of post test damage resulting from the vehicle crash test.

## **10. DEFINITIONS**

PADI: Procedures for Assembly, Disassembly, and Inspection

## 11. PRETEST REQUIREMENTS

### 11.1 TRANSDUCER REQUIREMENTS

The contractor shall provide and install the following instrumentation to the GFP dummies (excluding the chest deflection transducer).

- A. HEAD – The head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing SA572-S4 and be mounted in the head as shown in drawing 127-0000 sheet 3. (572.127(c))

Three accelerometers shall be mounted in the head cavity to measure orthogonal accelerations ( $A_x$ ,  $A_y$ ,  $A_z$ ) at the center of gravity (CG) of the head assembly.

- B. NECK – The upper neck force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S11 and shall be mounted in the head neck assembly as shown in drawing 127-0000, sheet 3. (572.127(d))

- C. CHEST – The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572-S4 and be mounted in the torso assembly in triaxial configuration at T4 as shown in drawing 127-0000 sheet 3. The chest accelerometers are not required for dummy calibration testing but are required for NCAP testing. (572.126(e))

The chest deflection transducer shall have the dimensions and response characteristics specified in drawing SA572-S50 and be mounted to the upper torso assembly as shown in drawing 127-0000 sheet 3. (572.137(f))

- D. LEGS -- The single axis femur force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S10 and be mounted in the leg as shown in drawing 127-0000 sheet 3. The femur transducers are not required for calibration of the dummy but are required for FMVSS 208 testing. (572.137(j))

- E. TEST FIXTURE – The neck pendulum, thorax and knee probe accelerometers shall have the dimensions and characteristics of drawing SA572-S4.

## 11.2 OTHER TRANSDUCER CONDITIONS

- A. TRANSDUCER MOUNTS – The mountings for sensing devices shall have no resonance frequency less than 3 times the frequency range of the applicable channel class. (572.127(m))
- B. TRANSDUCER SIGN CONVENTION - The sign convention for outputs of transducers mounted within the dummy that measure head and chest accelerations, chest deflection and femur loads are located in Figure 1C. For other transducers see SAE J1733DEC94. (572.127(l))
- 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 will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1 MAR95, "Instrumentation for Impact Test," with channel classes as follows: (572.127(k))
- |  |                                |
|--|--------------------------------|
| 1. Head acceleration                       | Class 1000 (572.127(k)(1))     |
| 2. Neck force                              | Class 1000 (572.127(k)(2)(i))  |
| 3. Neck pendulum acceleration              | Class 180 (572.127(k)(2)(iii)) |
| 4. Neck moment transducers                 | Class 600 (572.127(k)(2)(ii))  |
| 5. Thorax and thorax pendulum acceleration | Class 180 (572.127(k)(3)(ii))  |
| 6. Sternum deflection                      | Class 600 (572.127(k)(3)(iii)) |
| 7. Knee pendulum acceleration              | Class 600                      |
| 8. Femur force                             | Class 600 (572.127(k)(6))      |
| 9. Torso flexion                           | Class 60                       |

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

## 11.3 THORAX IMPACTOR PROBE (572.127(a))

- A. The test probe for thoracic impacts shall be of rigid metallic construction, concentric about its longitudinal axis.
- B. It shall have a mass of  $2.86 \pm 0.02$  kg ( $6.3 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
- C. It shall have a minimum mass moment of inertia of  $160 \text{ kg-cm}^2$  ( $0.141 \text{ lbs-in-sec}^2$ ) in yaw and pitch about the center of gravity.
- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with

- diameter of  $101.6 \pm 0.25$  mm ( $4.00 \pm 0.01$  in) and an edge radius of 7.6-12.7 mm (0.3-0.5 in).
- E. The impactor is a cylinder with a diameter of 101-103 mm (4.0-4.1 in) and it is at least 12.5 mm (0.5 in) long.
  - F. 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 axis of the probe.
  - G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor..

#### 11.4 KNEE IMPACTOR PROBE (572.127(b))

- A. The test probe for knee impacts shall be of rigid metallic construction, concentric in shape and symmetric about its longitudinal axis.
- B. It shall have a mass of  $0.82 \pm 0.02$  kg ( $1.8 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
- C. It shall have a minimum mass moment of inertia of  $34$  kg-cm<sup>2</sup> ( $0.03$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with a diameter of  $76.2 \pm 0.2$  mm ( $3.00 \pm 0.01$  in) and a maximum edge radius of 7.6-12.7 mm (0.3-0.5 in).
- E. The impactor is a cylinder with a diameter of 76-77 mm (3.0-3.1 in) and it is at least 12.5 mm (0.5 in) long.
- F. 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 axis of the probe.
- G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor.

**SIGN CONVENTION FOR PART 572 TEST DUMMIES**

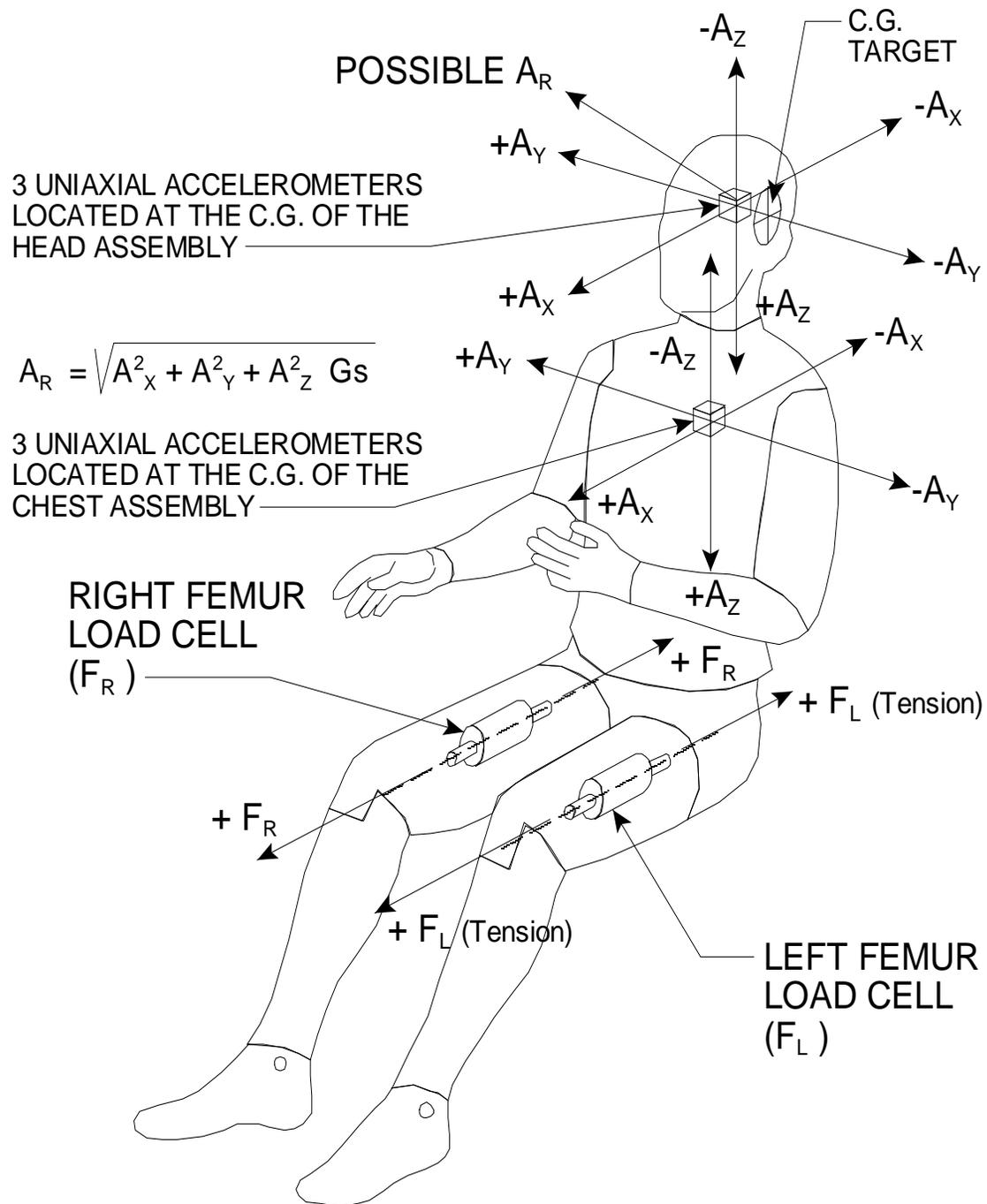


FIGURE 1C

TABLE 1C

| <b>SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS</b>  |   |
|---|---|
| <b>BODY SEGMENT —<br/>MEASURED FORCE</b>  | <b>POSITIVE OUTPUT DIRECTION</b>  |
| NECK<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW)  | HEAD REARWARD OR CHEST FORWARD<br>HEAD LEFTWARD, CHEST RIGHTWARD<br>HEAD UPWARD, CHEST DOWNWARD<br><br>LEFT EAR TOWARD LEFT SHOULDER<br>CHIN TOWARD STERNUM<br>CHIN TOWARD LEFT SHOULDER  |
| FEMUR<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW) | KNEE UPWARD, UPPER FEMUR DOWNWARD<br>KNEE RIGHTWARD, UPPER FEMUR LEFTWARD<br>KNEE FORWARD (TENSION), PELVIS REARWARD<br><br>KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE UPWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY |
| KNEE CLEVIS - FZ AXIAL  | TIBIA DOWNWARD (TENSION), FEMUR UPWARD  |
| UPPER TIBIA<br>MX MOMENT<br>MY MOMENT   | ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD  |
| LOWER TIBIA<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT<br>MY MOMENT                             | ANKLE FORWARD, KNEE REARWARD<br>ANKLE RIGHTWARD, KNEE LEFTWARD<br>ANKLE DOWNWARD (TENSION), KNEE UPWARD<br><br>ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD   |
| CHEST DISPLACEMENT  | CHEST COMPRESSED - NEGATIVE   |
| KNEE SHEAR DISPLACEMENT   | PUSH ON FRONT OF TIBIA - NEGATIVE   |

**NOTE:** DIRECTIONS ARE DEFINED IN RELATION TO A SEATED DUMMY

## 11.5 GENERAL TEST CONDITIONS

- A. Surfaces of dummy components are not painted unless otherwise specified. (572.127(p))
- B. Dummy performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise specified. (572.127(o))
- C. Except for neck assembly and thorax assembly testing, the dummy performance tests are conducted at any temperature from 18.9°C (66°F) to 25.6°C (78°F) and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours. For the neck assembly and thorax assembly, the temperature range is 20.6°C (69°F) to 22.2°C (72°F)
- D. Dummy limb joints are set at 1 G, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2 Gs throughout the range of limb motion. (572.127(n))
- E. Dummies will be clothed for the thorax calibration tests with a cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. (572.124(c)(2))

## 12. CALIBRATION TEST EXECUTION

Complete the Data Sheets in section 15.

## 13. 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.

## 14. REPORTS

### 14.1 APPARENT NONCONFORMANCE

During a calibration verification, 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 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 OCWS.

## 14.2 CALIBRATION DOCUMENTATION

### 14.2.1 COPIES

Copies of the data sheets containing the calibration data for each Part 572, Subpart N dummy used in the vehicle test shall be submitted with the final NCAP test report for the vehicle.

Contractors are required to **PROOF READ** all Final 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.

**15. DATA SHEETS**

**DATA SHEET C1**  
**DUMMY DAMAGE CHECKLIST (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

This check sheet is completed as part of the calibration verification.

Perform general cleaning.

| <i>Dummy Item</i>           | <i>Inspect for</i>   | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-----------------------------|--|-----------------|----------------|-----------|
| Outer skin                  | Gashes, rips, cracks   |                 |                |           |
| Head                        | Ballast secure   |                 |                |           |
|                             | General appearance   |                 |                |           |
| Neck                        | Broken or cracked rubber                                     |                 |                |           |
|                             | Upper neck bracket firmly attached to the lower neck bracket |                 |                |           |
|                             | Looseness at the condyle joint                               |                 |                |           |
|                             | Nodding blocks cracked or out of position                    |                 |                |           |
| Spine                       | Broken or cracks in rubber.                                  |                 |                |           |
| Ribs                        | Broken or bent ribs  |                 |                |           |
|                             | Broken or bent rib supports                                  |                 |                |           |
|                             | Damping material separated or cracked                        |                 |                |           |
|                             | Rubber bumpers in place                                      |                 |                |           |
| Chest Displacement Assembly | Bent shaft   |                 |                |           |
|                             | Slider arm riding in track                                   |                 |                |           |
| Abdomen                     | Proper positioning   |                 |                |           |
| Transducer leads            | Torn cables  |                 |                |           |

| <i>Dummy Item</i>       | <i>Inspect for</i>                    | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-------------------------|---------------------------------------|-----------------|----------------|-----------|
| Accelerometer Mountings | Head mounting secure                  |                 |                |           |
|                         | Chest mounting secure                 |                 |                |           |
| Knees                   | Skin condition                        |                 |                |           |
|                         | Insert (do not remove)                |                 |                |           |
|                         | Casting                               |                 |                |           |
| Limbs                   | Normal movement and adjustment        |                 |                |           |
| Knee Sliders            | Wires intact                          |                 |                |           |
|                         | Rubber returned to "at rest" position |                 |                |           |
| Pelvis                  | Broken                                |                 |                |           |
| Other                   |                                       |                 |                |           |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Describe the repair or replacement of parts:

Checked by

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET C2**  
**EXTERNAL MEASUREMENTS (6-YEAR-OLD)**  
 (See the PADI)

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

1. Remove the dummy's chest jacket and the abdominal insert.
2. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in Figure 3C and 4C. The seating surface is at least 215.9 mm (8.5 in) wide and 330.2 mm (13 in) in depth with a vertical section at least 215.9 mm (8.5 in) wide and 635 mm (25 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.
3. Remove the four 1/4-20 x 7/8 SHCS that attach the lumbar spine bracket to the pelvis. Torque the spine cable to  $0.22 \pm .02$  NM ( $2.0 \pm 0.2$  in-lbs).

**NOTE:** At this point the thorax is to be inspected for damage. The thorax displacement transducer may be removed for calibration if required (pretest calibration only). Extreme caution is to be used so as not to damage the instrumentation cables.

4. Reassemble the lumbar spine bracket to the pelvis.
5. Secure the dummy to the test fixture so that the rear surfaces of the upper thorax and the buttock are tangent to the rear vertical surface of the fixture. (or as near tangent as possible). The dummy's midsagittal plane should be vertical.
6. Position the dummy's H-point so it is  $68.6 \pm 5.1$  mm ( $2.7 \pm 0.2$  in) above the horizontal seating surface and  $94.0 \pm 5.1$  mm ( $3.7 \pm 0.2$  in) forward of the rear vertical surface of the fixture. The H-point is located 34.5 mm (1.36 in) forward and 48.7 mm (1.92 in) downward from the center pelvic angle reference hole.
7. Extend the dummy's neck so that the plane perpendicular to the skull to skullcap interface is level both fore-and-aft and side-to-side, within 0.5 degrees. (The vertical mating surface between the skull and skull cap will be vertical.) The rear surface of the skullcap should be  $20.3 \pm 2.5$  mm ( $0.8 \pm 0.1$  in) from the vertical surface of the test fixture. A strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.
8. Position the upper and lower legs parallel to the midsagittal plane so the knee and ankle pivots centerlines are parallel, forming a  $90^\circ$  angle between the tibia and femur.
9. Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.
10. Position the upper arms downward vertically so the centerlines of the shoulder yoke and elbow pivots are parallel.

- \_\_11. Position the lower arms horizontally so the centerline of the elbow and wrist pivot are parallel.
- \_\_12. Record the dimensions listed in following table, except for dimension Y and Z (reference figure 2C).
- \_\_13. Install the abdominal insert and chest jacket. Reposition the dummy on the test fixture. The head need not be level as previously specified.
- \_\_14. Mark the locations AA, and BB, and record the dimensions Y, Z, as specified in following table and figure 2C.

---

Signature

---

Date

| HYBRID III, PART 572, SUBPART N EXTERNAL DIMENSIONS  |                                |  |                         |                    |
|--|--------------------------------|--|-------------------------|--------------------|
| DIMENSION  | DESCRIPTION                    | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A  | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.  | 622.3 - 647.7           |                    |
| B  | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.   | 348.0 - 363.2           |                    |
| C  | H-POINT HEIGHT                 | Reference  | 63.5 - 73.7             |                    |
| D  | H-POINT LOCATION FROM BACKLINE | Reference  | 88.9 - 99.1             |                    |
| E  | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.   | 53.3 - 63.5             |                    |
| F  | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.  | 88.9 - 104.1            |                    |
| G  | BACK OF ELBOW TO WRIST PIVOT   | back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots   | 182.9 - 198.1           |                    |
| H  | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)   | 17.8 - 22.8             |                    |
| I  | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the broad upper surface of clavicle link below the collar to the lowest part of the flesh of the elbow in line with the elbow pivot bolt. | 215.9 - 231.1           |                    |
| J  | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.   | 157.4 - 177.8           |                    |
| K  | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.   | 370.8 - 391.2           |                    |
| L  | POPLITEAL HEIGHT               | Seat surface to the horizontal plane at the bottom of the feet.  | 269.2 - 289.6           |                    |
| M  | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.   | 307.4 - 322.6           |                    |
| HYBRID III, SUBPART N EXTERNAL DIMENSIONS, continued |                                |  |                         |                    |

| DIMENSION | DESCRIPTION  | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
|-----------|--|--|-------------------------|--------------------|
| N         | BUTTOCK POPLITEAL LENGTH                                     | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K". | 320.0 - 340.4           |                    |
| O         | CHEST DEPTH WITHOUT JACKET                                   | Measured $330.2 \pm 5.1$ mm above seat surface   | 129.6 - 144.8           |                    |
| P         | FOOT LENGTH  | Tip of toe to rear of heel   | 170.2 - 185.4           |                    |
| Q         | STATURE  | (THEORETICAL) ( $Q = A - C - D + R + M$ )  | 1099.9 - 1181.1         | N/A                |
| R         | BUTTOCK TO KNEE PIVOT LENGTH                                 | The rear surface of the buttocks to the knee pivot bolt  | 342.9 - 363.3           |                    |
| S         | HEAD BREADTH   | The widest part of the head  | 137.1 - 147.3           |                    |
| T         | HEAD DEPTH   | Back of the head to the forehead   | 167.6 - 177.8           |                    |
| U         | HIP BREADTH  | The widest part of the hips  | 208.3 - 223.5           |                    |
| V         | SHOULDER BREADTH   | Outside shoulder edges, in line with the shoulder pivot bolts  | 259.1 - 274.3           |                    |
| W         | FOOT BREADTH   | The widest part of the foot  | 62.3 - 77.5             |                    |
| X         | HEAD CIRCUMFERENCE   | Measured at the point as in dim. "T"   | 510.5 - 530.9           |                    |
| Y         | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                      | Measured $3330.2 \pm 5.1$ mm above seat surface  | 596.9 - 622.3           |                    |
| Z         | WAIST CIRCUMFERENCE (with chest jacket and abdominal insert) | Measured $158.8 \pm 5.1$ mm above seat surface   | 558.8 - 584.2           |                    |
| AA        | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE    | Reference  | 325.1 - 335.3           |                    |
| BB        | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE    | Reference  | 153.7 - 163.9           |                    |

## EXTERNAL DIMENSION SPECIFICATIONS

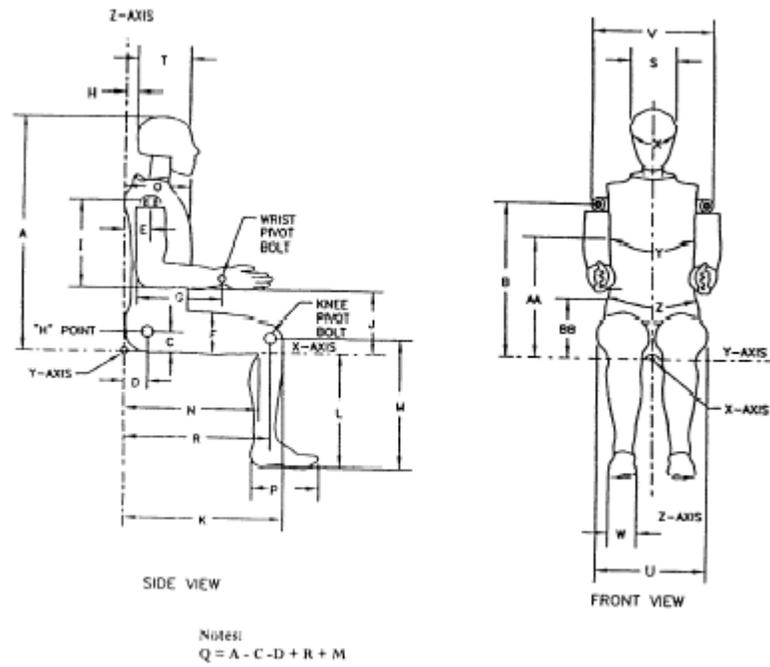
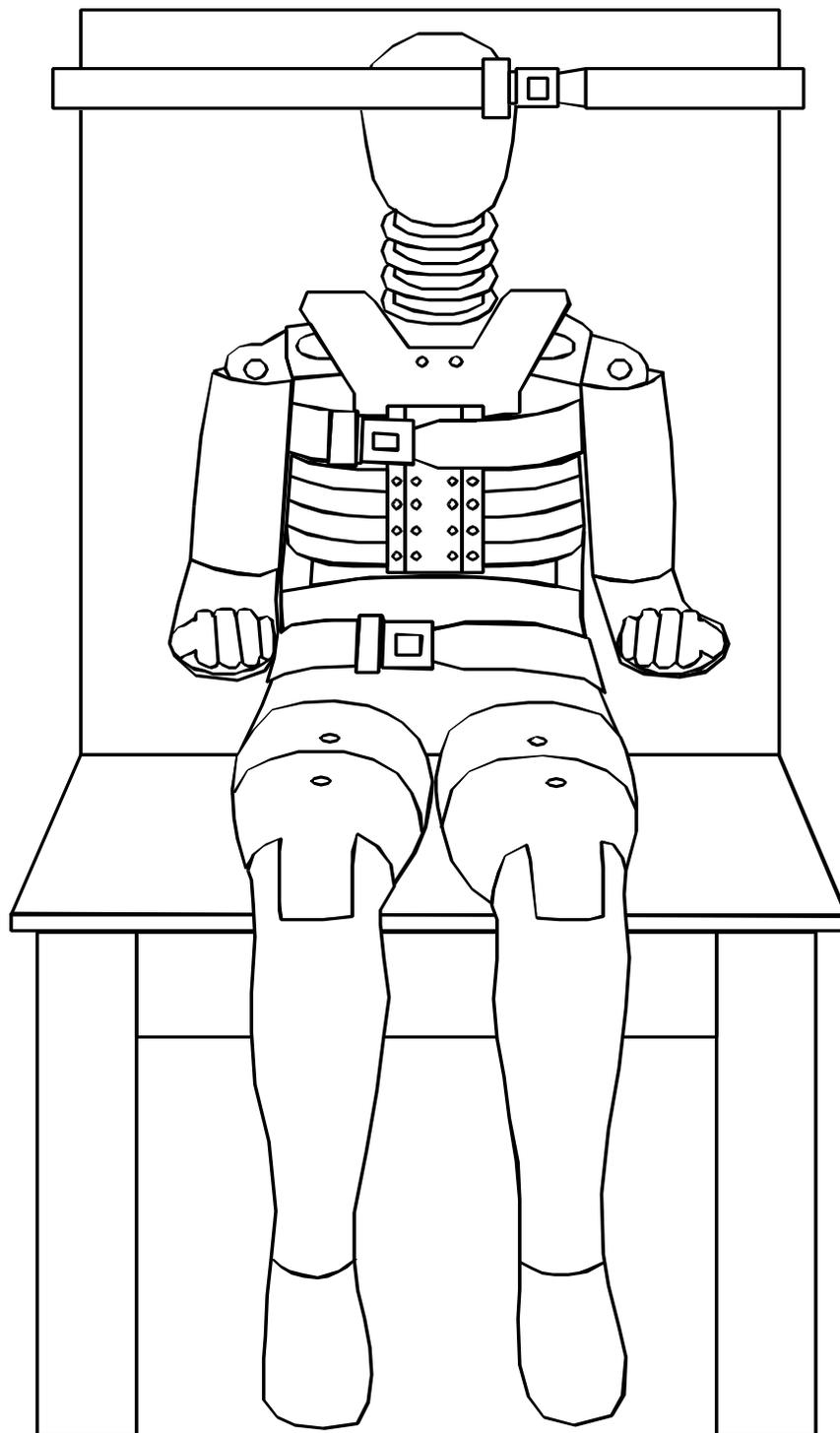


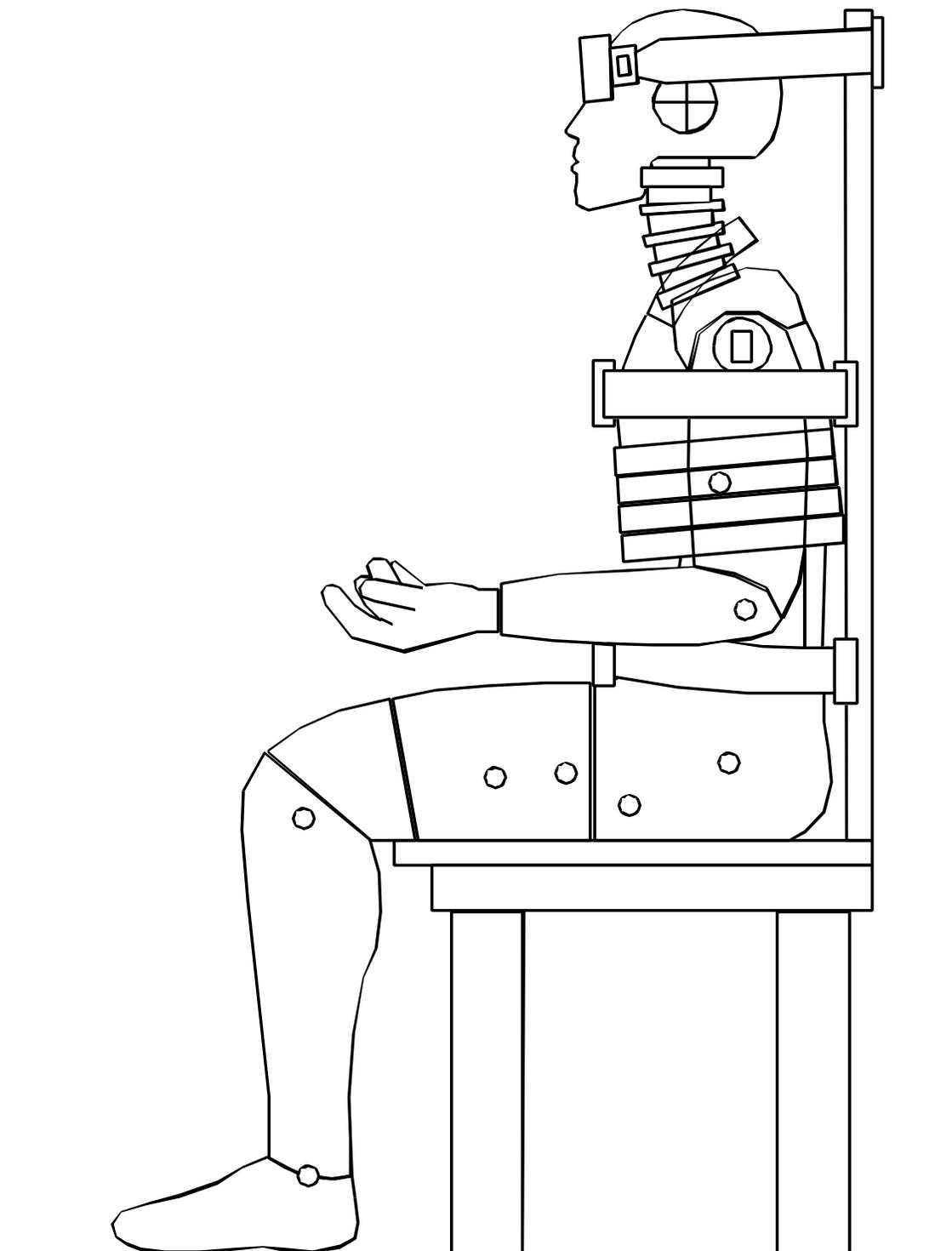
FIGURE 2C

# EXTERNAL DIMENSIONS TEST SETUP



*FIGURE 3C*

# EXTERNAL DIMENSIONS TEST SETUP



*FIGURE 4C*

**DATA SHEET C3**  
**HEAD DROP TEST (572.122) (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

- Pretest calibration
- Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

- 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))  
 N/A, ONLY one head drop performed
- 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- 4. Accelerometers and their respective mounts are smooth and clean.
- 5. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))  
Record the maximum temperature \_\_\_\_\_  
Record the minimum temperature \_\_\_\_\_  
Record the maximum humidity \_\_\_\_\_  
Record the minimum humidity \_\_\_\_\_
- 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial.

**Note:** If the damage resulted 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.

Record findings and actions: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

- \_\_10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.122(c)(3))  
Record the actual distance \_\_\_\_\_

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- \_\_11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))  
Record the right side distance \_\_\_\_\_  
Record the left side distance \_\_\_\_\_
- \_\_12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.122(c)(4))  
Record actual micro finish \_\_\_\_\_
- \_\_13. The impact surface is rigidly supported. (572.122(c)(4))
- \_\_14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))  
Record thickness \_\_\_\_\_  
Record width \_\_\_\_\_  
Record length \_\_\_\_\_
- \_\_15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b) & (572.122(c)(4))
- \_\_16. Complete the following table using channel class 1000 data. (572.122(b)):

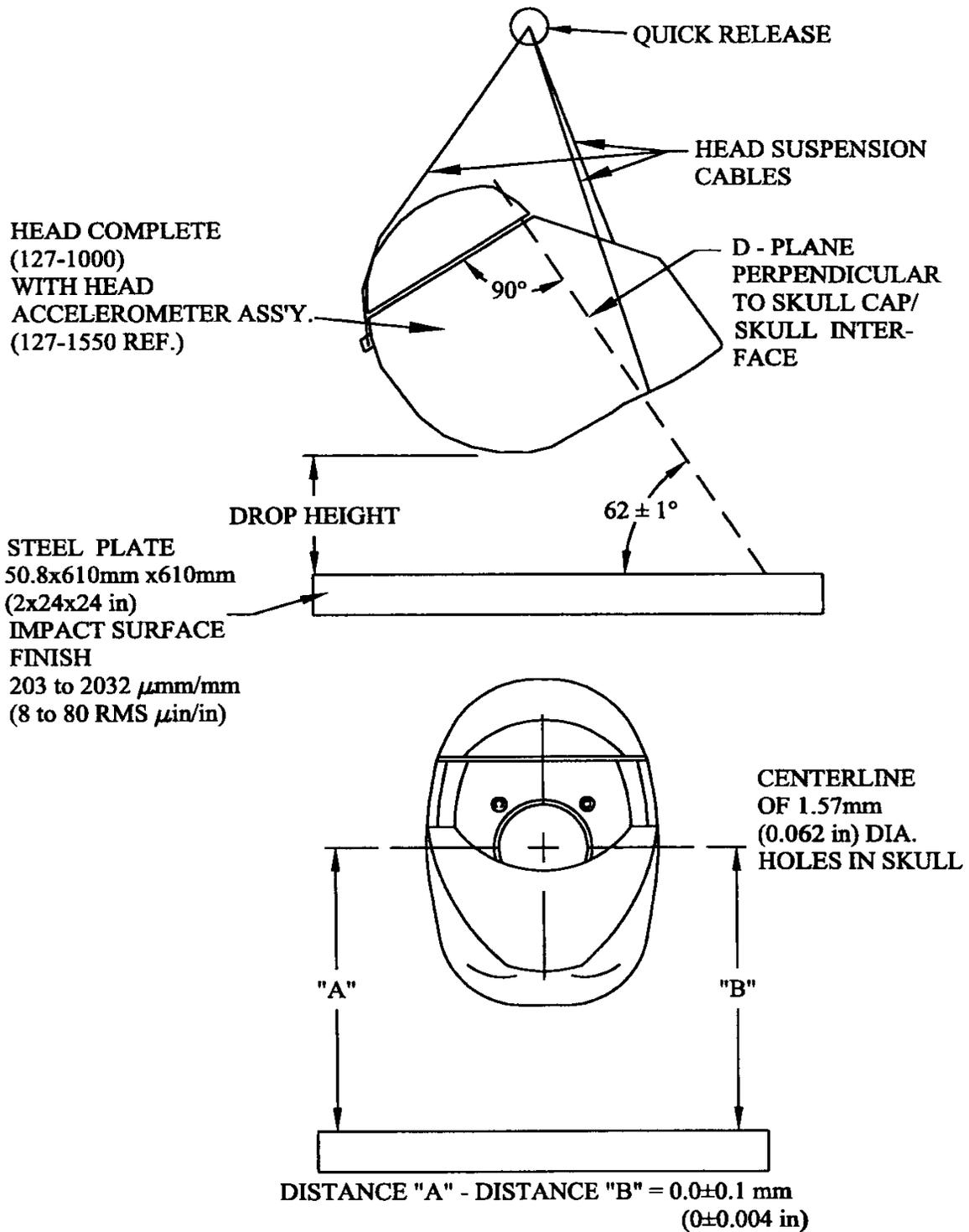
| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $245 \text{ g} \leq x \leq 300 \text{ g}$        |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          |        |

- \_\_17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## HEAD DROP TEST SET-UP SPECIFICATIONS



**FIGURE 5C**

**DATA SHEET C4**  
**NECK FLEXION TEST (572.123) (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

- Pretest calibration
- Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

- 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 N/A, ONLY one neck test performed
- 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert ( 910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pre-test calibration.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- 6. Torque the jam nut (9000341) on the neck cable (127-1016) to  $0.23 \pm 0.02$  Nm ( $2.0 \pm 0.2$  in-lb). (572.123(c)(2))

- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- \_\_8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123(c)(3))
- \_\_10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4)(i))
- \_\_12. Complete the following table:

Neck Flexion Test Results (572.123(b)(1) &amp; (572.123(c)(4)(i &amp; ii))

| Parameter  | Specification  | Result                               |
|--|--|--------------------------------------|
| Pendulum impact speed                            | 4.83 m/s $\leq$ speed $\leq$ 5.07 m/s  |                                      |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms   | 1.2 m/s $\leq \Delta V \leq$ 1.6 m/s |
|  | @ 20 ms  | 2.4 m/s $\leq \Delta V \leq$ 3.4 m/s |
|  | @30ms  | 3.8 m/s $\leq \Delta V \leq$ 5.0 m/s |
| Plane D Rotation                                 | Peak moment*<br>27 Nm $\leq$ moment $\leq$ 33 Nm during the following rotation range 74° $\leq$ angle $\leq$ 92° | ___Nm @<br>___degrees                |
| Positive Moment Decay**<br>(Flexion)             | Time to decay to 5 Nm<br>103 ms $\leq$ time $\leq$ 123 ms  |                                      |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(1)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- \_\_14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET C5**  
NECK EXTENSION TEST (572.123) (6-YEAR-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive extension tests are necessary)

1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pre-test calibration.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Torque the jam nut (9000341) on the neck cable (127-1016) to  $0.23 \pm 0.02$  Nm ( $2.0 \pm 0.2$  in-lb). (572.123(c)(2))

- \_\_7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- \_\_8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- \_\_9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))
- \_\_10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- \_\_11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))
- \_\_12. Complete the following table:

Neck Extension Test Results (572.123(b)(2) &amp; (572.123(c)(4)(i &amp; ii))

| Parameter  | Specification   | Result                               |
|--|---|--------------------------------------|
| Pendulum impact speed                            | 4.18 m/s $\leq$ speed $\leq$ 4.42 m/s   |                                      |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | 1.0 m/s $\leq \Delta V \leq$ 1.4 m/s |
|  | @ 20 ms   | 2.2 m/s $\leq \Delta V \leq$ 3.0 m/s |
|  | @ 30ms  | 3.2 m/s $\leq \Delta V \leq$ 4.2 m/s |
| Plane D Rotation                                 | Peak moment*<br>-24 Nm $\leq$ moment $\leq$ -19 Nm during the following rotation range $85^\circ \leq$ angle $\leq 103^\circ$ | ___Nm @<br>___degrees                |
| Negative Moment Decay** (Extension)              | Time to decay to -5 Nm<br>123 ms $\leq$ time $\leq$ 147 ms  |                                      |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(2)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- \_\_14 Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## PENDULUM SPECIFICATIONS

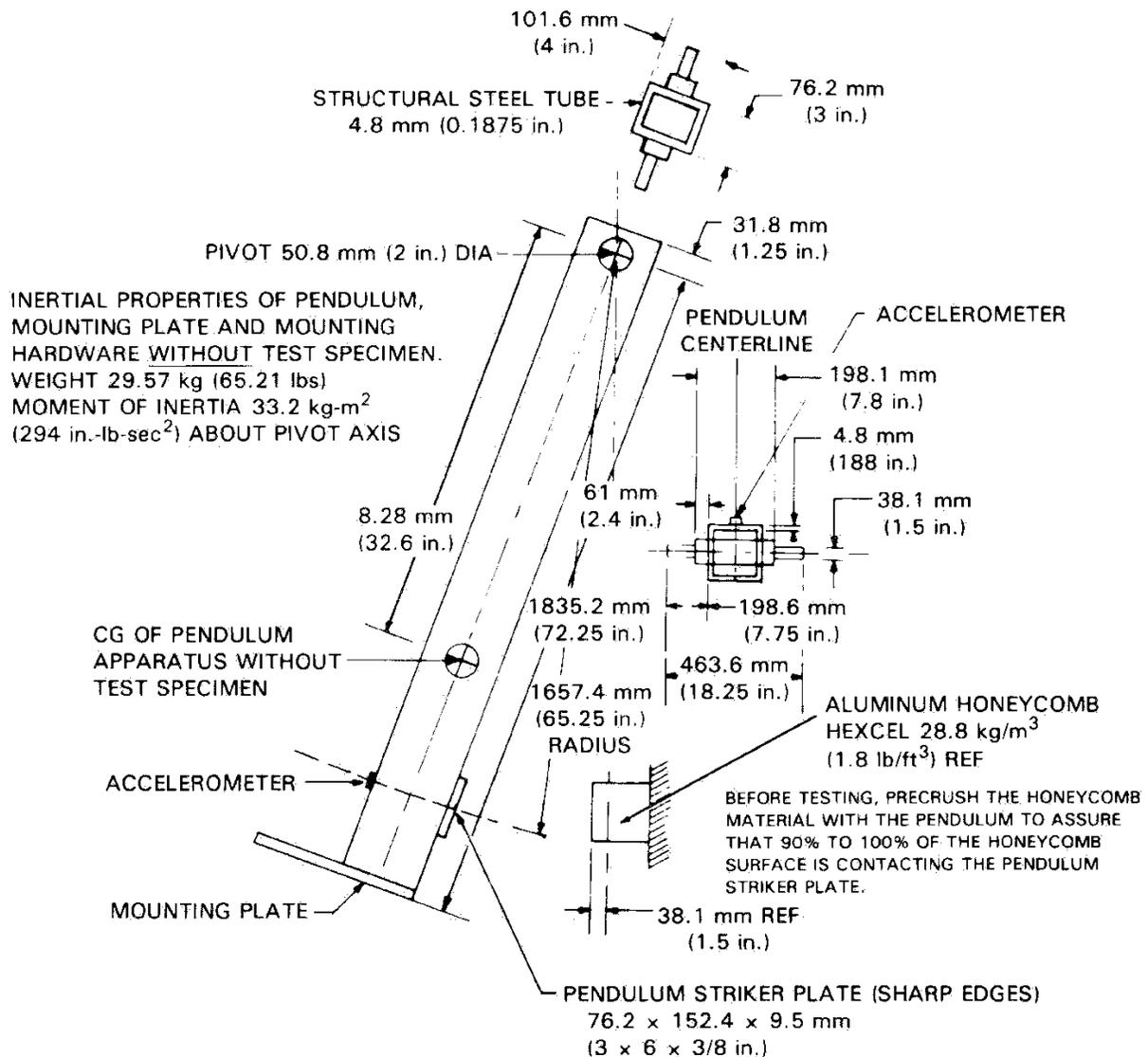
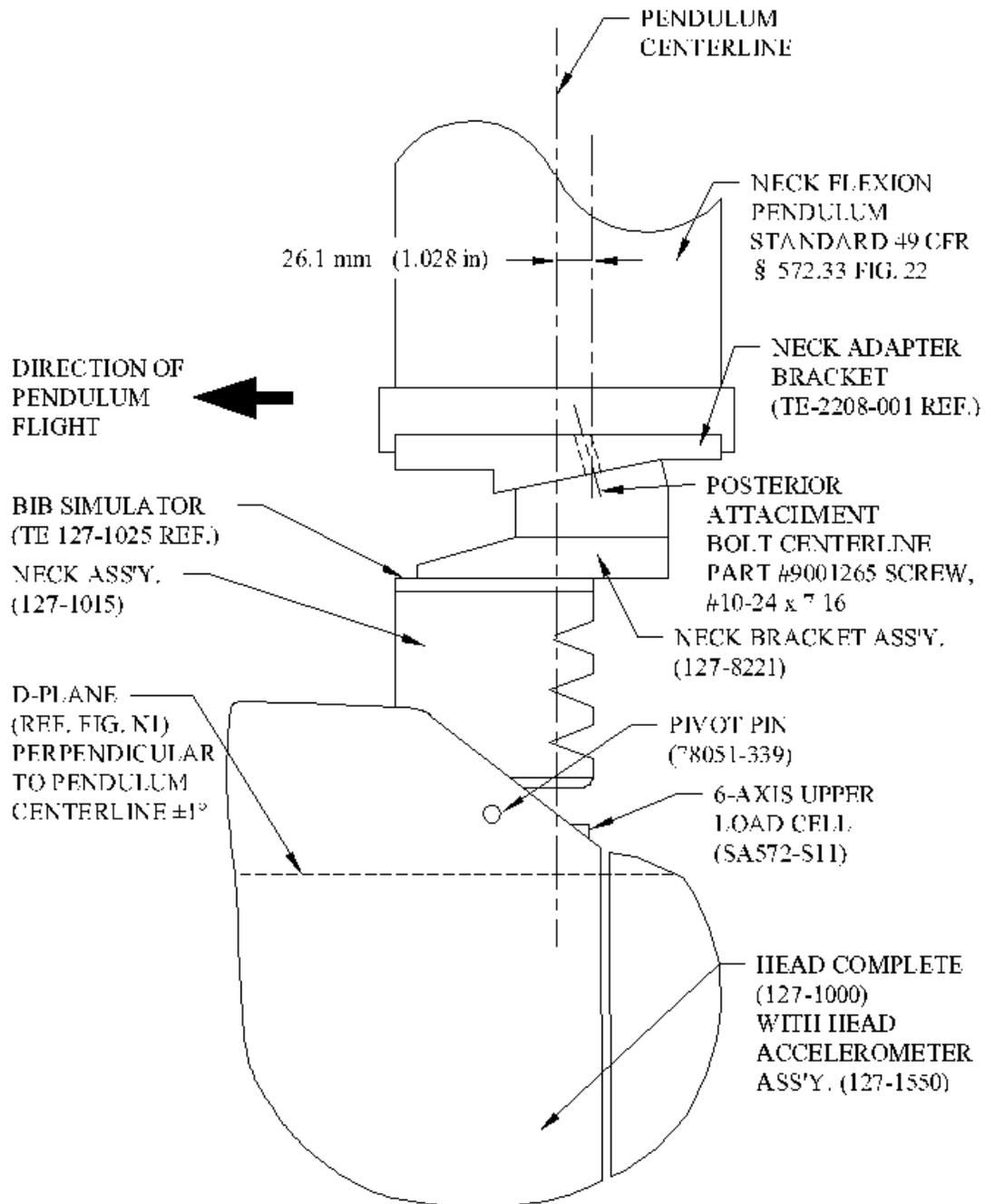


FIGURE 6C

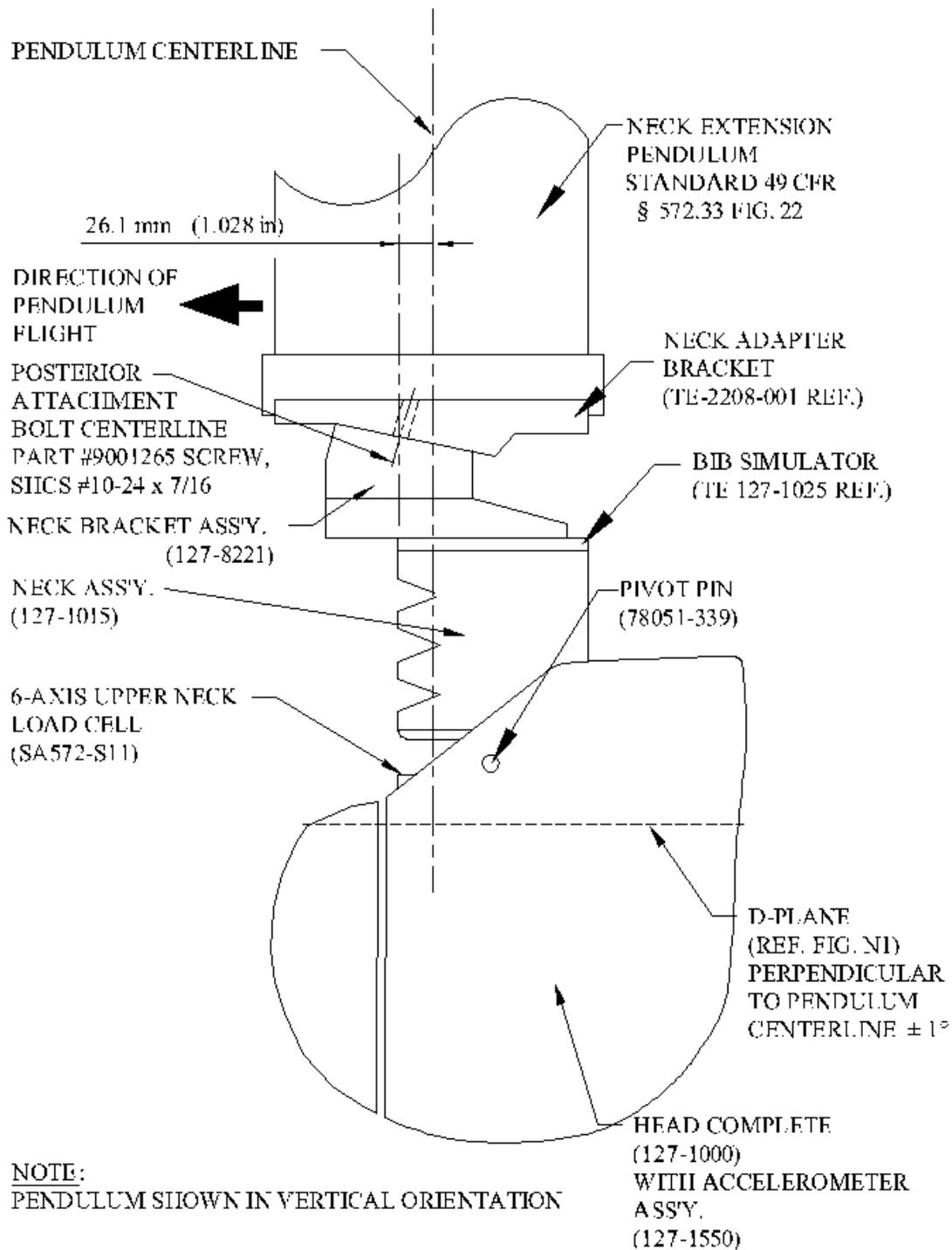
## NECK FLEXION TEST SET-UP SPECIFICATIONS



NOTE:  
PENDULUM SHOWN IN VERTICAL ORIENTATION

*FIGURE 7C*

## NECK EXTENSION TEST SET-UP SPECIFICATIONS



*FIGURE 8C*

**DATA SHEET C6**  
**THORAX IMPACT TEST (572.134) (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive thorax impact tests are necessary)

- \_\_1. It has been at least 30 minutes since the last thorax impact test. (572.127(o))  
 \_\_ N/A, ONLY one thorax impact test performed
- \_\_2. The test fixture conforms to the specifications in Figure 11C.
- \_\_3. The complete assembled dummy (127-0000) is used (572.124(b)).
- \_\_4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.  
 \_\_ - No damage  
 \_\_ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_ - The following repairs or replacement was performed. Record  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_6. The dummy is dressed in a size 4 pair of long pants having a weight of less than 0.090 kg (0.2 lb) with the legs cut off sufficiently above the knee to allow the knee target to be visible. (572.124(c)(2))
- \_\_7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))
- \_\_8. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $8^\circ \pm 2^\circ$ . The angle may be measured at the pelvis lumbar joining surface.

- \_\_9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.124(c)(3))
- \_\_10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))
- \_\_11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- \_\_12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- \_\_13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- \_\_14. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- \_\_15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- \_\_16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

\_\_17. Complete the following table:

Thorax Impact Results (572.124(b) and 572.124(b)(1)&(2))

| Parameter*  | Specification  | Result |
|---|--|--------|
| Test Probe Speed  | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     |        |
| Chest Compression                                       | $38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$ |        |
| Peak force** between 38.0 and 46.0 mm chest compression | $1150\text{N} \leq \text{peak force} \leq 1380\text{N}$        |        |
| Peak force** between 12.5 and 38.0 mm chest compression | Peak force $\leq 1500 \text{ N}$                               |        |
| Internal Hysteresis***                                  | $65\% \leq \text{hysteresis} \leq 85\%$                        |        |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration

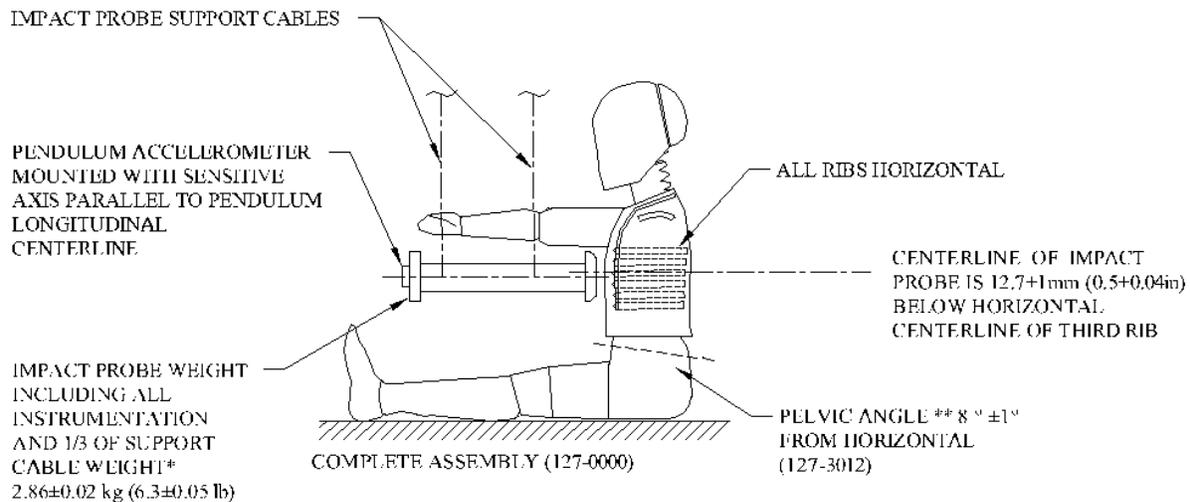
\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

\_\_18. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### THORAX IMPACT TEST SET-UP SPECIFICATIONS



\* 1/3 CABLE WEIGHT NOT TO EXCEED 5 % OF THE TOTAL IMPACT PROBE WEIGHT

\*\* PELVIS LUMBAR JOINING SURFACE

#### Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of  $2.86 \pm 0.02$  kg ( $6.3 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe are included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $160 \text{ kg-cm}^2$  ( $0.141 \text{ lbs-in-sec}^2$ ) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has a flat, continuous, and non-deformable face with diameter of  $101.6 \pm 0.25$  mm ( $4.00 \pm 0.01$  in) and a edge radius of 7.6-12.7 mm (0.3-0.5 in).
5. The impactor is a cylinder with a diameter of 101-103 mm (4.0-4.1 in) and it is at least 12.5 mm (0.5 in) long.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor.

*FIGURE 9C*

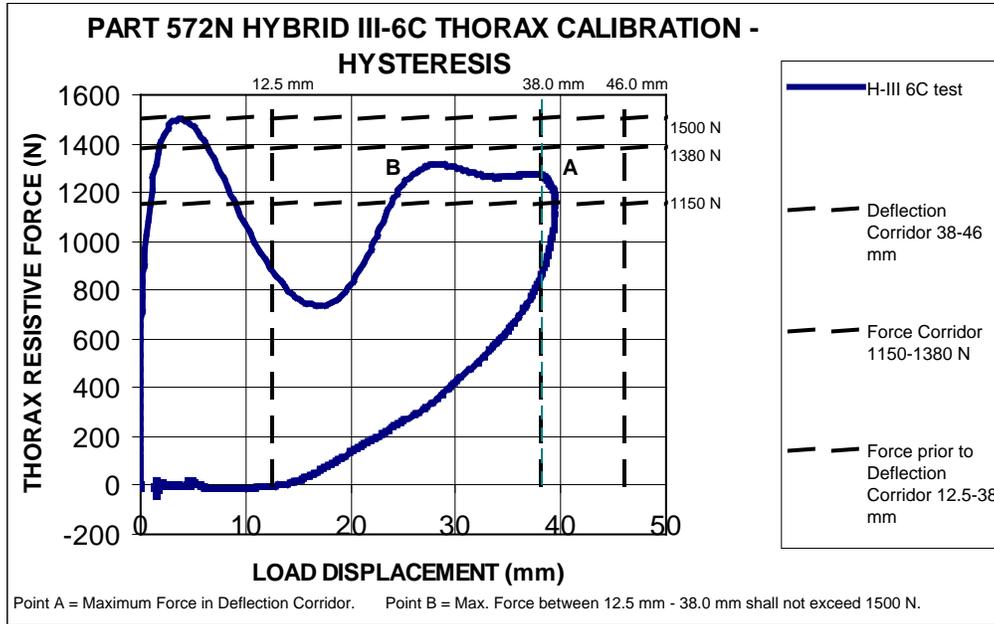


FIGURE 10C

**DATA SHEET C7**  
**TORSO FLEXION TEST (572.125) (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive torso flexion tests are necessary)

1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 11C.
3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))  
Record the maximum temperature \_\_\_\_\_  
Record the minimum temperature \_\_\_\_\_  
Record the maximum humidity \_\_\_\_\_  
Record the minimum humidity \_\_\_\_\_
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
10. Remove all external support that was implemented in 9 above. (572.125(c)(5))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))  
Record reference plane angle (max. allowed 22°) \_\_\_\_\_
12. Attach the pull cable and the load cell. (572.125(c)(6))
13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))
14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
15. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))

- \_\_16. 3 minutes after the release of the force, measure the reference plane angle.  
(572.125(c)(9))
- \_\_17. Complete the following table:

Torso Flexion Results (572.125(b), 572.125(c)(7), (572.125(c)(8))

| Parameter                         | Specification   | Result |
|-----------------------------------|---|--------|
| Initial ref. plane angle          | Angle $\leq 22^\circ$   |        |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ |        |
| Force at $45^\circ \pm 0.5^\circ$ | $147 \text{ N} \leq \text{force} \leq 200 \text{ N}$          |        |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        |        |

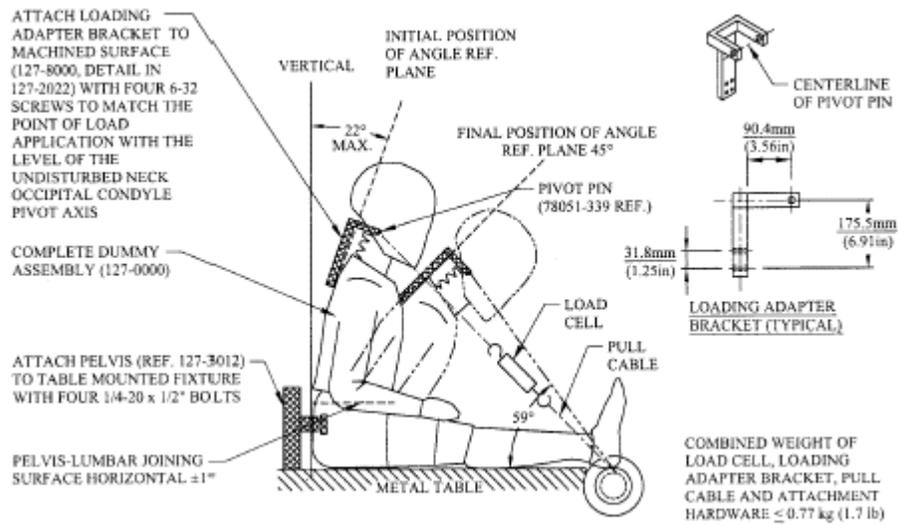
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Signature

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Date

**TORSO FLEXION TEST SET-UP SPECIFICATIONS**



**FIGURE 11C**

**DATA SHEET C8**  
LEFT KNEE IMPACT TEST (572.126) (6-YEAR-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 12C.
3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

\_\_11. Complete the following table:

Knee Impact Results (572.126(b)(1) and 572.126(c)(5))

| Parameter              | Specification  | Result |
|------------------------|--|--------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ |        |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     |        |

\*Force = impactor mass x deceleration (572.126(b))

\_\_12. Plots of acceleration versus time and force versus time follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET C9**  
**RIGHT KNEE IMPACT TEST (572.126) (6-YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive knee impact tests are necessary)

1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 12C.
3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))  
Record the maximum temperature \_\_\_\_\_  
Record the minimum temperature \_\_\_\_\_  
Record the maximum humidity \_\_\_\_\_  
Record the minimum humidity \_\_\_\_\_
5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

\_\_11. Complete the following table:

Knee Impact Results (572.126(b)(1) and 572.126(c)(5))

| Parameter              | Specification  | Result |
|------------------------|--|--------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ |        |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     |        |

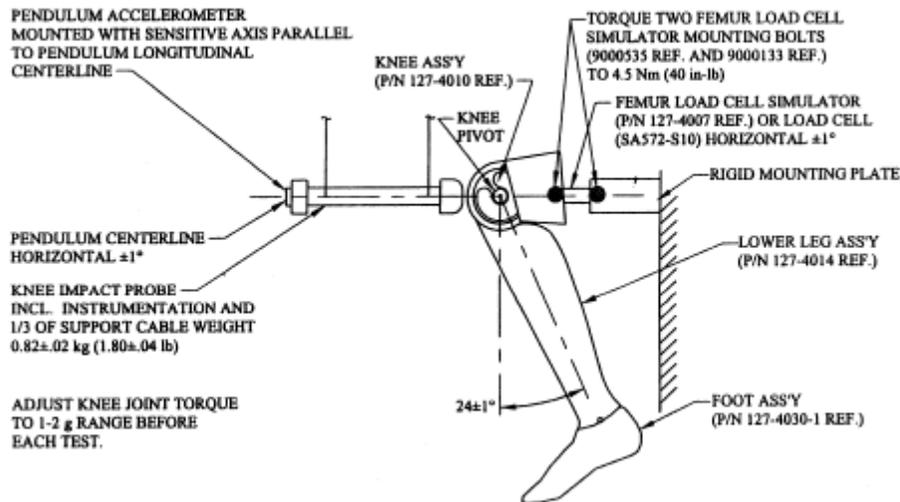
\*Force = impactor mass x deceleration (572.126(b))

\_\_12. Plots of acceleration versus time and force versus time follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

KNEE IMPACT TEST SET-UP SPECIFICATIONS



Probe specifications (572.127(b)):

1. Rigid metallic construction, concentric in shape and symmetric about its longitudinal axis.
2. A mass of  $0.82 \pm 0.02$  kg ( $1.8 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $34$  kg-cm<sup>2</sup> ( $0.03$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with diameter of  $76.2 \pm 0.2$  mm ( $3.00 \pm 0.01$  in) and an edge radius of 7.6-12.7 mm (0.3-0.5 in).
5. The impactor is a cylinder with a diameter of 76-77 mm (3.0-3.1 in) and it is at least 12.5 mm (0.5 in) long.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor.

FIGURE 12C

**DATA SHEET C10**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

| I.D. NO.                              | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|-----------|------------|--------------------------|--------------------------|
| <b>DUMMY INSTRUMENTATION</b>          |              |           |            |                          |                          |
| <b>HEAD ACCELEROMETERS</b>            |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| NECK TRANSDUCER                       |              |           |            |                          |                          |
| <b>CHEST ACCELEROMETERS</b>           |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| CHEST POTENTIOMETER                   |              |           |            |                          |                          |
| <b>FEMUR LOAD CELLS</b>               |              |           |            |                          |                          |
| (1) RIGHT FEMUR                       |              |           |            |                          |                          |
| (2) LEFT FEMUR                        |              |           |            |                          |                          |
| <b>LABORATORY INSTRUMENTATION</b>     |              |           |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| THORAX PENDULUM ACCELEROMETER         |              |           |            |                          |                          |
| KNEE PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) |              |           |            |                          |                          |

LABORATORY TECHNICIAN: \_\_\_\_\_

**APPENDIX D**  
**PART 572P (3-YEAR OLD) DUMMY PERFORMANCE**  
**CALIBRATION TEST PROCEDURE**

**APPENDIX D**  
**PART 572, SUBPART P DUMMY PERFORMANCE CALIBRATION TEST**  
**PROCEDURE**

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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 Crashworthiness Standards) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart P 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 DIMENSIONS (PADI)
- B. HEAD DROP TEST (572.142)
- C. NECK FLEXION TEST (572.143(b)(1))
- D. NECK EXTENSION TEST 572.143(b)(2)
- E. THORAX IMPACT TEST ((572.144)
- F. TORSO FLEXION (572.145)

National Highway Traffic Safety Administration (NHTSA) contract laboratories performing NCAP testing for the Office of Crashworthiness Standards (OCWS) must use this laboratory procedure for the calibration of Part 572, Subpart P dummies.

## 2. GENERAL REQUIREMENTS

The Code of Federal Regulations (49CFR), Parts 571 and 572, was amended to adopt the Hybrid III, 3-Year-Old Child Dummy as the means of determining a vehicle's conformance to the performance requirements of NCAP. Each Part 572, Subpart P dummy used in an NCAP test must meet the specifications and performance criteria of Part 572 before and after each vehicle crash test in order to be an acceptable NCAP test tool.

The Part 572, Subpart P Hybrid III, 3-Year-Old Child Dummy consists of components and assemblies specified in the drawing and specifications package which is available from Reprographics Technologies, 9000 Virginia Manor, Beltsville, MD 20705, telephone - (301) 419-5070.

## 3. SECURITY

All NHTSA Part 572, Subpart P test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as a dummy calibration laboratory. The contractor is financially responsible for any acts of theft and/or vandalism that 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 maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart P dummy calibration tests before and after each vehicle crash test.

No Information concerning the Part 572, Subpart P 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 P dummies are being calibrated as test tools to be used in NCAP vehicle crash tests. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. 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. All calibration test data for each particular Part 572, Subpart P dummy will be sent to the COTR with each test report.

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

#### **7. GOVERNMENT FURNISHED PROPERTY (GFP)**

Part 572, Subpart P test dummies will be furnished to the contract laboratory by the OCWS. The dummies shall be stored in a hanging position using the bracket and positioning shown in the following drawings.

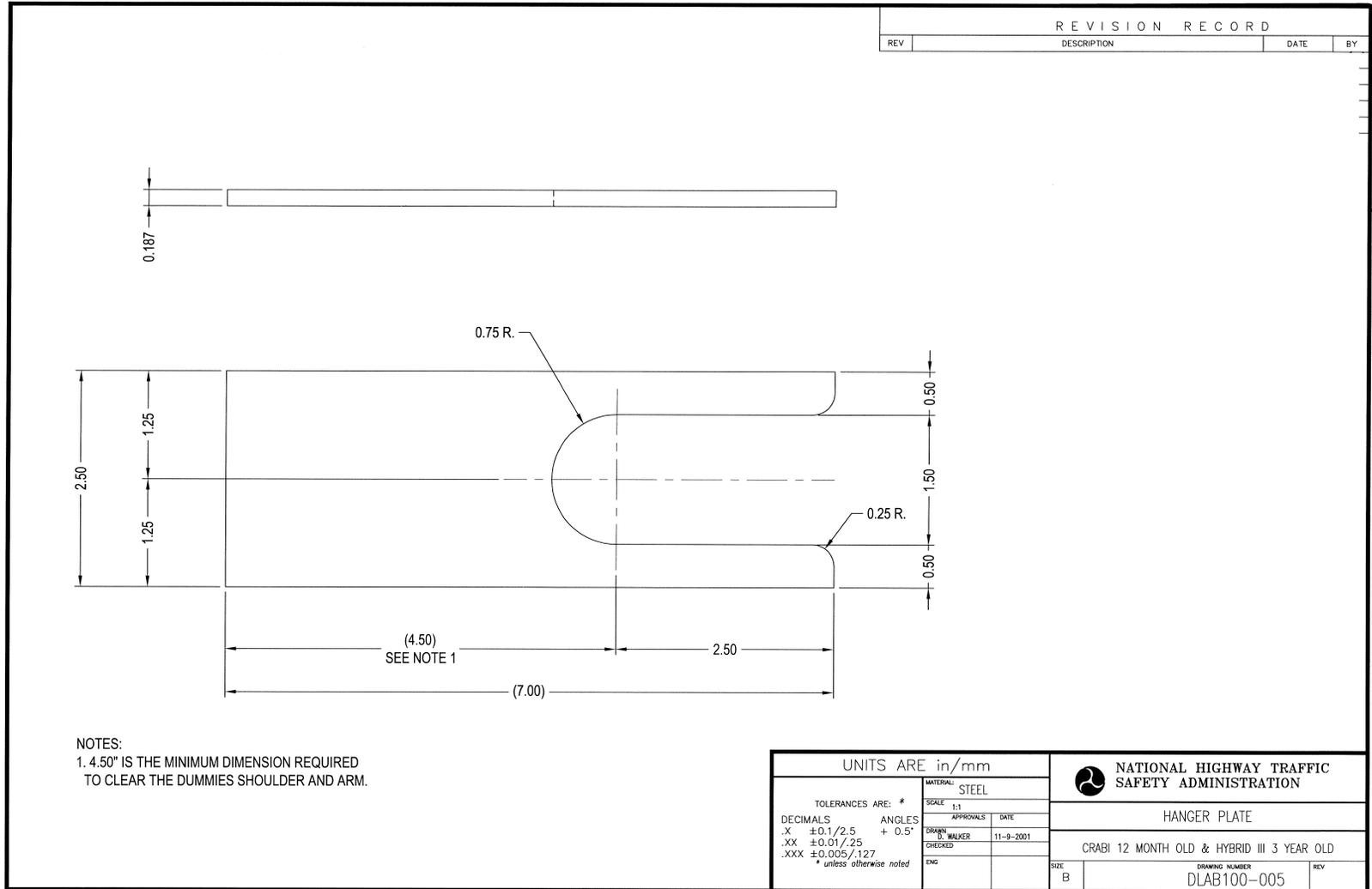


FIGURE 1D

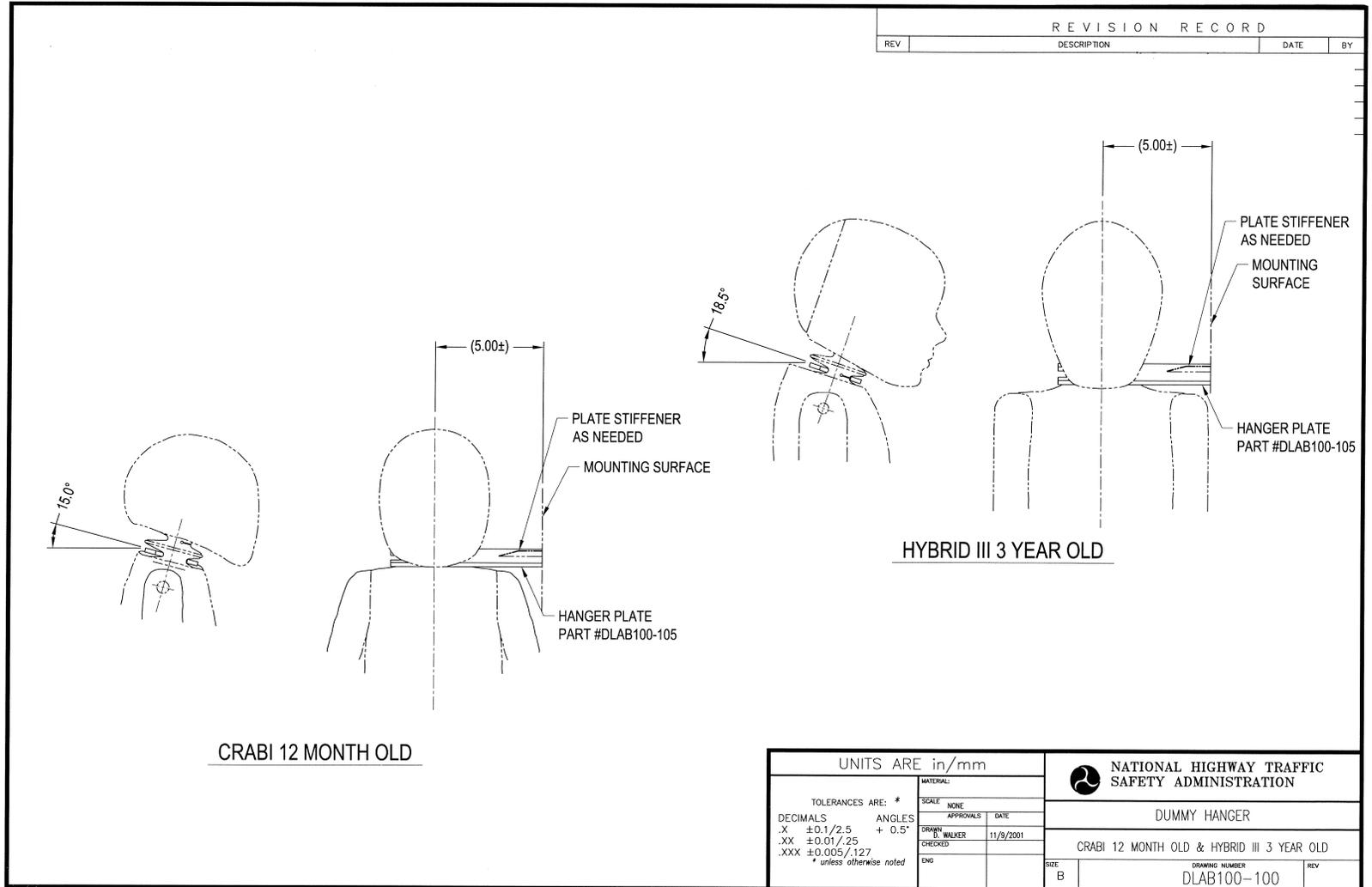


FIGURE 2D

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 NCAP test and complete a dummy damage checklist that will be included with the final test report. The contractor will check dummy components for damage after each crash test and complete a dummy damage checklist (as part of the NCAP procedure), which will be included with the dummy calibration, if requested. The COTR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be calibrated by the contractor according to the schedule indicated in the NCAP test procedure.

## **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 as indicated in NCAP test procedure. These calibrations shall be submitted with the final report.

## **9. PHOTOGRAPHIC DOCUMENTATION**

Provide still photographs (color prints properly focused for clear images, no more than two (2) per 8.5"x11" sheet) of post test damage resulting from the vehicle crash test.

## **10. DEFINITIONS**

PADI: Procedures for Assembly, Disassembly, and Inspection

## **11. PRETEST REQUIREMENTS**

### **11.1 TRANSDUCER REQUIREMENTS**

The contractor shall provide and install the following instrumentation to the GFP dummies (excluding the chest deflection transducer).

- A. HEAD – The head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing SA572-S4 and be mounted in the head as shown in drawing 210-0000. (572.146(b))

Three accelerometers shall be mounted in the head cavity to measure orthogonal accelerations ( $A_x$ ,  $A_y$ ,  $A_z$ ) at the center of gravity (CG) of the head assembly.

- B. NECK – The upper neck force transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S19 and shall be mounted at the upper neck transducer location as shown in drawing 210-0000. (572.146(c))

- C. CHEST – The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572-S4 and be mounted in the torso assembly in triaxial configuration at the T4 location as shown drawing 210-0000. The chest accelerometers are not required for dummy calibration testing but are required for NCAP testing. (572.146(e))

The chest deflection potentiometer shall have the dimensions and response characteristics specified in drawing SA572-S50 and be mounted in the torso assembly as shown in drawing 210-0000. (572.146(f))

- D. TEST FIXTURE – The neck pendulum, thorax and knee probe accelerometers shall have the dimensions and characteristics of drawing SA572-S4.

## 11.2 OTHER TRANSDUCER CONDITIONS

- A. TRANSDUCER MOUNTS – The mountings for sensing devices shall have no resonance frequency less than 3 times the frequency range of the applicable channel class. (572.146(n))
- B. TRANSDUCER SIGN CONVENTION - The sign convention for outputs of transducers mounted within the dummy that measure head and chest accelerations, chest deflection and neck loads are located in Figure 3D. For other transducers see SAE J1733DEC94. (572.146(m))
- 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 will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1 MAR95, "Instrumentation for Impact Test," with channel classes as follows: (572.146(l))

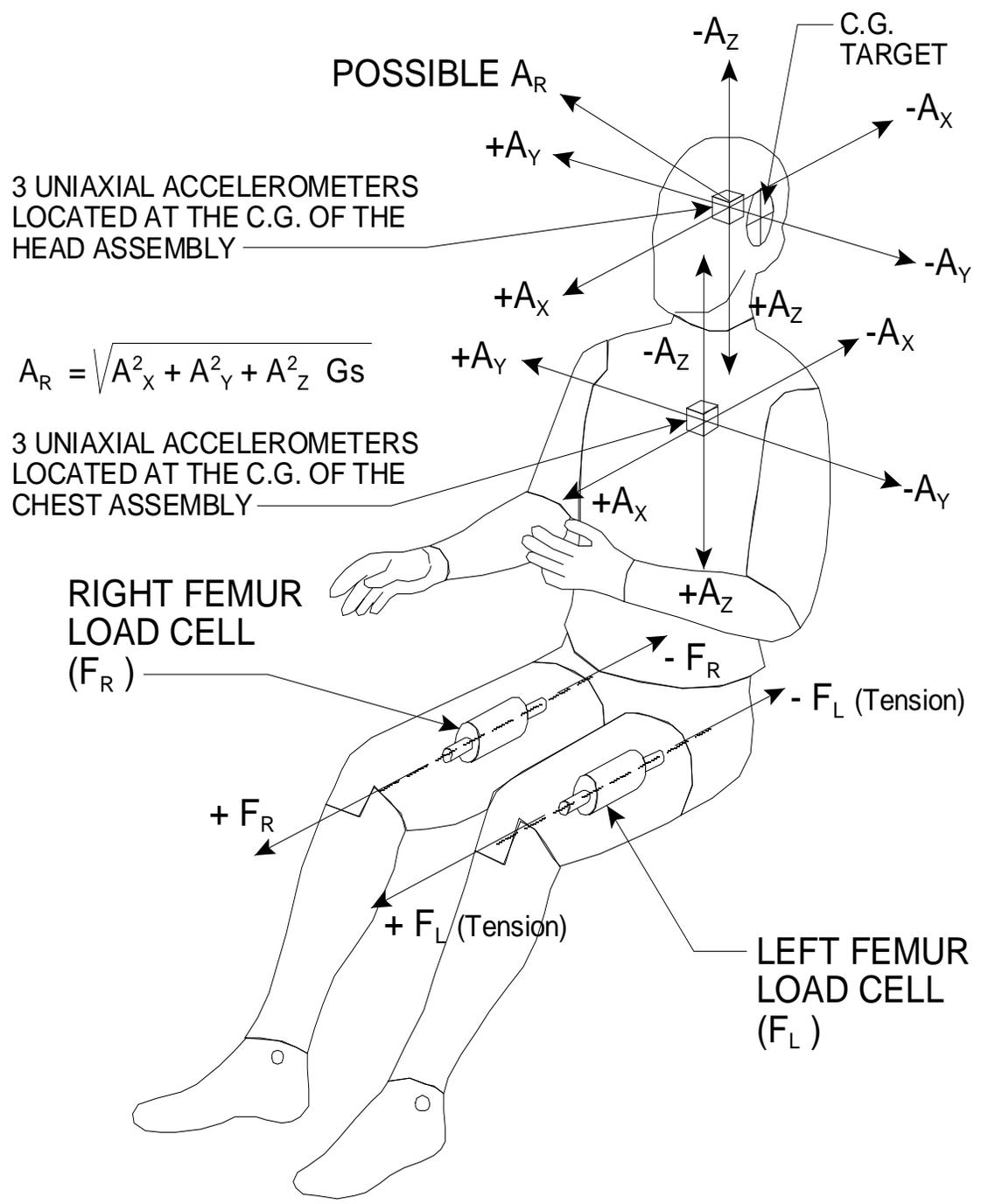
|                                 |            |                      |
|---------------------------------|------------|----------------------|
| 1. Head acceleration            | Class 1000 | (572.146(l)(1))      |
| 2. Neck force                   | Class 1000 | (572.146(l)(2)(i))   |
| 3. Neck pendulum acceleration   | Class 180  | (572.146(l)(2)(iii)) |
| 4. Neck moment                  | Class 600  | (572.146(l)(2)(ii))  |
| 5. Neck potentiometer           | Class 60   | (572.146(l)(2)(iv))  |
| 6. Thorax spine acceleration    | Class 180  | (572.146(l)(3)(ii))  |
| 7. Thorax pendulum acceleration | Class 180  | (572.146(l)(3)(ii))  |
| 8. Sternum deflection           | Class 600  | (572.146(l)(3)(iii)) |
| 9. Lumbar torso flexion         | Class 60   | (572.146(l)(4)(iii)) |

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

## 11.3 THORAX IMPACTOR PROBE (572.146(a))

- A. The test probe for thoracic impacts shall be of rigid metallic construction, concentric in shape and symmetric about its longitudinal axis.
- B. It shall have a mass of  $1.70 \pm 0.01$  kg ( $3.75 \pm 0.02$  lbs). 1/3 of the weight of the suspension cables and their attachments to the impact probe must be included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
- C. It shall have a minimum mass moment of inertia of  $283 \text{ kg-cm}^2$  ( $0.25 \text{ lbs-in-sec}^2$ ) in yaw and pitch about the center of gravity.
- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It must have a flat, continuous, and non-deformable face with a diameter of  $50.8 \pm 0.2$  mm ( $2.00 \pm 0.01$  in) and a maximum edge radius of 12.7 mm (0.5 in).
- E. The impactor is a cylinder with a diameter of 53.3 mm (2.1 in) and it is at least 25.4 mm (1.0 in) long.
- F. 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 axis of the probe.
- G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor.

**SIGN CONVENTION FOR PART 572 TEST DUMMIES**



**FIGURE 3D**

TABLE 1D

| <b>SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS</b>  |   |
|---|---|
| <b>BODY SEGMENT —<br/>MEASURED FORCE</b>  | <b>POSITIVE OUTPUT DIRECTION</b>  |
| NECK<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW)  | HEAD REARWARD OR CHEST FORWARD<br>HEAD LEFTWARD, CHEST RIGHTWARD<br>HEAD UPWARD, CHEST DOWNWARD<br><br>LEFT EAR TOWARD LEFT SHOULDER<br>CHIN TOWARD STERNUM<br>CHIN TOWARD LEFT SHOULDER  |
| FEMUR<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW) | KNEE UPWARD, UPPER FEMUR DOWNWARD<br>KNEE RIGHTWARD, UPPER FEMUR LEFTWARD<br>KNEE FORWARD (TENSION), PELVIS REARWARD<br><br>KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE UPWARD, HOLD UPPER FEMUR IN PLACE<br>KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY |
| KNEE CLEVIS - FZ AXIAL  | TIBIA DOWNWARD (TENSION), FEMUR UPWARD  |
| UPPER TIBIA<br>MX MOMENT<br>MY MOMENT   | ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD  |
| LOWER TIBIA<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT<br>MY MOMENT                             | ANKLE FORWARD, KNEE REARWARD<br>ANKLE RIGHTWARD, KNEE LEFTWARD<br>ANKLE DOWNWARD (TENSION), KNEE UPWARD<br><br>ANKLE LEFTWARD, HOLD KNEE IN PLACE<br>ANKLE FORWARD, BOTTOM OF KNEE CLEVIS<br>REARWARD   |
| CHEST DISPLACEMENT  | CHEST COMPRESSED - NEGATIVE   |
| KNEE SHEAR DISPLACEMENT   | PUSH ON FRONT OF TIBIA - NEGATIVE   |

**NOTE:** DIRECTIONS ARE DEFINED IN RELATION TO A SEATED DUMMY

## 11.4 GENERAL TEST CONDITIONS

- A. Surfaces of dummy components are not painted unless otherwise specified. (572.146(q))
- B. Dummy performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise specified. (572.146(p))
- C. Except for neck assembly and thorax assembly testing, the dummy performance tests are conducted at any temperature from 18.9°C (66°F) to 25.6°C (78°F) and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours. For the neck assembly and thorax assembly, the temperature range is 20.6°C (69°F) to 22.2°C (72°F).
- D. Dummy limb joints are set at 1 G, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2 Gs throughout the range of limb motion. (572.146(o))
- E. Dummies will be clothed for the thorax calibration tests with a form fitting cotton-polyester-based tight-fitting long-sleeved shirt and ankle length pants. The total weight of the shirt and pants shall not exceed 0.25 kg (0.55 lb). (572.144(c)(1))

## 12. CALIBRATION TEST EXECUTION

Complete the Data Sheets in section 15.

## 13. 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.

## 14. REPORTS

### 14.1 APPARENT NONCONFORMANCE

During calibration verification, 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 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 OCWS.

## 14.2 FINAL PERFORMANCE CALIBRATION REPORTS

### 14.2.1 COPIES

Copies of the data sheets containing the calibration verification data for each Part 572, Subpart P dummy used in the NCAP test shall be submitted with the final test report for the vehicle.

Contractors are required to PROOF READ all Final 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.

**15. DATA SHEETS**

**DATA SHEET D1**  
**DUMMY DAMAGE CHECKLIST (3 YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

This check sheet is completed as part of the calibration verification.

Perform general cleaning.

| <i>Dummy Item</i>           | <i>Inspect for</i>   | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-----------------------------|--|-----------------|----------------|-----------|
| Outer skin                  | Gashes, rips, cracks   |                 |                |           |
| Head                        | Ballast secure   |                 |                |           |
|                             | General appearance   |                 |                |           |
| Neck                        | Broken or cracked rubber                                     |                 |                |           |
|                             | Upper neck bracket firmly attached to the lower neck bracket |                 |                |           |
|                             | Looseness at the condyle joint                               |                 |                |           |
|                             | Nodding blocks cracked or out of position                    |                 |                |           |
| Spine                       | Broken or cracks in rubber.                                  |                 |                |           |
| Ribs                        | Broken or bent ribs  |                 |                |           |
|                             | Broken or bent rib supports                                  |                 |                |           |
|                             | Damping material separated or cracked                        |                 |                |           |
|                             | Rubber bumpers in place                                      |                 |                |           |
| Chest Displacement Assembly | Bent shaft   |                 |                |           |
|                             | Slider arm riding in track                                   |                 |                |           |
| Transducer leads            | Torn cables  |                 |                |           |

| <i>Dummy Item</i>       | <i>Inspect for</i>                    | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-------------------------|---------------------------------------|-----------------|----------------|-----------|
| Accelerometer Mountings | Head mounting secure                  |                 |                |           |
|                         | Chest mounting secure                 |                 |                |           |
| Knees                   | Skin condition                        |                 |                |           |
|                         | Insert (do not remove)                |                 |                |           |
|                         | Casting                               |                 |                |           |
| Limbs                   | Normal movement and adjustment        |                 |                |           |
| Knee Sliders            | Wires intact                          |                 |                |           |
|                         | Rubber returned to "at rest" position |                 |                |           |
| Pelvis                  | Broken                                |                 |                |           |
| Other                   |                                       |                 |                |           |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Describe the repair or replacement of parts:

Checked by

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET D2**  
**EXTERNAL MEASUREMENTS (3 YEAR-OLD)**  
 (See the PADI)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

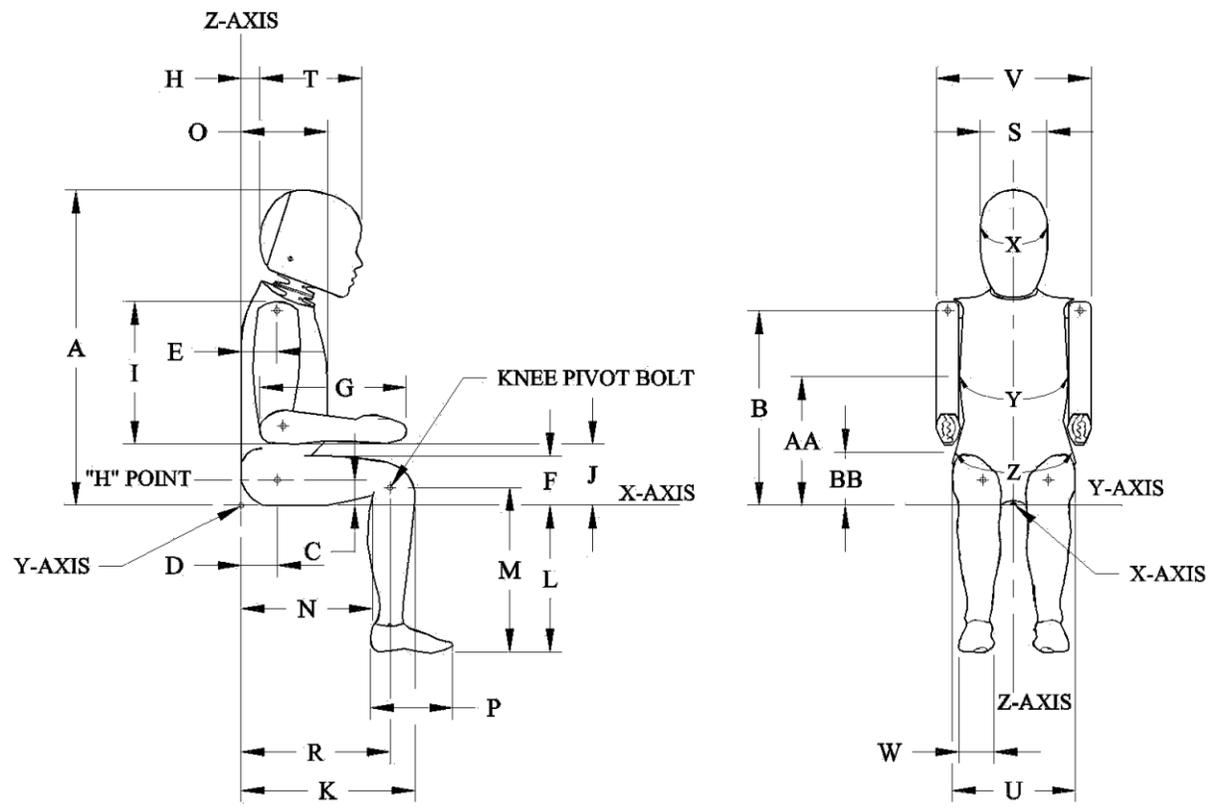
1. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in Figure 5D and 6D. The seating surface is at least 406 mm (16 in) wide and 221 mm (8 11/16 in) in depth with a vertical section at least 406 mm (16 in) wide and 610 mm (24 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.
2. Secure the dummy to the test fixture so that the upper torso and buttocks are against the rear surface.
3. Position the dummy's H-point so it is  $39.4 \pm 5.1$  mm ( $1.55 \pm 0.2$  in) above the horizontal seating surface and  $62.0 \pm 5.1$  mm ( $2.44 \pm 0.2$  in) forward of the rear vertical surface of the fixture.
4. Extend the dummy's neck so that the base of the skull is level both fore-and-aft and side-to-side, within 0.5 degrees. The rearmost surface of the head should be  $53.3 \pm 5.1$  mm ( $2.1 \pm 0.2$  in) from the vertical surface of the test fixture. A strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.
5. Position the upper and lower legs parallel to the midsagittal plane so the centerline between the knee pivot and the ankle pivot is parallel to the rear vertical surface of the fixture.
6. Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.
7. Position the upper arms downward vertically so the centerline between the shoulders and elbow pivots is parallel to the rear vertical surface of the fixture.
8. Position the lower arms horizontally so the centerline of the lower arm-hand is parallel to the seat surface.
9. Record the dimensions listed in following table, except for dimension Q, X, Y and Z (reference figure 4D).
10. Mark the locations AA, and BB, and record the dimensions Y, Z, as specified in the following table and figure 4D. Measure and record dimensions Q and X.

\_\_\_\_\_  
 Signature

\_\_\_\_\_  
 Date

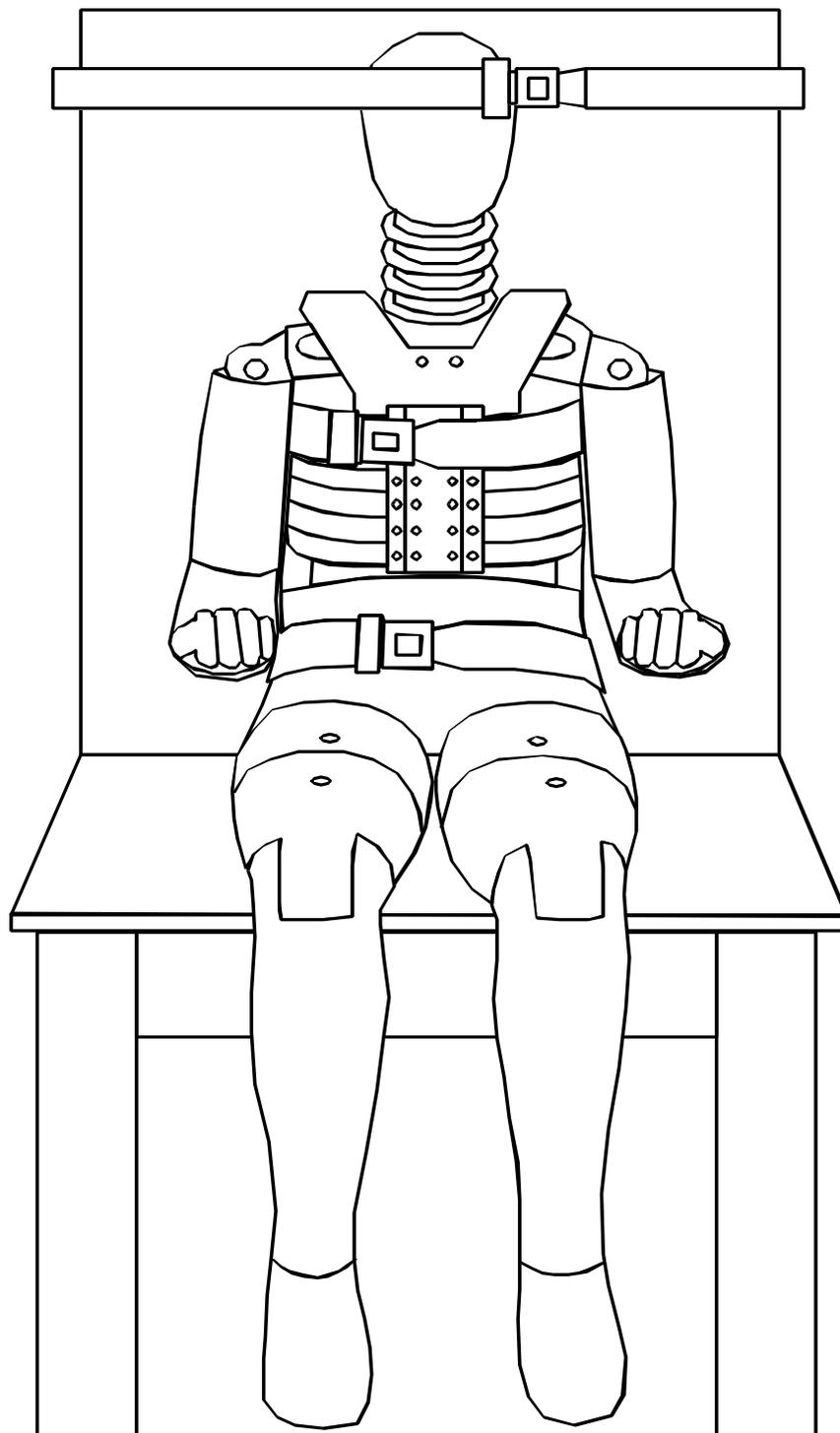
| HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS  |                                |   |                         |                    |
|--|--------------------------------|---|-------------------------|--------------------|
| DIMENSION  | DESCRIPTION                    | DETAILS   | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A  | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.   | 538.5-553.7             |                    |
| B  | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.  | 307.4-322.6             |                    |
| C  | H-POINT HEIGHT                 | Reference   | 34.3-44.5               |                    |
| D  | H-POINT LOCATION FROM BACKLINE | Reference   | 56.9-67.1               |                    |
| E  | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder pivot bolt to the fixture's rear vertical surface.   | 60.9-71.1               |                    |
| F  | THIGH CLEARANCE                | Fixture's seat surface to highest point on the upper leg segment  | 81.0-91.2               |                    |
| G  | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the finger tip, in line with the elbow and wrist centerlines   | 247.4-262.6             |                    |
| H  | HEAD BACK TO BACKLINE          | Rearmost surface of the head to the fixture's rear vertical surface (Reference)   | 48.2-58.4               |                    |
| I  | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the shoulder to the lowest part of the flesh on the elbow in line with the shoulder and elbow pivot bolts. | 185.4-200.6             |                    |
| J  | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.  | 133.6-148.8             |                    |
| K  | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the fixture's rear vertical surface, in line with the knee and hip pivots.                               | 284.8-300               |                    |
| L  | POPLITEAL HEIGHT               | Seat surface to the horizontal plane of the bottom of the feet.   | 218.5-233.7             |                    |
| M  | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.  | 241.6-256.8             |                    |
| N  | BUTTOCK POPLITEAL LENGTH       | The most forward portion of the crevice between the upper and lower legs behind the knee to the fixture's rear vertical surface.                    | 218.0-233.2             |                    |
| HYBRID III, SUBPART P EXTERNAL DIMENSIONS, continued |                                |   |                         |                    |

| DIMENSION | DESCRIPTION                        | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
|-----------|------------------------------------|--|-------------------------|--------------------|
| O         | CHEST DEPTH WITH JACKET            | Measured $254.0 \pm 5.1$ mm above seat surface   | 138.5-153.7             |                    |
| P         | FOOT LENGTH                        | Tip of toe to rear of heal   | 137.6-147.8             |                    |
| Q         | STATURE                            | Lay the dummy out on a flat surface with the rear surfaces of the head, upper torso, buttocks and heels touching the surface and with the bottom of the feet perpendicular to that surface. Measure the distance from the bottom of the feet to the top of the head. | 932.2-957.6             | N/A                |
| R         | BUTTOCK TO KNEE PIVOT LENGTH       | Knee pivot bolt to the fixture's rear vertical surface.  | 251.4-261.6             |                    |
| S         | HEAD BREADTH                       | Distance across the widest of the head at its widest point   | 128.3-143.5             |                    |
| T         | HEAD DEPTH                         | Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsgittal plane.   | 167.4-182.6             |                    |
| U         | HIP BREADTH                        | Distance across the width of the hip at the widest point of the jacket   | 200.7-215.9             |                    |
| V         | SHOULDER BREADTH                   | Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts  | 236.5-251.7             |                    |
| W         | FOOT BREADTH                       | The widest part of the foot  | 53.6-63.8               |                    |
| X         | HEAD CIRCUMFERENCE                 | At the largest location  | 500.4-515.6             |                    |
| Y         | CHEST CIRCUMFERENCE WITH JACKET    | Distance around chest at reference location AA, with jacket on.  | 527.1-552.5             |                    |
| Z         | WAIST CIRCUMFERENCE                | Distance around chest at reference location BB, with jacket on.  | 527.1-552.5             |                    |
| AA        | REFERENCE LOCATION FOR DIMENSION Y | Reference: $254.0 \pm 5.1$ MM above the seat surface   | 248.9-259.1             |                    |
| BB        | REFERENCE LOCATION FOR DIMENSION Z | Reference: $165.1 \pm 5.1$ MM above seat surface   | 160.0-170.2             |                    |



**EXTERNAL DIMENSION MEASUREMENT DESIGNATIONS**  
*FIGURE 4D*

# EXTERNAL DIMENSIONS TEST SETUP



*FIGURE 5B*

# EXTERNAL DIMENSIONS TEST SETUP

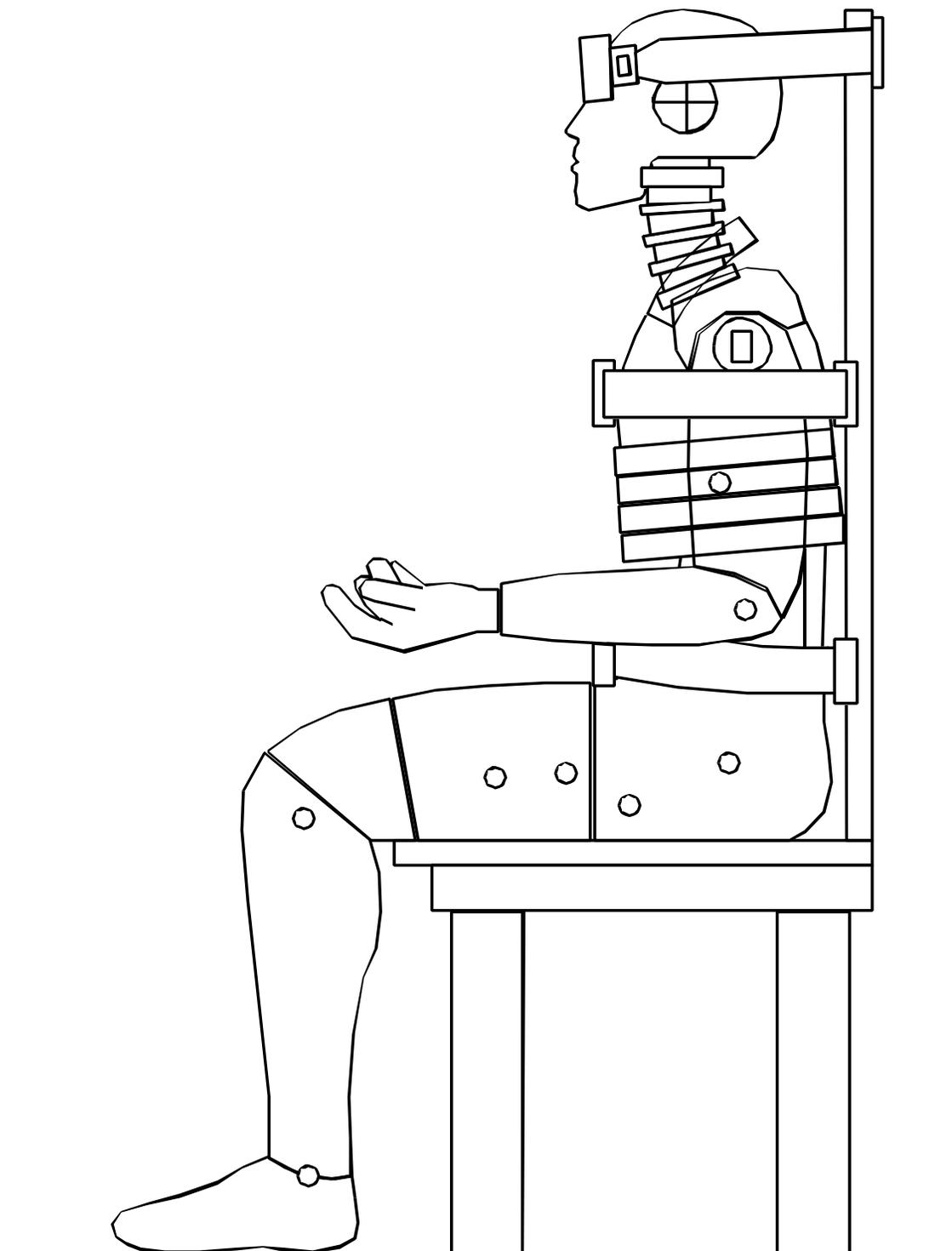


FIGURE 6D

**DATA SHEET D3**  
**HEAD DROP TEST (572.142) (3 YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

\_\_ Pretest calibration

\_\_ Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

- \_\_1. It has been at least 2 hours since the last head drop. (572.142(c)(5))  
 \_\_ N/A, ONLY one head drop performed
- \_\_2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1” flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- \_\_4. Accelerometers and their respective mounts are smooth and clean.
- \_\_5. The head accelerometer mounting plate screws ((10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- \_\_6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(1))
- \_\_7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
- \_\_8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- \_\_9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

- \_\_10. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.142(c)(3))  
Record the actual distance \_\_\_\_\_

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- \_\_11. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistant within 2 mm from the impact surface. (572.142(c)(3))  
Record the right side distance \_\_\_\_\_  
Record the left side distance \_\_\_\_\_
- \_\_12. The impact surface is clean and dry and has a microfinish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.142(c)(4))  
Record actual microfinish \_\_\_\_\_

- \_\_14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))  
Record thickness \_\_\_\_\_  
Record width \_\_\_\_\_  
Record length \_\_\_\_\_

- \_\_15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b) & (572.142(c)(4))

- \_\_16. Complete the following table. (572.142(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 280 \text{ g}$        |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          |        |

- \_\_17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## HEAD DROP TEST SET-UP SPECIFICATIONS

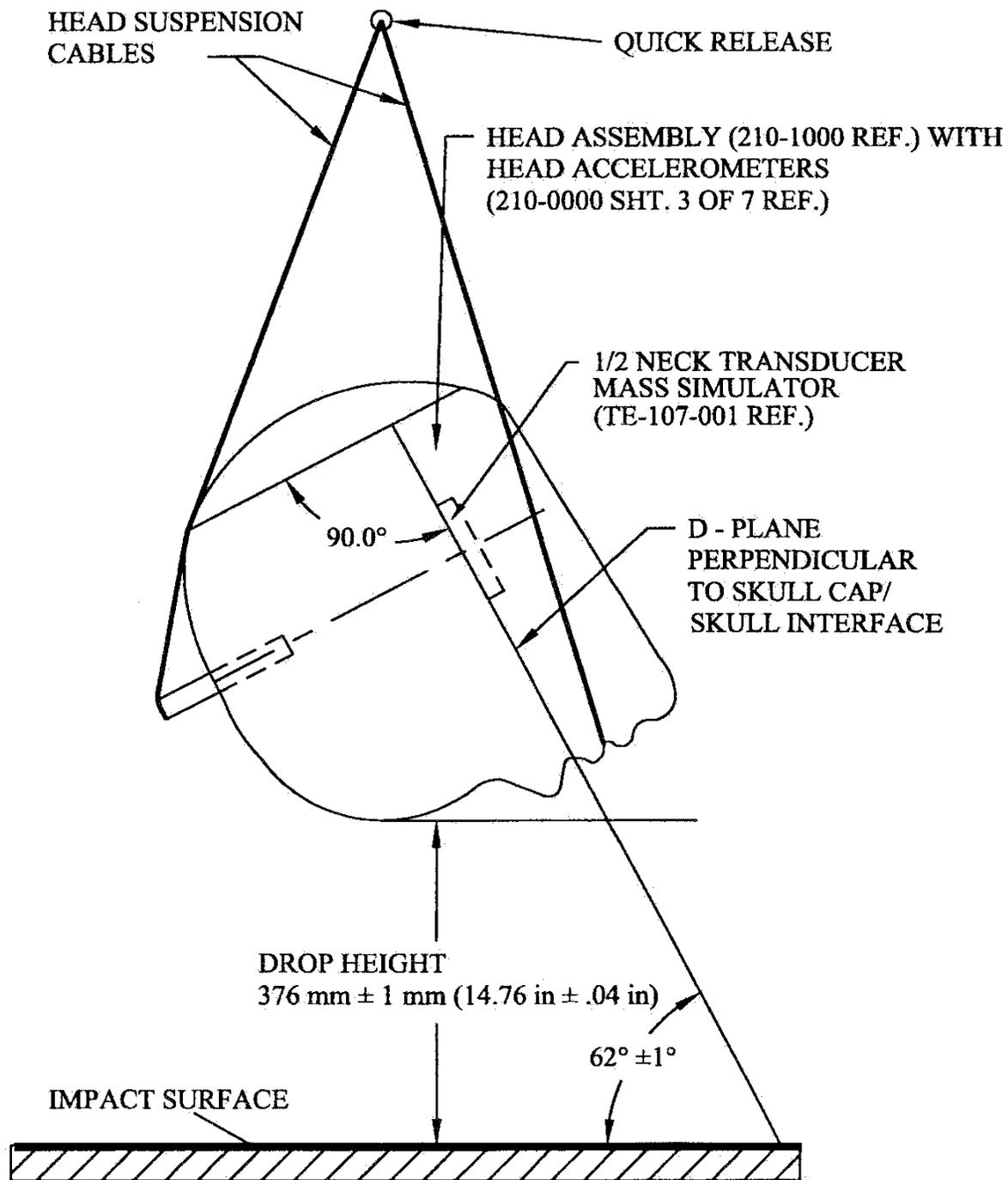


FIGURE 7D

**DATA SHEET D4**  
NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
8. The test fixture pendulum conforms to the specifications in Figure 8D.
9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))
10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of

the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

- \_\_11. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- \_\_12. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- \_\_13. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- \_\_14. Complete the following table:

Neck Flexion Test Results (572.143(b)(1) & (572.143(c)(4)(ii))

| Parameter  | Specification  | Result   |
|--|--|--|
| Pendulum impact speed                            | $5.4 \text{ m/s} \leq \text{speed} \leq 5.6 \text{ m/s}$   |  |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms   | $2.0 \text{ m/s} \leq \Delta V \leq 2.7 \text{ m/s}$ |
|  | @ 15 ms  | $3.0 \text{ m/s} \leq \Delta V \leq 4.0 \text{ m/s}$ |
|  | @ 20ms   | $4.0 \text{ m/s} \leq \Delta V \leq 5.1 \text{ m/s}$ |
| Plane D Rotation                                 | Peak moment*<br>$42 \text{ Nm} \leq \text{moment} \leq 53 \text{ Nm}$ during the following rotation range $70^\circ \leq \text{angle} \leq 82^\circ$ | ____Nm @<br>____degrees                              |
| Positive Moment Decay**<br>(Flexion)             | Time to decay to 10 Nm<br>$60 \text{ ms} \leq \text{time} \leq 80\text{ms}$  |  |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- \_\_15. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET D5**  
NECK EXTENSION TEST (572.133) (3 YEAR-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive extension tests are necessary)

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
8. The test fixture pendulum conforms to the specifications in Figure 8D.
9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))
10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of

the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

- \_\_11. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- \_\_12. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))
- \_\_13. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- \_\_14. Complete the following table:

Neck Extension Test Results (572.143(b)(2) & (572.143(c)(4)(ii))

| Parameter  | Specification  | Result   |
|--|--|--|
| Pendulum impact speed                            | $3.55 \text{ m/s} \leq \text{speed} \leq 3.75 \text{ m/s}$   |  |
| Pendulum $\Delta V$ with respect to impact speed | @ 6 ms   | $1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$ |
|  | @ 10 ms  | $1.9 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$ |
|  | @ 14 ms  | $2.8 \text{ m/s} \leq \Delta V \leq 3.5 \text{ m/s}$ |
| Plane D Rotation                                 | Peak moment*<br>$-53.3 \text{ Nm} \leq \text{moment} \leq -43.7 \text{ Nm}$ during the following rotation range $83 \leq \text{angle} \leq 93$ | ____Nm @<br>____degrees                              |
| Negative Moment Decay** (Extension)              | Time to decay to -10 Nm<br>$60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$   |  |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- \_\_15. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**PENDULUM SPECIFICATIONS**

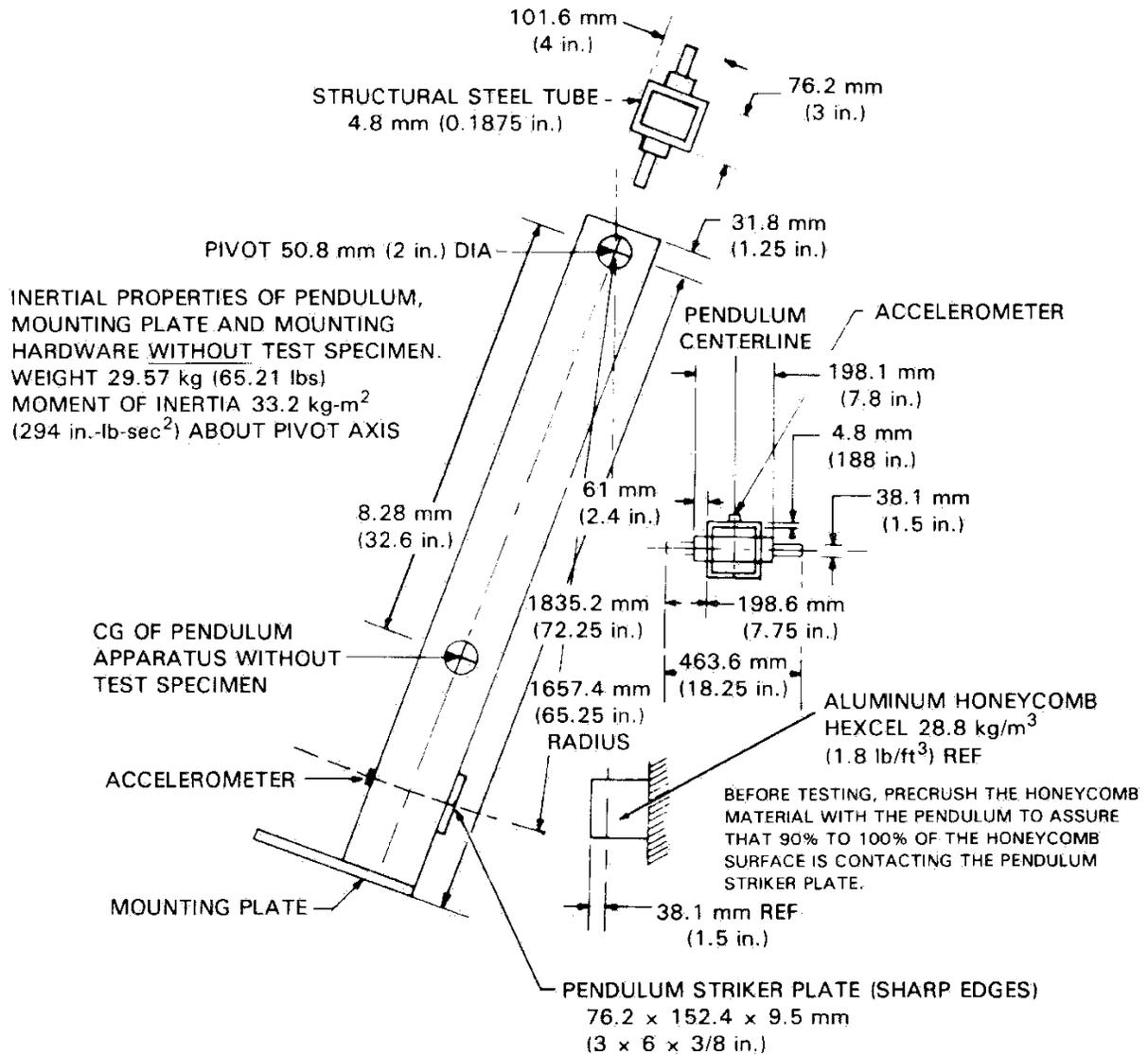
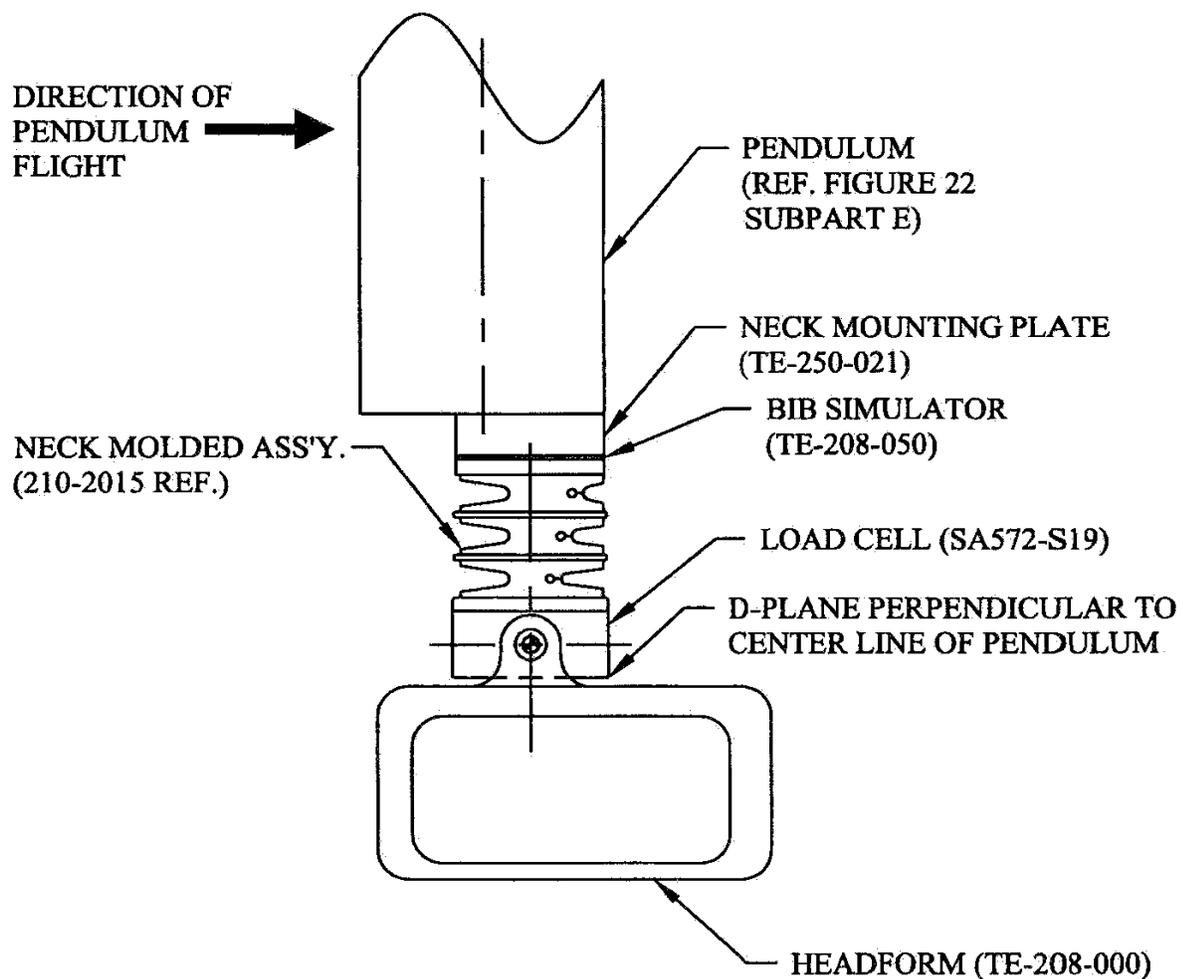


FIGURE 8D

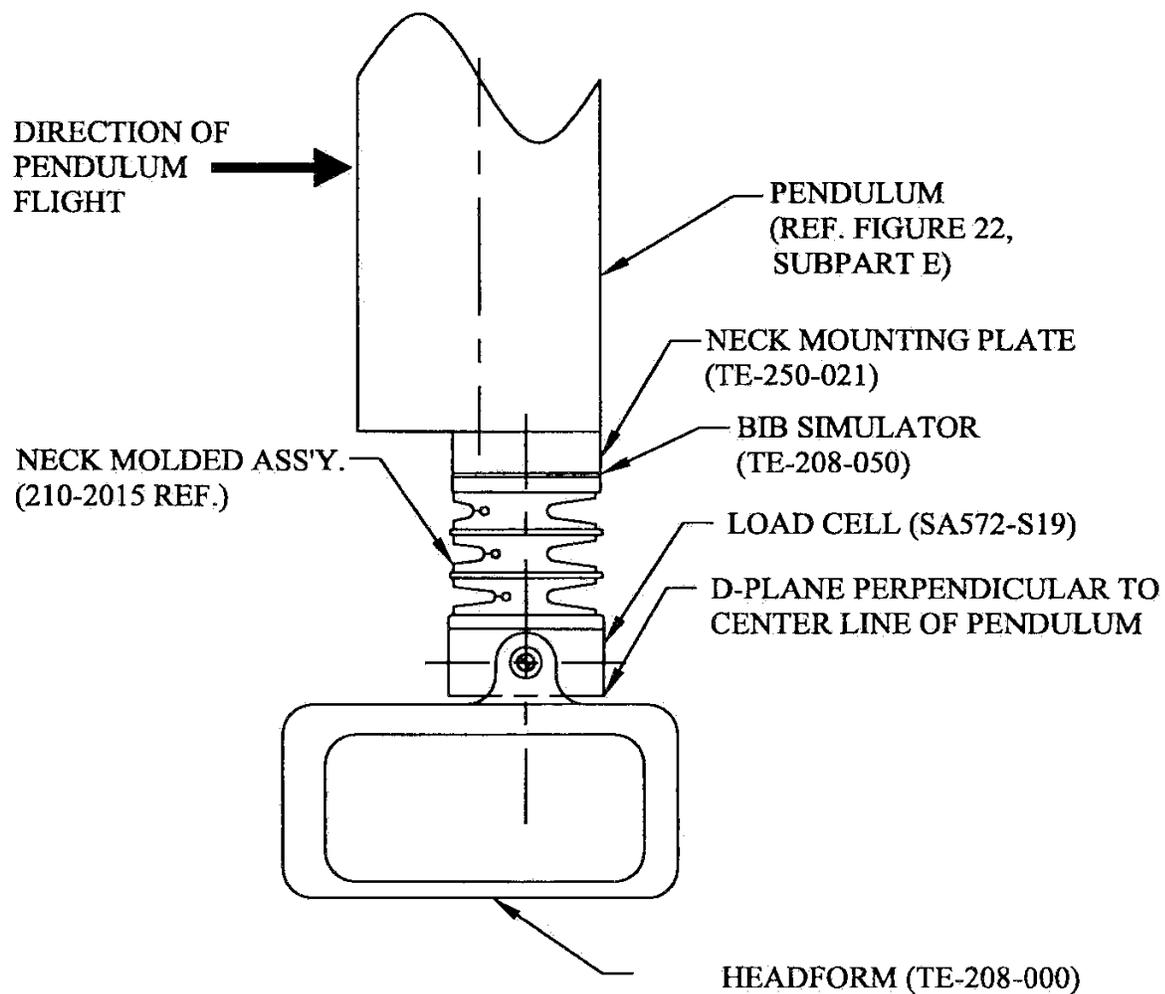
## NECK FLEXION TEST SET-UP SPECIFICATIONS



NOTE: MOUNT NECK AT LEADING EDGE OF PENDULUM TO AVOID INTERFERENCE WITH HEADFORM MOTION. PENDULUM SHOWN IN VERTICAL ORIENTATION.

FIGURE 9D

## NECK EXTENSION TEST SET-UP SPECIFICATIONS



NOTE: MOUNT NECK AT LEADING EDGE OF PENDULUM TO AVOID INTERFERENCE WITH HEADFORM MOTION.  
PENDULUM SHOWN IN VERTICAL ORIENTATION.

FIGURE 10D

**DATA SHEET D6**  
**THORAX IMPACT TEST (572.144) (3 YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive thorax impact tests are necessary)

1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 11D.
3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Remove the arms.
6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.  
 - No damage  
 - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_  
 \_\_\_\_\_  
 - The following repairs or replacement was performed. Record \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))
8. Level the middle rib both longitudinally and laterally  $\pm 0.5^\circ$ . (572.144(c)(3))
9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.144(c)(3))

- \_\_10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within  $\pm 2.5$  mm within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- \_\_11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- \_\_12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- \_\_13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- \_\_14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(1)).
- \_\_15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

\_\_16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

| Parameter*  | Specification  | Result |
|---|--|--------|
| Test Probe Speed  | $5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$   |        |
| Chest Compression                                       | $32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$ |        |
| Peak force** between 32 and 38 mm chest compression     | $680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$  |        |
| Peak force** between 12.5 and 32.0 mm chest compression | Peak force $\leq 910 \text{ N}$                            |        |
| Internal Hysteresis***                                  | $65\% \leq \text{hysteresis} \leq 85\%$                    |        |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

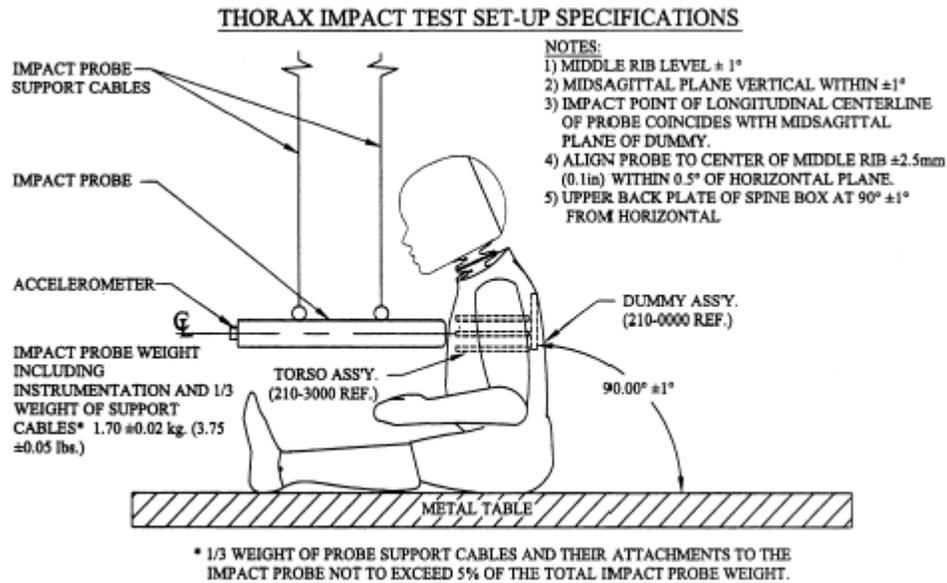
\*\*Force = impactor mass x acceleration (572.144(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

\_\_17. Plots of chest compression, pendulum acceleration, pendulum force, and force versus deflection follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



Probe specifications:

1. Rigid metallic construction, concentric its longitudinal axis.
2. A mass of  $1.7 \pm 0.02$  kg ( $3.75 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and their attachments to the impact probe are included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $164 \text{ kg}\cdot\text{cm}^2$  ( $0.145 \text{ lbs}\cdot\text{in}\cdot\text{sec}^2$ ) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has a flat, continuous, and non-deformable face with diameter of  $50.8 \pm 0.2$  mm ( $2.00 \pm 0.01$  in) and a maximum edge radius of 7.6-12.7 mm (0.3-0.5 in).
5. The impactor is a cylinder with a diameter of 53.3 mm (2.1 in) and it is at least 25.4 mm (1.0 in) long.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in the direction of the longitudinal direction of the impactor.

*FIGURE 11D*

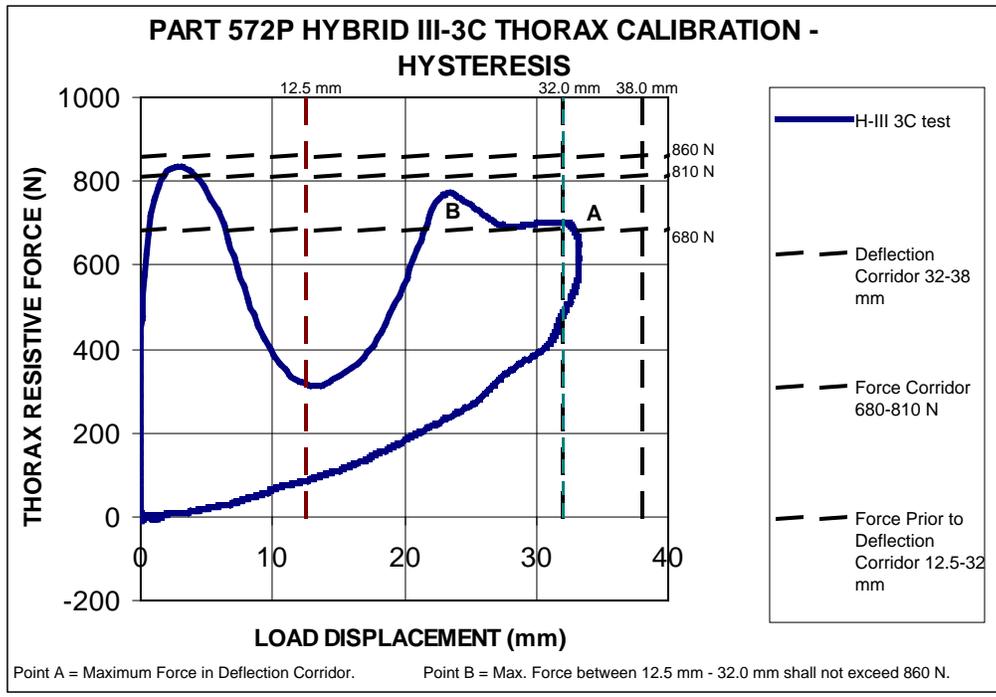


FIGURE 12D

**DATA SHEET D7**  
**TORSO FLEXION TEST (572.145) (3 YEAR-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive torso flexion tests are necessary)

1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))  
 N/A, ONLY torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13D.
3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
5. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within  $\pm 1^\circ$  and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
6. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
7. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))
8. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between  $0^\circ$  and  $30^\circ \pm 2^\circ$ . The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))
9. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near  $0^\circ$ . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
10. Remove all external support that was implemented in 9 above and wait 2 minutes. (572.145(c)(4))

- \_\_11. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))  
Record reference plane angle (max. allowed  $15^\circ$ )\_\_\_\_\_
- \_\_12. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- \_\_13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the torso reference plane reaches  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.145(c)(5))
- \_\_14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))
- \_\_15. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- \_\_16. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- \_\_17. Complete the following table:

Torso Flexion Results (572.145(b)(1)&amp;(2), 572.145(c)(4), (572.145(c)(5))

| Parameter                         | Specification   | Result |
|-----------------------------------|---|--------|
| Initial ref. plane angle          | Angle $\leq 15^\circ$   |        |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ |        |
| Force at $45^\circ \pm 0.5^\circ$ | $130 \text{ N} \leq \text{force} \leq 180 \text{ N}$          |        |
| Final ref. plane angle            | Initial ref. plane angle $\pm 10^\circ$                       |        |

- \_\_18. A plot of the force versus time follows this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### TORSO FLEXION TEST SET-UP SPECIFICATION

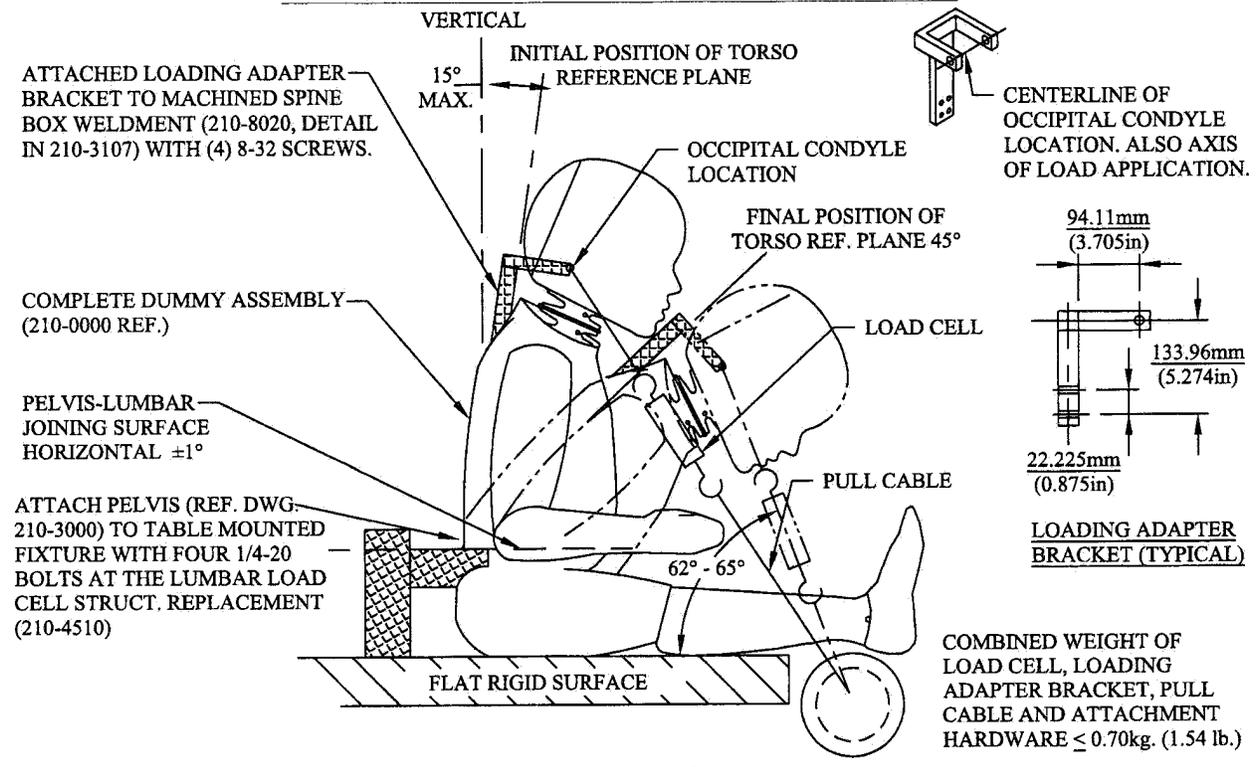


FIGURE 13D

**DATA SHEET D8**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|-----------|------------|--------------------------|--------------------------|
| <b>DUMMY INSTRUMENTATION</b>          |              |           |            |                          |                          |
| <b>HEAD ACCELEROMETERS</b>            |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| NECK TRANSDUCER                       |              |           |            |                          |                          |
| <b>CHEST ACCELEROMETERS</b>           |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| CHEST POTENTIOMETER                   |              |           |            |                          |                          |
| <b>FEMUR LOAD CELLS</b>               |              |           |            |                          |                          |
| (1) RIGHT FEMUR                       |              |           |            |                          |                          |
| (2) LEFT FEMUR                        |              |           |            |                          |                          |
| <b>LABORATORY INSTRUMENTATION</b>     |              |           |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| THORAX PENDULUM ACCELEROMETER         |              |           |            |                          |                          |
| KNEE PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) |              |           |            |                          |                          |

LABORATORY TECHNICIAN: \_\_\_\_\_

## **APPENDIX E**

### **PART 572R (12-MONTH-OLD) DUMMY PERFORMANCE CALIBRATION TEST PROCEDURE**

**APPENDIX E**  
**PART 572, SUBPART R DUMMY PERFORMANCE CALIBRATION TEST**  
**PROCEDURE**

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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 Crashworthiness Standards) with standard test procedures for performing receiving-inspection and performance calibration tests on the Part 572, Subpart R 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 DIMENSIONS (PADI)
- B. HEAD DROP TEST (572.152)
- C. NECK FLEXION TEST (572.153(b)(1))
- D. NECK EXTENSION TEST 572.153(b)(2)
- E. THORAX IMPACT TEST ((572.154)

National Highway Traffic Safety Administration (NHTSA) contract laboratories performing NCAP testing for the Office of Crashworthiness Standards (OCWS) must use this laboratory procedure for the calibration of Part 572, Subpart R dummies.

## 2. GENERAL REQUIREMENTS

The Code of Federal Regulations (49CFR), Parts 571 and 572, was amended to adopt the Hybrid III, CRABI 12-Month-Old Dummy as the means of determining a vehicle's conformance to the performance requirements of FMVSS 208. Each Part 572, Subpart R dummy used in an NCAP test must meet the specifications and performance criteria of Part 572 before and after each vehicle crash test in order to be an acceptable test tool.

The Part 572, Subpart R Hybrid III, CRABI 12-Month-Old Dummy consists of components and assemblies specified in the drawing and specifications package which is available from Reprographics Technologies, 9000 Virginia Manor, Beltsville, MD 20705, telephone - (301) 419-5070.

## 3. SECURITY

All NHTSA Part 572, Subpart R test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as a dummy calibration laboratory. The contractor is financially responsible for any acts of theft and/or vandalism that 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 maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart R dummy calibration tests before and after each vehicle test usage.

No Information concerning the Part 572, Subpart R 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 R dummies are being calibrated as test tools to be used in NCAP vehicle crash tests. The schedule for these performance calibration tests must be correlated with that of the vehicle tests. 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. All calibration test data for each particular Part 572, Subpart R dummy will be sent to the COTR with each test report.

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

#### **7. GOVERNMENT FURNISHED PROPERTY (GFP)**

Part 572, Subpart R test dummies will be furnished to the contract laboratory by the OCWS. The dummies shall be stored in a hanging position using the bracket and positioning shown in drawings 1E and 2E.



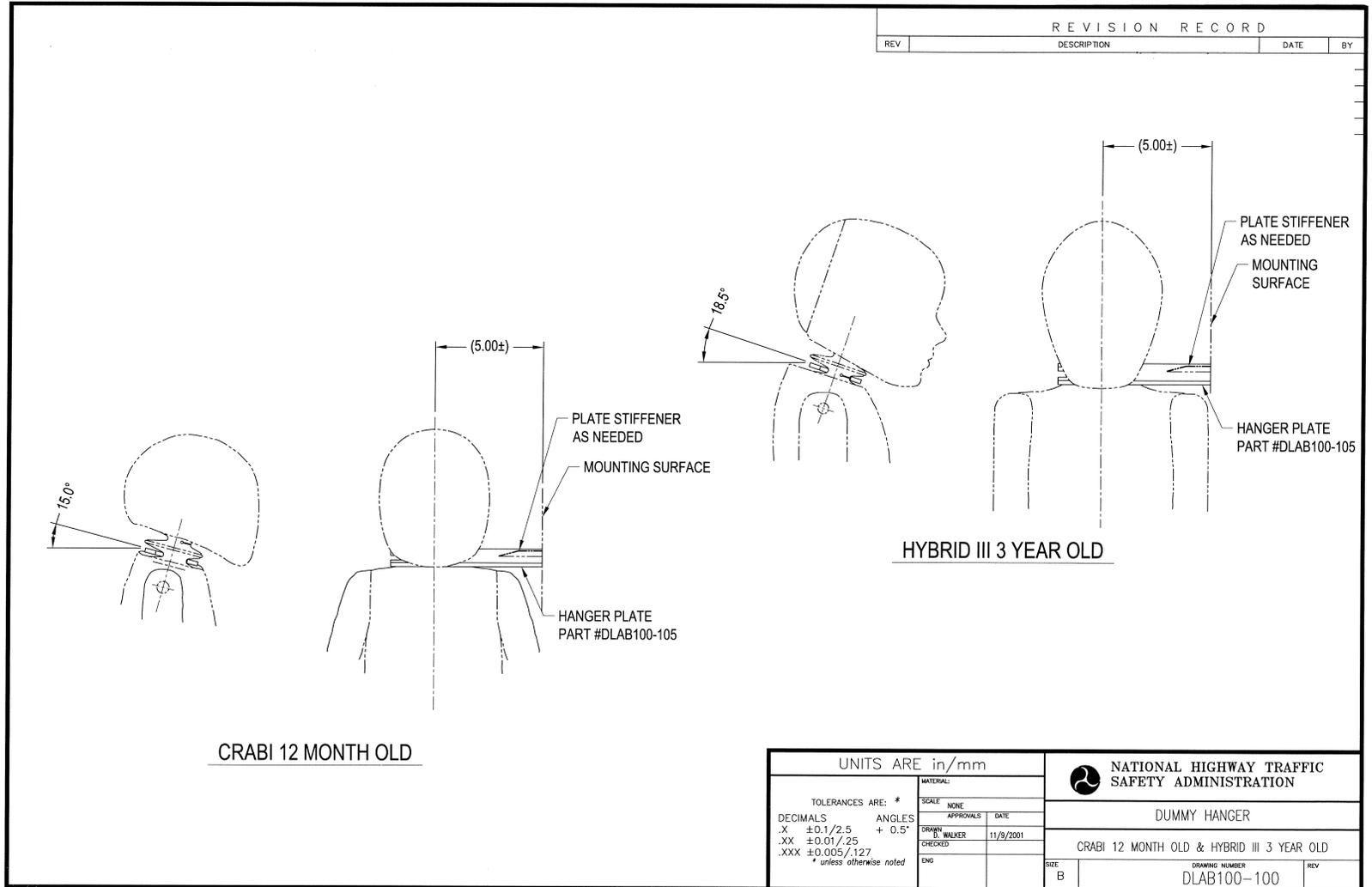


FIGURE 2E

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 (as part of the NCAP procedure), which will be included with the dummy calibration, if requested. The COTR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be calibrated by the contractor according to the schedule indicated in the NCAP test procedure.

## **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 as indicated in NCAP test procedure. These calibrations shall be submitted with the final report.

## **9. PHOTOGRAPHIC DOCUMENTATION**

Provide still photographs (color prints properly focused for clear images, no more than two (2) per 8.5"x11" sheet) of post test damage resulting from the vehicle crash test.

## **10. DEFINITIONS**

PADI: Procedures for Assembly, Disassembly, and Inspection

## **11. PRETEST REQUIREMENTS**

### **11.1 TRANSDUCER REQUIREMENTS**

The contractor shall provide and install the following instrumentation to the GFP dummies (excluding the chest deflection transducer).

- A. HEAD – The head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing SA572-S4 and be mounted in the head as shown in drawing 921022-000. (572.155(b))

Three accelerometers shall be mounted in the head cavity to measure orthogonal accelerations ( $A_x$ ,  $A_y$ ,  $A_z$ ) at the center of gravity (CG) of the head assembly.

- B. NECK – The neck force-moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S23 and shall be mounted as shown in drawing 921022-000. (572.155(c))

- C. CHEST – The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572-S4 and be mounted in the torso assembly in triaxial configuration at the T4 location as shown drawing 921022-000. The chest accelerometers are not required for dummy calibration testing but are required for NCAP testing. (572.155(e))
- D. TEST FIXTURE – The neck pendulum and thorax accelerometers shall have the dimensions and characteristics of drawing SA572-S4.

## 11.2 OTHER TRANSDUCER CONDITIONS

- A. TRANSDUCER MOUNTS – The mountings for sensing devices shall have no resonance frequency less than 3 times the frequency range of the applicable channel class. (572.155(k))
- B. TRANSDUCER SIGN CONVENTION - The sign convention for outputs of transducers mounted within the dummy that measure head and chest accelerations, chest deflection and neck loads are located in Figure 3E. For other transducers see SAE J1733DEC94. (572.155(i))
- 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 will be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1 MAR95, "Instrumentation for Impact Test," with channel classes as follows: (572.155(i))

|                               |            |                      |
|-------------------------------|------------|----------------------|
| 1. Head acceleration          | Class 1000 | (572.155(i)(1))      |
| 2. Neck force                 | Class 1000 | (572.155(i)(2)(i))   |
| 3. Neck moment                | Class 600  | (572.155(i)(2)(ii))  |
| 4. Neck pendulum acceleration | Class 180  | (572.155(i)(2)(iii)) |
| 5. Neck rotation transducers  | Class 60   | (572.155(i)(2)(iv))  |
| 6. Thorax spine acceleration  | Class 180  | (572.155(i)(3)(ii))  |
| 7. Thorax pendulum            | Class 180  | (572.155(i)(3)(ii))  |
| 8. acceleration               |            |                      |

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

## 11.3 THORAX IMPACTOR PROBE (572.155(a))

- A. The test probe for thoracic impacts shall be of rigid metallic construction, concentric about its longitudinal axis.
- B. It shall have a mass of  $2.86 \pm 0.02$  kg ( $6.3 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and any attachments to the impact probe must be included in

the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.

- C. It shall have a minimum mass moment of inertia of  $164 \text{ kg-cm}^2$  ( $0.145 \text{ lbs-in-sec}^2$ ) in yaw and pitch about the center of gravity.
- D. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. The face has a diameter of  $101.6 \pm 0.25 \text{ mm}$  ( $4.00 \pm 0.01 \text{ in}$ ), a maximum edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in) and is flat, continuous and non-deformable.
- E. A 101-103 mm diameter cylinder surface extends at least 12.5 mm to the rear of the impact face.
- F. 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 axis of the probe.
- G. The impact probe shall have a free air resonant frequency of not less than 1000 Hz measured in line with the longitudinal axis of the impactor.

SIGN CONVENTION FOR PART 572 TEST DUMMIES

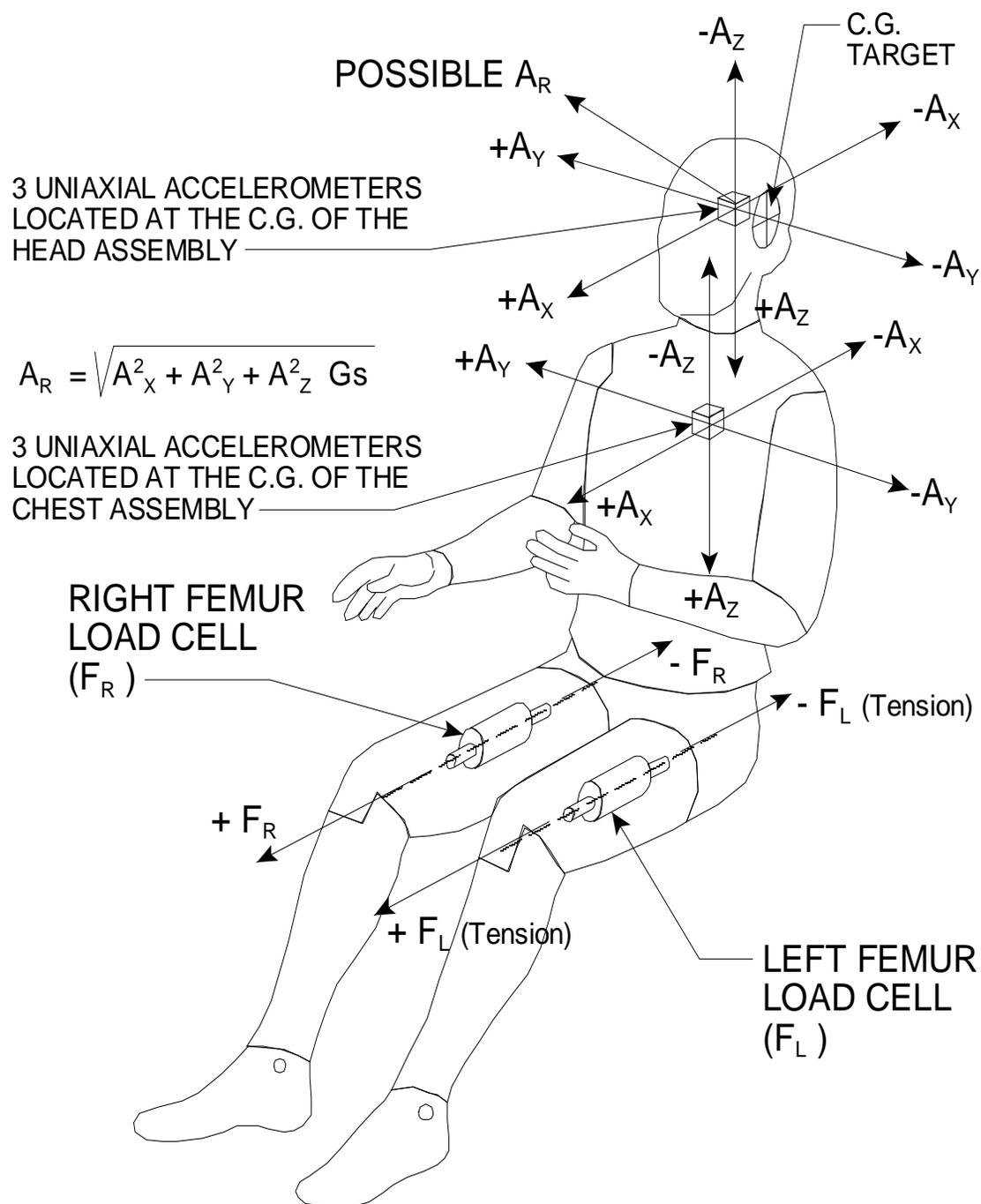


FIGURE 3E

TABLE 1E

| <b>SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS</b>   |   |
|--|---|
| <b>BODY SEGMENT —<br/>MEASURED FORCE</b>   | <b>POSITIVE OUTPUT DIRECTION</b>  |
| NECK<br>FX SHEAR<br>FY SHEAR<br>FZ AXIAL<br><br>MX MOMENT (ROLL)<br>MY MOMENT (PITCH)<br>MZ MOMENT (YAW) | HEAD REARWARD OR CHEST FORWARD<br>HEAD LEFTWARD, CHEST RIGHTWARD<br>HEAD UPWARD, CHEST DOWNWARD<br><br>LEFT EAR TOWARD LEFT SHOULDER<br>CHIN TOWARD STERNUM<br>CHIN TOWARD LEFT SHOULDER                                  |
| LEFT SHOULDER<br>FX<br><br>FZ  | LEFT ARM/SHOULDER FORWARD, CHEST<br>REARWARD<br>LEFT ARM/SHOULDER DOWNWARD, CHEST<br>UPWARD   |
| RIGHT SHOULDER<br>FX<br><br>FZ   | RIGHT ARM/SHOULDER FORWARD, CHEST<br>REARWARD<br>RIGHT ARM/SHOULDER DOWNWARD, CHEST<br>UPWARD   |
| LUMBAR SPINE<br>FX<br>FY<br>FZ<br>MX MOMENT<br>MY MOMENT<br>MZ MOMENT                                    | CHEST REARWARD, PELVIS FORWARD<br>CHEST LEFTWARD, PELVIS RIGHTWARD<br>CHEST UPWARD, PELVIS DOWNWARD<br>LEFT SHOULDER TOWARD LEFT HIP<br>STERNUM TOWARD FRONT OF LEGS<br>RIGHT SHOULDER FORWARD, LEFT SHOULDER<br>REARWARD |
| PUBIC<br>FX SHEAR<br>FZ AXIAL  | PUBIC REARWARD, CHEST FORWARD<br>PUBIC UPWARD, CHEST DOWNWARD   |

**NOTE:** DIRECTIONS ARE DEFINED IN RELATION TO A SEATED DUMMY

## 11.4 GENERAL TEST CONDITIONS

- A. Surfaces of dummy components are not painted unless otherwise specified. (572.155(n))
- B. Dummy performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise specified. (572.155(m))
- C. The dummy head performance tests are conducted at any temperature from 18.9°C (66°F) to 25.6°C (78°F) and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours. For the neck-headform assembly and thorax assembly, the temperature range is 20.6°C (69°F) to 22.2°C (72°F) and at any relative humidity from 10% to 70% after exposure of the dummy to these conditions for a period of not less than 4 hours.
- D. Dummy limb joints are set at 1 G, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2 Gs throughout the range of limb motion. (572.155(l))
- E. Dummies will be clothed for the thorax calibration tests with a form fitting cotton-polyester-based tight-fitting sweat shirt with long sleeves and ankle length pants. The total weight of the shirt and pants shall not exceed 0.25 kg (0.55 lb). (572.154(c)(2))

## 12. CALIBRATION TEST EXECUTION

Complete the Data Sheets in section 15.

## 13. 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.

## 14. REPORTS

### 14.1 APPARENT NONCONFORMANCE

During the a calibration verification, 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 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 OCWS.

## 14.2 FINAL PERFORMANCE CALIBRATION REPORTS

### 14.2.1 COPIES

A report containing the calibration data for each Part 572, Subpart R dummy used in the vehicle crash test shall be submitted with the final NCAP test report for the vehicle.

Contractors are required to PROOF READ all Final 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.

**15. DATA SHEETS**

**DATA SHEET E1**  
**DUMMY DAMAGE CHECKLIST (12-MONTH-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

This check sheet is completed as part of the calibration verification.

Indicate NA in the OK column for any components not applicable to this size dummy.

\_\_Perform general cleaning.

| <i>Dummy Item</i>           | <i>Inspect for</i>   | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-----------------------------|--|-----------------|----------------|-----------|
| Outer skin                  | Gashes, rips, cracks   |                 |                |           |
| Head                        | Ballast secure   |                 |                |           |
|                             | General appearance   |                 |                |           |
| Neck                        | Broken or cracked rubber                                     |                 |                |           |
|                             | Upper neck bracket firmly attached to the lower neck bracket |                 |                |           |
|                             | Looseness at the condyle joint                               |                 |                |           |
|                             | Nodding blocks cracked or out of position                    |                 |                |           |
| Spine                       | Broken or cracks in rubber.                                  |                 |                |           |
| Ribs                        | Broken or bent ribs  |                 |                |           |
|                             | Broken or bent rib supports                                  |                 |                |           |
|                             | Damping material separated or cracked                        |                 |                |           |
|                             | Rubber bumpers in place                                      |                 |                |           |
| Chest Displacement Assembly | Bent shaft   |                 |                |           |
|                             | Slider arm riding in track                                   |                 |                |           |
| Transducer leads            | Torn cables  |                 |                |           |

| <i>Dummy Item</i>       | <i>Inspect for</i>                    | <i>Comments</i> | <i>Damaged</i> | <i>OK</i> |
|-------------------------|---------------------------------------|-----------------|----------------|-----------|
| Accelerometer Mountings | Head mounting secure                  |                 |                |           |
|                         | Chest mounting secure                 |                 |                |           |
| Knees                   | Skin condition                        |                 |                |           |
|                         | Insert (do not remove)                |                 |                |           |
|                         | Casting                               |                 |                |           |
| Limbs                   | Normal movement and adjustment        |                 |                |           |
| Knee Sliders            | Wires intact                          |                 |                |           |
|                         | Rubber returned to "at rest" position |                 |                |           |
| Pelvis                  | Broken                                |                 |                |           |
| Other                   |                                       |                 |                |           |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Describe the repair or replacement of parts:

Checked by

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET E2**  
**EXTERNAL MEASUREMENTS (12-MONTH-OLD)**  
 (See the PADI, pages 52-55)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

1. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface. The seating surface is at least 406 mm (16 in) wide and 221 mm (8 11/16 in) in depth with a vertical section at least 406 mm (16 in) wide and 610 mm (24 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.
2. Secure the dummy to the test fixture so that the upper torso and buttocks are tangent to the rear vertical surface of the fixture (as tangent as possible).
3. Push the dummy's forehead rearward and secure the head (at the forehead) against the seat back surface.
4. Place the centerlines of the upper arms vertical.
5. Place the centerlines of the lower arms horizontal.
6. Position the upper legs so that they are parallel to one another.
7. Position the lower legs so that they are perpendicular to the upper legs and the bottom of the foot is horizontal.
8. Record the dimensions listed in following table, except for dimension Q (reference figure 4E).
9. Place the dummy in supine position on the measurement surface. Place a block that is perpendicular to the table at both the head and feet of the dummy. Position the blocks perpendicular to the midsagittal plane of the dummy. Position the blocks so they are in contact with the head and the heels of the dummy. Measure the distance between the blocks for Q.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

| HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS |                               |  |                         |                    |
|---|-------------------------------|--|-------------------------|--------------------|
| DIMENSION   | DESCRIPTION                   | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A   | TOTAL SITTING HEIGHT          | Seat surface to highest point on top of the head with head pulled back to touch vertical surface of fixture. | 456-471.2               |                    |
| B   | SHOULDER PIVOT HEIGHT         | Centerline of shoulder pivot bolt to the seat surface.   | 276.6-291.8             |                    |
| C   | HIP PIVOT HEIGHT              | Centerline of hip pivot bolt to seat surface   | 27.9-38.1               |                    |
| D   | HIP PIVOT FROM BACKLINE       | Centerline of hip pivot bolt to vertical surface of seat   | 40.1-50.3               |                    |
| E   | SHOULDER PIVOT FROM BACKLINE  | Center of the shoulder pivot bolt to the fixture's rear vertical surface.                                    | 50.3-60.5               |                    |
| F   | THIGH CLEARANCE               | Fixture's seat surface to highest point on the upper femur segment   | 63.0-73.2               |                    |
| G   | ELBOW PIVOT TO FINGERTIP      | Elbow pivot to the finger tip, in line with the elbow and wrist centerlines                                  | 176.6-191.8             |                    |
| I   | SHOULDER PIVOT TO-ELBOW PIVOT | Shoulder pivot bolt to elbow pivot bolt  | 99.1-114.3              |                    |
| J   | ELBOW REST HEIGHT             | Seat surface to bottom of lower arm  | 150.1-165.3             |                    |
| K   | BUTTOCK TO KNEE LENGTH        | The forward most part of the knee flesh to the fixture's rear vertical surface                               | 202.7-217.9             |                    |
| L   | POPLITEAL HEIGHT              | Seat surface to the horizontal plane of the bottom of the feet.  | 138.7-153.9             |                    |
| M   | KNEE PIVOT HEIGHT             | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                             | 165.1-180.3             |                    |
| N   | BUTTOCK POPLITEAL LENGTH      | The rearmost surface of the lower leg to the same point on the rear surface of buttocks used for dimension K | 144.8-160               |                    |

| HYBRID III, SUBPART R EXTERNAL DIMENSIONS, continued |  |  |                         |                    |
|--|--|--|-------------------------|--------------------|
| DIMENSION  | DESCRIPTION                            | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O  | CHEST DEPTH WITH JACKET                | Measured $261.6 \pm 5.1$ mm above seat surface   | 107.5-122.7             |                    |
| P  | FOOT LENGTH                            | Tip of toe to rear of heel   | 92.4-102.6              |                    |
| Q  | STATURE                                | Place the dummy in supine position on the measurement surface. Place a block that is perpendicular to the table at both the head and feet of the dummy. Position the blocks perpendicular to the midsagittal plane of the dummy. Position the blocks so they are in contact with the head and the heels of the dummy. Measure the distance between the blocks. | 727.7-753.1             | N/A                |
| R  | BUTTOCK TO KNEE PIVOT LENGTH           | Knee pivot bolt to the fixture's rear vertical surface.  | 178.5-188.7             |                    |
| S  | HEAD BREADTH                           | Distance across the head at its widest point   | 124.4-134.6             |                    |
| T  | HEAD DEPTH                             | Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsagittal plane.  | 149.9-165.1             |                    |
| U  | HIP BREADTH                            | Distance across the width of the hip at the widest point of the jacket   | 158.5-173.7             |                    |
| V  | SHOULDER BREADTH                       | Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts  | 200.7-215.9             |                    |
| W  | FOOT BREADTH                           | The widest part of the foot  | 39.1-49.3               |                    |
| Y  | CHEST CIRCUMFERENCE WITH JACKET        | Distance around chest at reference location AA, with jacket on. Measured $261.6 \pm 5.1$ mm above the seat surface.  | 452.4-477.8             |                    |
| Z  | WAIST CIRCUMFERENCE                    | Distance around waist at reference location BB, with jacket on. Measured $111.8 \pm 5.1$ mm above the seat surface.  | 447-472.4               |                    |
| AA   | REFERENCE LOCATION FOR DIMENSION Y & O | Reference: $261.6 \pm 5.1$ mm above the seat surface   | 256.5-266.7             |                    |

| HYBRID III, SUBPART R EXTERNAL DIMENSIONS, continued |                                    |  |                         |                    |
|--|------------------------------------|--|-------------------------|--------------------|
| DIMENSION  | DESCRIPTION                        | DETAILS  | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| BB   | REFERENCE LOCATION FOR DIMENSION Z | Reference: $111.8 \pm 5.1$ mm above seat surface | 106.7-116.9             |                    |
| CC   | SHOULDER HEIGHT                    | Top of arm to seat surface                       | 299.7-314.9             |                    |
| DD   | CHIN HEIGHT                        | Bottom of chin to seat surface                   | 289.6-304.8             |                    |

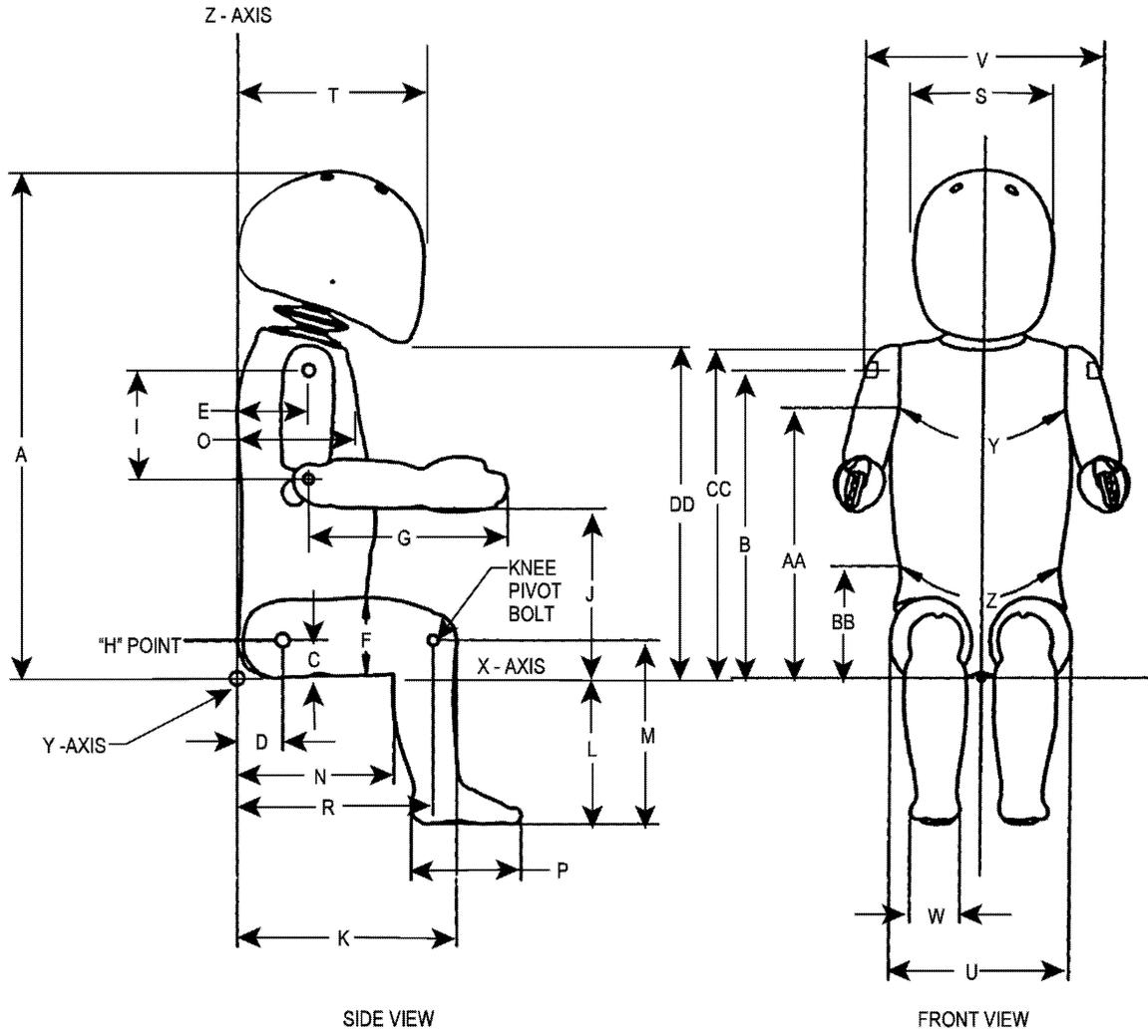


FIGURE 4E

**DATA SHEET E3**  
FRONTAL HEAD DROP TEST (572.152) (12-MONTH-OLD)

Dummy Serial Number \_\_\_\_\_

Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

1. It has been at least 2 hours since the last frontal head drop and at least 30 minutes since the last rear head drop. (572.152(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
3. Accelerometers and their respective mounts are smooth and clean.
4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
5. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.152(c)(1))
- Record the maximum temperature \_\_\_\_\_
- Record the minimum temperature \_\_\_\_\_
- Record the maximum humidity \_\_\_\_\_
- Record the minimum humidity \_\_\_\_\_
6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- \_\_8. Suspend and orient the head assembly as shown in Figure 5E. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.152(c)(3)(i))  
Record the actual distance \_\_\_\_\_

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- \_\_9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistant within 2 mm from the impact surface. (572.152(c)(3)(i))  
Record the right side distance \_\_\_\_\_  
Record the left side distance \_\_\_\_\_
- \_\_10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is  $45 \pm 1$  degrees. (572.152(c)(3)(i))  
Record the angle \_\_\_\_\_
- \_\_11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.152(c)(4))  
Record actual micro finish \_\_\_\_\_
- \_\_12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))  
Record thickness \_\_\_\_\_  
Record width \_\_\_\_\_  
Record length \_\_\_\_\_
- \_\_13. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b) & (572.152(c)(4))
- \_\_14. Complete the following table. (572.152(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $100 \text{ g} \leq x \leq 120 \text{ g}$        |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 17% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq \pm 15 \text{ g}$      |        |

- \_\_15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

# FRONTAL HEAD DROP TEST SET-UP SPECIFICATIONS

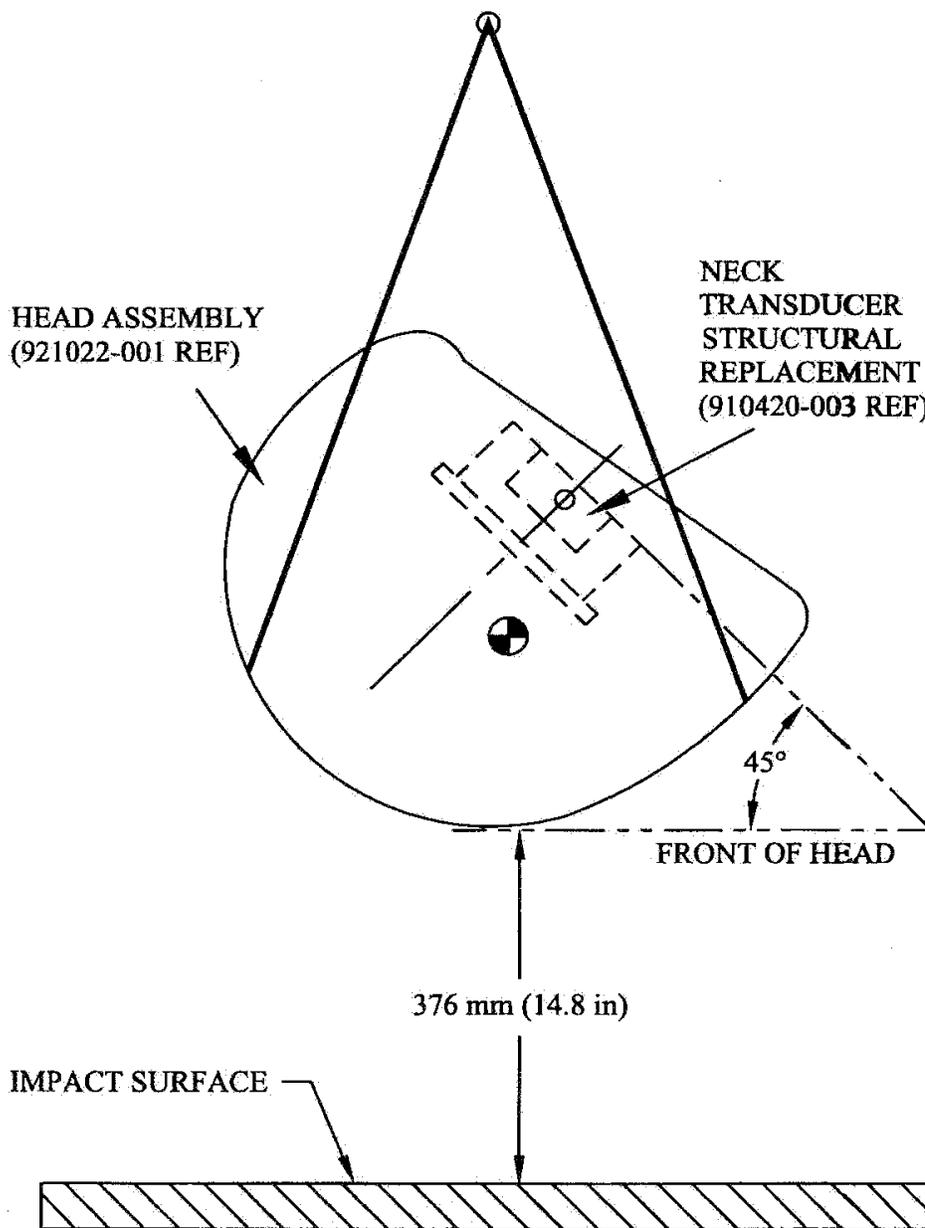


FIGURE 5E

**DATA SHEET E4**  
**REAR HEAD DROP TEST (572.152) (12-MONTH-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive head drops are necessary)

1. It has been at least 2 hours since the last rear head drop and at least 30 minutes since the last frontal head drop. (572.152(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
3. Accelerometers and their respective mounts are smooth and clean.
4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
5. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.152(c)(1))
- Record the maximum temperature \_\_\_\_\_
- Record the minimum temperature \_\_\_\_\_
- Record the maximum humidity \_\_\_\_\_
- Record the minimum humidity \_\_\_\_\_
6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted 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.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- \_\_8. Suspend and orient the head assembly as shown in Figure 6E. The lowest point on the back of the head is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.152(c)(3)(ii))

Record the actual distance \_\_\_\_\_

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- \_\_9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.152(c)(3)(ii))

Record the right side distance \_\_\_\_\_

Record the left side distance \_\_\_\_\_

- \_\_10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is  $90 \pm 1$  degrees. (572.152(c)(3)(ii))

Record the angle \_\_\_\_\_

- \_\_11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.152(c)(4))

Record actual micro finish \_\_\_\_\_

- \_\_12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))

Record thickness \_\_\_\_\_

Record width \_\_\_\_\_

Record length \_\_\_\_\_

- \_\_13. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b) & (572.152(c)(4))

- \_\_14. Complete the following table. (572.152(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--|--------|
| Peak resultant acceleration         | $55 \text{ g} \leq x \leq 71 \text{ g}$          |        |
| Resultant versus time history curve | Unimodal   |        |
| Oscillations after the main pulse   | Less than 17% of the peak resultant acceleration |        |
| Lateral acceleration                | y-axis acceleration $\leq \pm 15 \text{ g}$      |        |

- \_\_15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

# REAR HEAD DROP TEST SET-UP SPECIFICATIONS

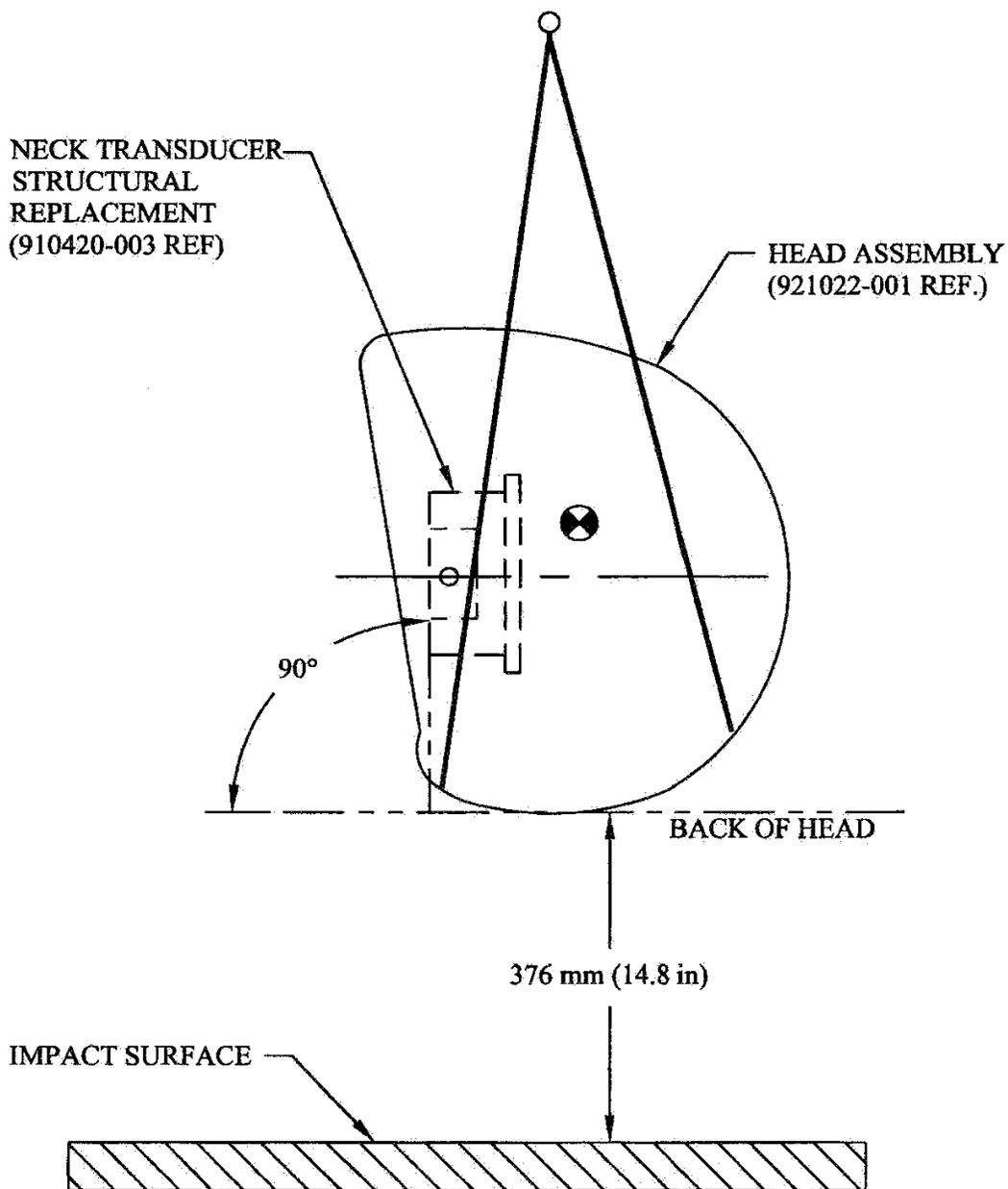


FIGURE 6E

**DATA SHEET E5**  
NECK FLEXION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

1. It has been at least 30 minutes since the last neck test. (572.155(m))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
8. The test fixture pendulum conforms to the specifications in Figure 7E.
9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 8E for the flexion test. (572.153(c)(3))
10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
11. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.

- \_\_12. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- \_\_13. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.1 m/s to 5.3 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- \_\_14. Complete the following table:

Neck Flexion Test Results (572.143(b)(1) &amp; (572.153(c)(4)(ii))

| Parameter  | Specification   | Result                               |
|--|---|--------------------------------------|
| Pendulum impact speed                                  | 5.1 m/s $\leq$ speed $\leq$ 5.3 m/s   |                                      |
| Pendulum<br>$\Delta V$ with respect<br>to impact speed | @ 10ms  | 1.6 m/s $\leq \Delta V \leq$ 2.3 m/s |
|  | @ 20 ms   | 3.4 m/s $\leq \Delta V \leq$ 4.2 m/s |
|  | @25ms   | 4.3 m/s $\leq \Delta V \leq$ 5.2 m/s |
| Plane D Rotation                                       | Peak moment*<br>36 Nm $\leq$ moment $\leq$ 45 Nm during the<br>following rotation range $75^\circ \leq$ angle $\leq$ $86^\circ$ | ____Nm @<br>____degrees              |
| Positive Moment Decay**<br>(Flexion)                   | Time to decay to 5Nm<br>60 ms $\leq$ time $\leq$ 80ms   |                                      |

\*Moment about the occipital condyle =  $M_y - (0.005842 \text{ m} \times F_x)$  (572.153(b)(1)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.153(c)(4)(i))

- \_\_15. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**DATA SHEET E6**  
NECK EXTENSION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive flexion tests are necessary)

1. It has been at least 30 minutes since the last neck test. (572.155(m))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
 Record findings and actions: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
8. The test fixture pendulum conforms to the specifications in Figure 7E.
9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9E for the flexion test. (572.153(c)(3))
10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
11. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.

- \_\_12. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- \_\_13. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 2.4 m/s to 2.6 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- \_\_14. Complete the following table:

Neck Extension Results (572.143(b)(1) &amp; (572.153(c)(4)(ii))

| Parameter  | Specification  | Result   |
|--|--|--|
| Pendulum impact speed                                  | $2.4 \text{ m/s} \leq \text{speed} \leq 2.6 \text{ m/s}$   |  |
| Pendulum<br>$\Delta V$ with respect<br>to impact speed | @ 6 ms   | $0.8 \text{ m/s} \leq \Delta V \leq 1.2 \text{ m/s}$ |
|  | @ 10 ms  | $1.5 \text{ m/s} \leq \Delta V \leq 2.1 \text{ m/s}$ |
|  | @ 14 ms  | $2.2 \text{ m/s} \leq \Delta V \leq 2.9 \text{ m/s}$ |
| Plane D Rotation                                       | Peak moment*<br>-12 Nm $\leq$ moment $\leq$ -23 Nm during the<br>following rotation range $80^\circ \leq \text{angle} \leq 92^\circ$ | ___Nm @<br>___degrees                                |
| Negative Moment Decay**<br>(Extension)                 | Time to decay to -5Nm<br>$76 \text{ ms} \leq \text{time} \leq 90 \text{ ms}$   |  |

\*Moment about the occipital condyle =  $M_y - (0.005842 \text{ m} \times F_x)$  (572.153(b)(2)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.153(c)(4)(i))

- \_\_15. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## PENDULUM SPECIFICATIONS

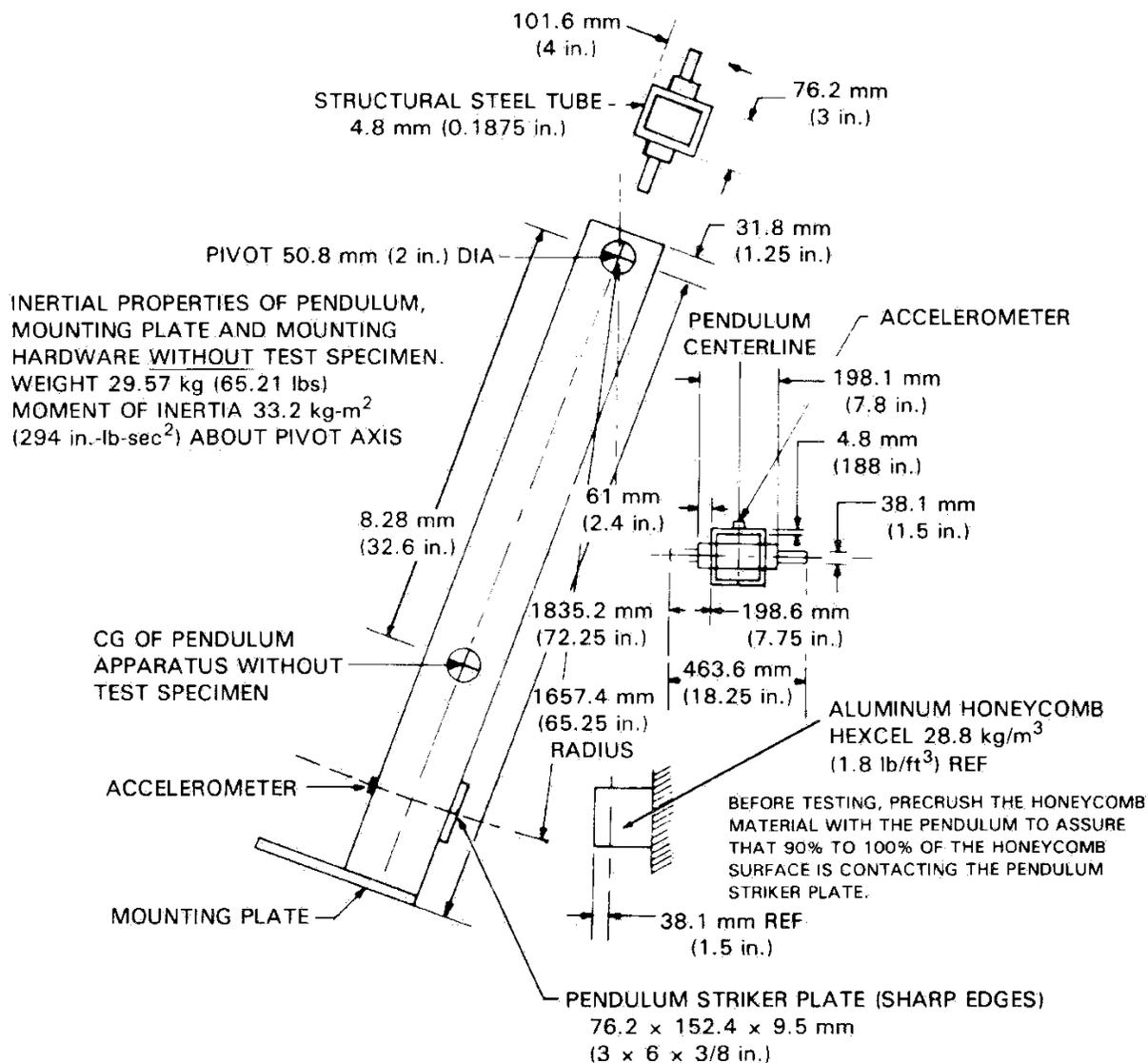
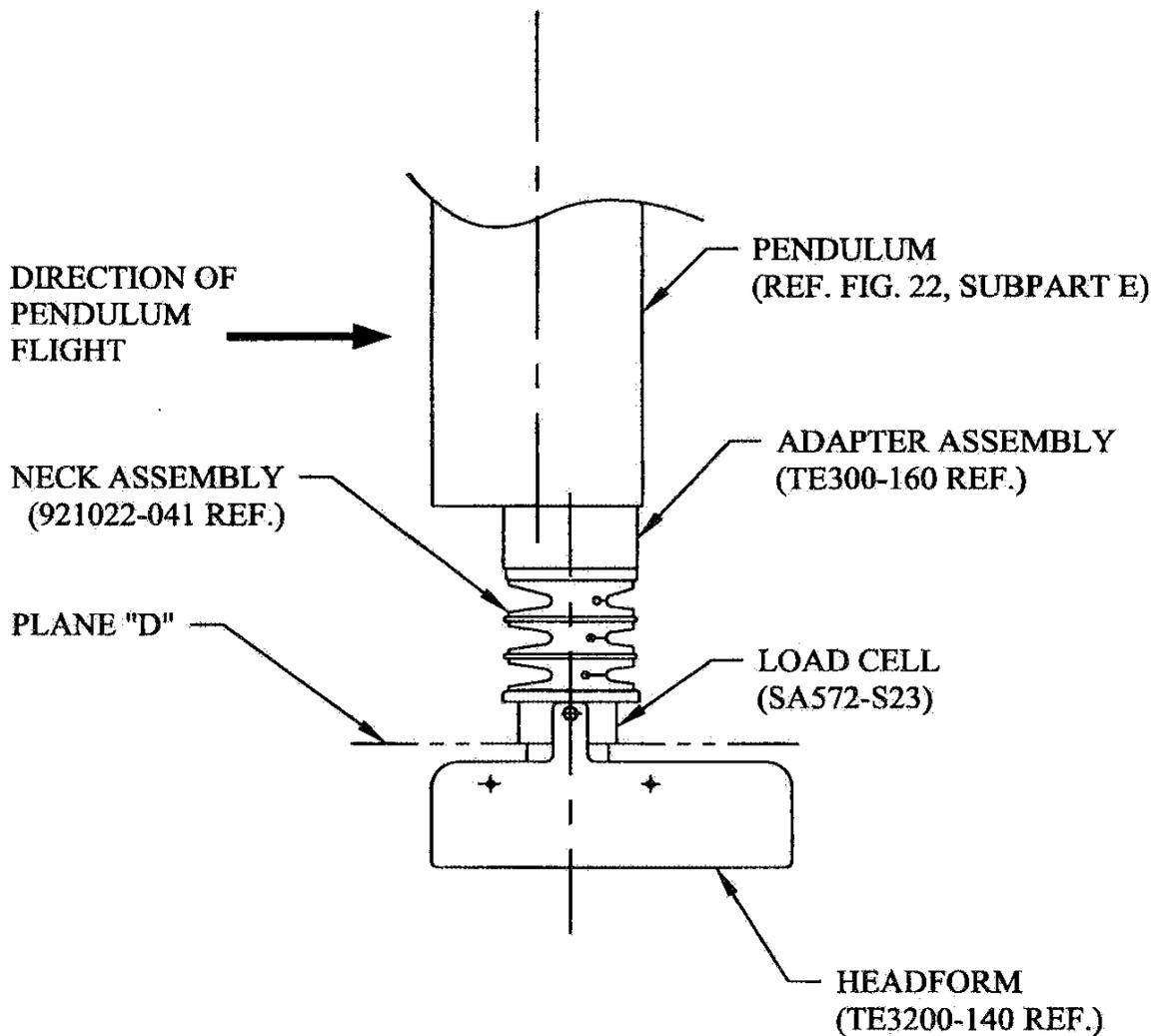


FIGURE 7E

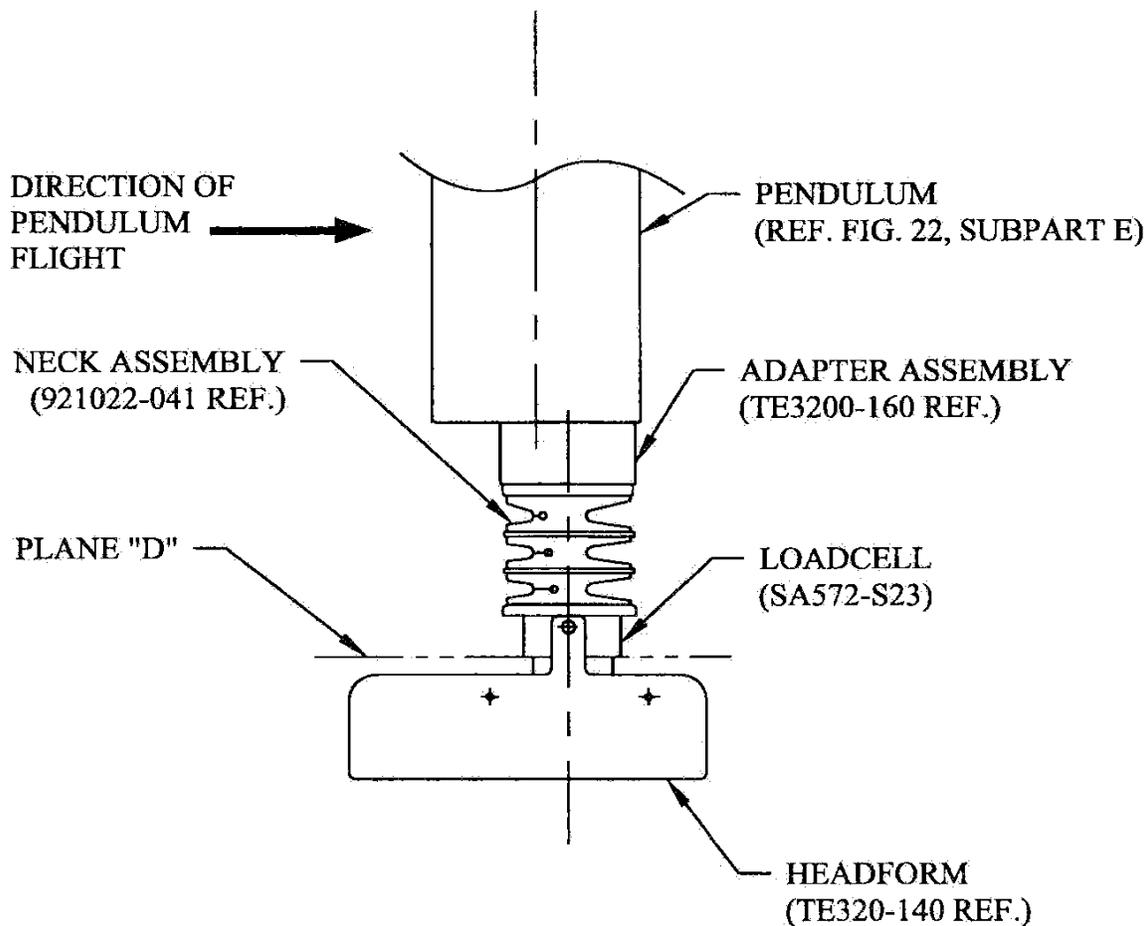
## NECK FLEXION TEST SET-UP SPECIFICATIONS



NOTE: MOUNT NECK AT LEADING EDGE OF PENDULUM TO  
AVOID INTERFERENCE.

FIGURE 8E

## NECK EXTENSION TEST SET-UP SPECIFICATIONS



NOTE: MOUNT NECK AT LEADING EDGE OF PENDULUM TO  
AVOID INTERFERENCE.

FIGURE 9E

**DATA SHEET E7**  
**THORAX IMPACT TEST (572.154) (12-MONTH-OLD)**

Dummy Serial Number \_\_\_\_\_ Test Date \_\_\_\_\_

Technician \_\_\_\_\_

Pretest calibration

Post test calibration verification

Test attempt no. \_\_\_\_ (when successive thorax impact tests are necessary)

1. It has been at least 30 minutes since the last thorax impact test. (572.155(m))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 10E.
3. The complete assembled dummy (921022-000) is used (572.154(b)) and is dressed in cotton-polyester-based tight-fitting long-sleeved sweat shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.154(c)(2))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.154(c)(1))  
 Record the maximum temperature \_\_\_\_\_  
 Record the minimum temperature \_\_\_\_\_  
 Record the maximum humidity \_\_\_\_\_  
 Record the minimum humidity \_\_\_\_\_
5. Seat the dummy, without back support on the test fixture surface as shown in Figure 10E. The legs are extended forward, parallel to the midsagittal plane. The surface must be long enough to support the pelvis and outstretched legs. (572.154(c)(3))
6. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.154(c)(3))
7. The posterior surface of the upper spine box is  $90^\circ \pm 1^\circ$  from the horizontal. Shim material may be used under the upper legs to maintain the dummy's specified spine box surface alignment. (572.154(c)(3))
8. Place the upper arms parallel to the torso. Place the lower arms  $0^\circ$  to  $5^\circ$  forward of vertical. (572.154(c)(3))
9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane,  $196 \pm 2.5$  mm vertically from the plane of the seating surface and is within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.154(c)(4))
10. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(1)).
11. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.154(c)(5)) The velocity of the test probe at the time of impact is between 4.9 m/s and 5.1 m/s. (572.154(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.154(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.154(c)(7))

\_\_12. Complete the following table:

Thorax Impact Results (572.154(b))

| Parameter*       | Specification   | Result |
|------------------|---|--------|
| Test Probe Speed | $4.9 \text{ m/s} \leq \text{speed} \leq 5.1 \text{ m/s}$    |        |
| Peak force**     | $1514 \text{ N} \leq \text{peak force} \leq 1796 \text{ N}$ |        |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

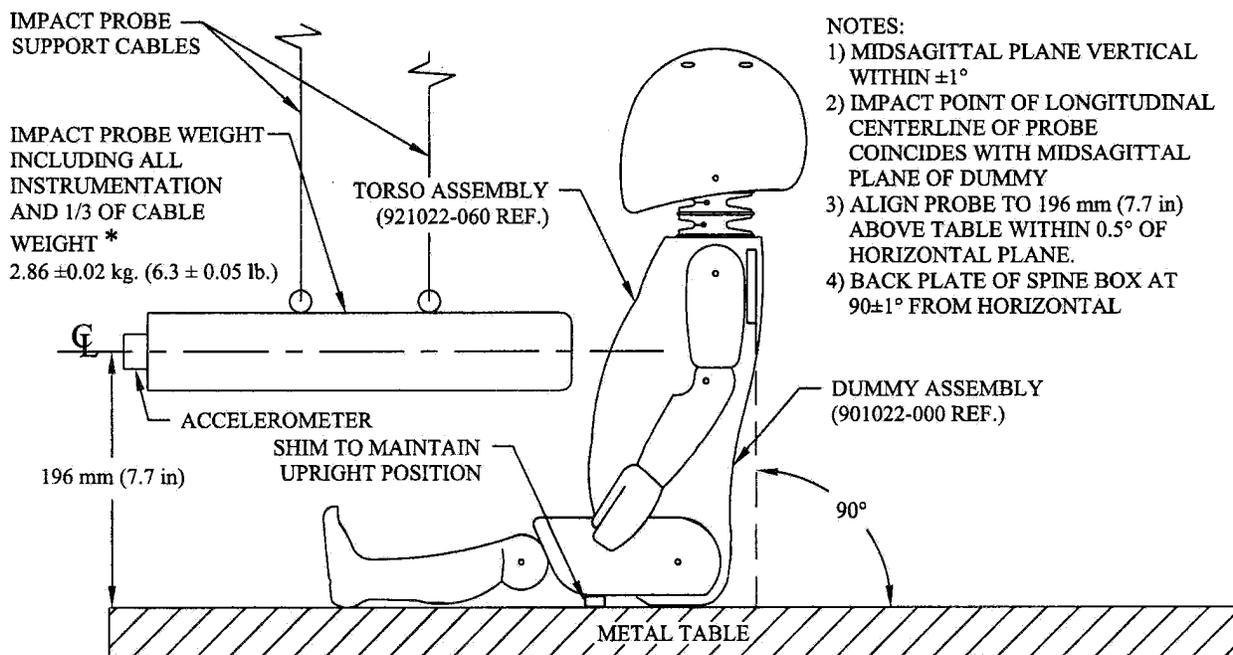
\*\*Force = impactor mass x acceleration (572.144(b)(3))

\_\_13. Plots of pendulum acceleration, and pendulum force, follow this sheet.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### THORAX IMPACT TEST SET-UP SPECIFICATIONS



**NOTES:**

- 1) MIDSAGITTAL PLANE VERTICAL WITHIN  $\pm 1^\circ$
- 2) IMPACT POINT OF LONGITUDINAL CENTERLINE OF PROBE COINCIDES WITH MIDSAGITTAL PLANE OF DUMMY
- 3) ALIGN PROBE TO 196 mm (7.7 in) ABOVE TABLE WITHIN  $0.5^\circ$  OF HORIZONTAL PLANE.
- 4) BACK PLATE OF SPINE BOX AT  $90 \pm 1^\circ$  FROM HORIZONTAL

\* 1/3 OF CABLE WEIGHT NOT TO EXCEED 5% OF THE TOTAL IMPACT PROBE WEIGHT.

**Probe specifications:**

1. Rigid metallic construction and concentric about its longitudinal axis.
2. A mass of  $2.86 \pm 0.02$  kg ( $6.3 \pm 0.05$  lbs). 1/3 of the weight of the suspension cables and their attachments to the impact probe are included in the calculation of mass, and such components may not exceed 5 percent of the total weight of the test probe.
3. Minimum mass moment of inertia of  $164$  kg-cm<sup>2</sup> ( $0.145$  lbs-in-sec<sup>2</sup>) in yaw and pitch about the center of gravity.
4. The impacting end of the probe is perpendicular to and concentric with the longitudinal axis. It has a flat, continuous, and non-deformable face with diameter of  $101.6 \pm 0.25$  mm ( $4.00 \pm 0.01$  in) and a edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in.).
5. A 101-103 mm (4.0-4.1 in) diameter cylinder surface extends at least 12.5 mm to the rear of the impact face.
6. 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 axis of the probe.
7. The impact probe shall have a free air resonant frequency of not less than 1000 Hz in line with the longitudinal axis of the impactor.

*FIGURE 10E*

**DATA SHEET E8**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

| I.D. NO.                              | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|-----------|------------|--------------------------|--------------------------|
| <b>DUMMY INSTRUMENTATION</b>          |              |           |            |                          |                          |
| <b>HEAD ACCELEROMETERS</b>            |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| NECK TRANSDUCER                       |              |           |            |                          |                          |
| <b>CHEST ACCELEROMETERS</b>           |              |           |            |                          |                          |
| (1) LONGITUDINAL                      |              |           |            |                          |                          |
| (2) LATERAL                           |              |           |            |                          |                          |
| (3) VERTICAL                          |              |           |            |                          |                          |
| CHEST POTENTIOMETER                   |              |           |            |                          |                          |
| <b>FEMUR LOAD CELLS</b>               |              |           |            |                          |                          |
| (1) RIGHT FEMUR                       |              |           |            |                          |                          |
| (2) LEFT FEMUR                        |              |           |            |                          |                          |
| <b>LABORATORY INSTRUMENTATION</b>     |              |           |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| THORAX PENDULUM ACCELEROMETER         |              |           |            |                          |                          |
| KNEE PENDULUM ACCELEROMETER           |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) |              |           |            |                          |                          |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) |              |           |            |                          |                          |

LABORATORY TECHNICIAN: \_\_\_\_\_

## **APPENDIX F**

### **DRIVER AND PASSENGER DUMMY SEATING & POSITIONING PROCEDURES**

**DATA SHEET 1**  
**Seating and Dummy Positioning Procedures for the 50<sup>th</sup> Male Driver Dummy**  
**(Part 572, Subpart E, all section references refer to FMVSS No. 208)**

1. Position the seat's adjustable lumbar supports so that the lumbar support is in its lowest, retracted or deflated adjustment position. (S8.1.3)

N/A – No lumbar adjustment

2. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. (S16.2.10.2)

N/A – No additional support adjustment

3. Use all the seat controls that have any affect on the fore-aft movement of the seat to move the seat cushion to the rearmost position. **Mark** this position. (8/31/95 legal interp to Hogan and Hartson)

4. Use all the seat controls that have any affect on the fore-aft movement of the seat to move the seat cushion to the foremost position. **Mark** this position. (8/31/95 legal interp to Hogan and Hartson)

5. **Mark** each fore-aft position so that there is a visual indication when the seat is at a particular position. For manual seats, **mark** each detent. For power seats, **mark** only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost. Determine the mid fore-aft seat position based on the foremost and rearmost positions determined in items 3 and 4. (8/31/95 legal interp to Hogan and Hartson)

6. Move the seat to the mid position.

7. While maintaining the mid position, move the seat to its lowest position. **Mark** the height position. For seats with adjustable seat cushions, use the manufacturer's recommended seat cushion angle for determining the lowest height position.

N/A- No cushion angle adjustment

Manufacturers seat cushion angle \_\_\_\_\_

Tested seat cushion angle \_\_\_\_\_

8. Visually **mark** the seat back angle, if adjustable, at the manufacturer's nominal design riding position for a **50th percentile adult male** in the manner specified by the manufacturer.

N/A – No seat back angle adjustment

Manufacturer's design seat back angle \_\_\_\_\_

Tested seat back angle \_\_\_\_\_

9. Is the seat a bucket seat?

Yes, go to 10 and skip 11

No, go to 11 and skip 10

\_\_10. Bucket seats:

Locate and **mark** the longitudinal centerline of the seat cushion. The intersection of the vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface determines the longitudinal centerline of a bucket seat cushion. (S10.4.1.2 and S16.3.1.10)

\_\_11. Bench seats:

Locate and **mark** the longitudinal line on the seat cushion that marks the intersection of the vertical longitudinal plane through the centerline of the steering wheel and the seat cushion upper surface. (S10.4.1.1)

\_\_12. If adjustable, set the head restraint at the full up position. (S8.1.3) If there are adjustments other than vertical, adjust them as recommended by the manufacturer.

\_\_N/A – No head restraint adjustment

\_\_13. Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant (S8.1.3)

\_\_N/A – No adjustable upper seat belt anchorage

Manufacturer's specified anchorage position. \_\_\_\_\_

Tested anchorage position \_\_\_\_\_

\_\_14. Place adjustable pedals in the full forward position.

\_\_N/A – the pedals are not adjustable.

\_\_15. Is the steering wheel adjustable up and down and/or in and out?

\_\_Yes – go to 16

\_\_No – go to 19

\_\_16. Find and **mark** 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.

\_\_N/A – steering wheel is not adjustable up and down

\_\_17. Find and **mark** 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.

\_\_N/A – steering wheel is not adjustable in and out.

\_\_18. Set the steering wheel hub at the geometric center of the full range of driving positions including any telescoping positions.

\_\_19. Place the dummy in the seat such that the midsagittal plane is coincident with the longitudinal seat cushion markings as determined in item 10 or 11 and the upper torso rests against the seat back. (S10.4.1.1 & S10.4.1.2)

\_\_20. Rest the thighs on the seat cushion. (S10.5)

\_\_21. Position the H-point of the dummy within 0.5 inch of the vertical dimension and 0.5 inch of the horizontal dimension of a point 0.25 inch below the H-point determined using the SAE J826 H-point machine. (S10.4.2.1) Then measure the pelvic angle with respect to the horizontal using the pelvic angle gage. Adjust the dummy position until these three measurements are within the specifications. (S10.4.2.1 and S10.4.2.2)

\_\_\_\_horizontal inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_vertical inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_pelvic angle (20° to 25°)

\_\_22. Is the head level within  $\pm 0.5^\circ$ ? (S10.1)

\_\_Yes, go to 23

\_\_No, go to 22.1

\_\_22.1 Adjust the position of the H-point. (S10.1)

\_\_22.2 Is the head level within  $\pm 0.5^\circ$ ? (S10.1)

\_\_Yes, record the following, then go to 23. \_\_No, go to 22.3

\_\_\_\_horizontal inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_vertical inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_pelvic angle (20° to 25°) (S10.4.2.2)

\_\_22.3 Adjust the pelvic angle. (S10.1)

\_\_22.4 Is the head level within  $\pm 0.5^\circ$ ? (S10.1)

\_\_Yes, record the following, then go to 23. \_\_No, go to 22.5

\_\_\_\_horizontal inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_vertical inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_pelvic angle (20° to 25°) (S10.4.2.2)

\_\_22.5 Adjust the neck bracket of the dummy the minimum amount necessary from the nonadjusted "0" setting until the head is level within  $\pm 0.5^\circ$ . (S10.1)

Record the following, then go to 23

\_\_\_\_horizontal inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_vertical inches from the point 0.25 below the determined H-point (0.5 inch max.) (S10.4.2.1)

\_\_\_\_pelvic angle (20° to 25°) (S10.4.2.2)

\_\_23. Set the distance between the outboard knee clevis flange surfaces at 10.6 inches.

\_\_\_\_measured distance (10.6 inches) (S10.5)

\_\_24. Can the right foot be placed on the accelerator?

\_\_Yes, go to 24.1 and skip 24.2

- No, go to 24.2
- 24.1. To the extent practicable keep the right thigh and the leg in a vertical plane (S10.5) while resting the foot on the undepressed accelerator pedal with the rearmost point of the heel on the floor pan in the plane of the pedal. (S10.6.1.1)
- 24.2 Initially set the foot perpendicular to the leg and then place it as far forward as possible in the direction of the pedal centerline with the rearmost point of the heel resting on the floor pan. (S10.6.1.1)
- 24.2.1 Move the adjustable pedal to its most rearward position or until the right foot is flat on the pedal, whichever occurs first. (S10.6.1.1)
  - N/A – the accelerator pedal is not adjustable
  
- 25. Does the vehicle have a foot rest?
  - Yes, go to 25.1
  - No, go to 25.2
- 25.1 With the left thigh and leg in a vertical plane, place the left foot on the foot rest with the heel resting on the floor pan. (S10.6.1.2)
- 25.1.1 Is the left foot elevated above the right foot?
  - Yes, go to 25.2 and position the foot off the foot rest
  - No, go to 26
- 25.2 Check the ONLY one of the following that applies
  - The left foot reaches the toeboard without adjusting the foot or leg. To the extent practicable keep the left thigh and the leg in a vertical longitudinal plane (S10.5) and place the foot on the toeboard, skip 25.3 (S10.6.1.2)
  - The left foot reaches the toeboard but contacts the brake or clutch pedal and must be rotated to avoid pedal contact. To the extent practicable keep the left thigh and the leg in a vertical longitudinal plane (S10.5) and place the foot on the toeboard. The foot was rotated about the leg to avoid pedal contact, skip 25.3 (S10.6.1.2)
  - The left foot reaches the toeboard but contacts the brake or clutch pedal and the foot and leg must be rotated to avoid pedal contact. To the extent practicable keep the left thigh and the leg in a vertical longitudinal plane (S10.5) and place the foot on the toeboard. The foot was rotated about the leg and the leg was rotated outboard about the hip the minimum distance necessary to avoid pedal contact, skip 12.3 (S10.6.1.2)
  - N/A – the foot does not reach the toeboard, go to 25.3
- 25.3 Check the ONLY one of the following that applies
  - The left foot did not contact the brake or clutch pedal. To the extent practicable keep the left thigh and the leg in a vertical longitudinal plane (S10.5). Set the foot perpendicular to the leg and place it as far forward as possible with the heel resting on the floor pan. (S10.6.1.2)
  - The left foot did contact the brake or clutch pedal and the foot was rotated to avoid contact. To the extent practicable keep the left thigh and the leg in a vertical longitudinal plane (S10.5). Set the foot perpendicular to the leg and place it as far forward as possible with the heel resting on the floor pan and rotate the foot the minimum amount to avoid pedal contact. (S10.6.1.2)
  - The left foot did contact the brake or clutch pedal and the foot was rotated about the leg and the leg was rotated outboard about the hip the minimum distance necessary to

avoid pedal contact. Set the foot perpendicular to the leg and place it as far forward as possible with the heel resting on the floor pan and rotate the foot about the leg and the thigh and leg outboard about the hip the minimum distance necessary to avoid pedal contact. (S10.6.1.2)

\_\_26. Place the right upper arm adjacent to the torso with the centerline as close to a vertical plane as possible. (S10.2.1)

\_\_27. Fasten the seat belt around the dummy.

\_\_27.1 Remove all slack from the lap belt portion. (S10.9)

\_\_27.2 Pull the upper torso webbing out of the retractor and allow it to retract; repeat this four times. (S10.9)

\_\_27.3 Apply a 2 to 4 pound tension load to the lap belt. (S10.9)  
\_\_\_\_pound load applied

\_\_27.4 Is the belt system equipped with a tension-relieving device?

\_\_Yes, continue

\_\_No, go to 28

\_\_27.5 Introduce the maximum amount of slack into the upper torso belt that is recommended by the vehicle manufacturer in the vehicle owner's manual. (S10.9).

\_\_28. Place the left upper arm adjacent to the torso with the centerline as close to a vertical plane as possible. (S10.2.1)

\_\_29. Place the right hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel. (S10.3.1)

\_\_30. Place the left hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel. (S10.3.1)

\_\_31. Tape the thumb of each hand to the steering wheel by using masking tape with a width of 0.25 inch. The length of the tape shall only be enough to go around the thumb and steering wheel one time.

**DATA SHEET 2**  
**Seating and Dummy Positioning Procedures for the 5<sup>th</sup> Female Passenger Dummy**  
**(Part 572, Subpart O, all section references refer to FMVSS No. 208)**

(Check this item ONLY if it applies to this vehicle.)

**\_\_ The passenger seat adjustments are controlled by the adjustments made to the driver's seat. Therefore, positioning of the passenger dummy is made simultaneously with the driver dummy. Adjustments made to the seat to position the driver will over ride any adjustments that would normally be made to position the passenger. (S16.2.10.3)**

1. Seat Position

**\_\_ 1.1** Position the seat's adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment positions. (S16.2.10.1, S20.1.9.1, S20.4.1, S22.1.7.1)

**\_\_ N/A** – No lumbar adjustment

**\_\_ 1.2** Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. (S16.2.10.2, S20.1.9.2, S20.4.1, S22.1.7.1, S22.4.2.1, S22.4.3.1, S24.4.2.1, S26.2.3, S26.3.1)

**\_\_ N/A** – No additional support adjustment

**\_\_ 1.3** Position an adjustable leg support system in its rearmost position. (8/27/04 interpretation to Toyota)

**\_\_ N/A** – No adjustable leg support system

**\_\_ 1.4 Mark** a point (seat cushion reference point) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion. (S16.3.1.12)

**\_\_ 1.5** Draw a line (seat cushion reference line) through the seat cushion reference point. (S16.3.1.13)

**\_\_ 1.6** Use only the controls that primarily move the seat in the fore-aft direction to move the seat cushion reference point to the rearmost position. (S16.2.10.3.1, S22.1.7.3)

**\_\_ 1.7** 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 seat cushion reference point to the rearmost position. (S16.2.10.3.1, S20.1.9.3)

**\_\_ N/A** – No independent fore-aft seat cushion adjustment

**\_\_ 1.8** Use any part of any control, other than the parts just used for fore-aft positioning, to determine the range of angles of the seat cushion reference line and to set the seat cushion reference line at the mid-angle. (S16.2.10.3.1)

Maximum angle \_\_\_\_\_

Minimum angle \_\_\_\_\_

Mid-angle \_\_\_\_\_

**\_\_ 1.9** If the seat and/or seat cushion height is adjustable, use any part of any control other than the parts which primarily move the seat or seat cushion fore-aft, to put the seat cushion reference point in its lowest position with the seat cushion reference line angle at the mid-angle found in 1.8. (S16.2.10.3.1)

**\_\_ N/A** – No seat height adjustment

**\_\_ 1.10** Use only the controls that primarily move the seat in the fore-aft direction to verify the seat is in the rearmost position.

**\_\_ 1.11** Use only the controls that primarily move the seat in the fore-aft direction to **mark** the

fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats, **mark** only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.

\_\_1.12 Use only the controls that primarily move the seat in the fore-aft direction to place the seat in the rearmost position.

\_\_1.13 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find and visually **mark** the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.8. (S20.1.9.4, S22.1.2, S22.1.7.4, S22.3.1, S22.4.3.1, S24.1.2, S24.3.1, S24.4.3.1, S26.2.3, S26.3.1)

\_\_N/A – No seat height adjustment. Go to 1.18

\_\_1.14 Use only the controls that primarily move the seat and/or seat cushion in the fore-aft direction to place the seat in the mid-fore-aft position.

\_\_1.15 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find and visually **mark** the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.8. (S20.1.9.4, S22.1.2, S22.1.7.4, S22.3.1, S24.1.2, S24.3.1)

\_\_1.16 Use only the controls that change the seat in the fore-aft direction to place the seat in the foremost position. (S16.2.10.3.2)

\_\_1.17 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find and visually **mark** the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.8. (S16.2.10.3.3, S20.1.9.4, S22.1.2, S22.1.7.4, S22.3.1, S24.1.2, S24.3.1)

\_\_1.18. Is the seat a bucket seat?

\_\_Yes, go to 1.19 and skip 1.20

\_\_No, go to 1.20 and skip 1.19

\_\_1.19 Bucket seats:

Locate and **mark** for future reference the longitudinal centerline of the seat cushion. The intersection of the vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface determines the longitudinal centerline of a bucket seat cushion. (S16.3.1.10 & S20.1.10)

\_\_1.20 Bench seats:

Locate and **mark** the longitudinal centerline of the passenger seat cushion. The longitudinal centerline is the same distance from the longitudinal centerline of the vehicle as the center of the steering wheel. (S20.2.1.4, S22.2.1.3, S24.2.3, S20.4.4, S22.2.2.1(b), S22.2.2.3(b), S22.2.2.4(a), S22.2.2.5(a), S22.2.2.6(a), S22.2.2.7(a), S24.2.3(a))

Record the distance from the longitudinal centerline of the vehicle to the center of the steering wheel. \_\_\_\_\_

Record the distance from the longitudinal centerline of the vehicle to the longitudinal centerline of the seat cushion.) \_\_\_\_\_

## 2. Head Restraint Position

N/A Vehicle contains automatic head restraints.

N/A, there is no head restraint adjustment Go to 3

2.1 Adjust the head restraint to its lowest position. (S16.2.10.2, S20.1.9.6 S20.4.1, S22.1.7.6, S22.4.2.1, S22.4.3.1, S24.4.3.1, S26.2.3, S26.3.1)

2.2 All adjustments of the head restraint shall be used to position it full forward. For example, if it rotates, rotate it such that the head restraint extends as far forward as possible. **Mark** the foremost position. (S16.2.10.2 & S16.3.4.4 & S20.1.9.6, S20.4.1, S22.4.2.1, S22.4.3.1, S24.4.3.1, S26.2.3, S26.3.1)

2.3 Measure the vertical distance from the top most point of the head restraint to the bottom most point. Locate and **mark** a horizontal plane through the midpoint of this distance. (S16.3.4.3)

Vertical height of head restraint \_\_\_\_\_ mm

Mid-point height \_\_\_\_\_ mm

3. Place the SCRP in the full rearward, mid-height position, and mid-seat cushion angle. (S16.3.3.1.1)

4. Fully recline the seat back. (S16.3.3.1.2)

N/A seat back not adjustable.

5. Place the dummy in the seat with the legs at an angle of 120 degrees to the thighs. The calves should not be touching the seat cushion. (S16.3.3.1.2)

6. Position the dummy in the seat such that the midsagittal plane is coincident with the longitudinal seat cushion marking that was determined in item 1.19 or 1.20. (S16.3.3.1.3 and S16.3.3.1.4)

7. Hold down the dummy's thighs and push rearward on the upper torso to maximize the pelvic angle. (S16.3.3.1.5)

8. Set the angle between the legs and the thighs to 120 degrees. (S16.3.3.1.6)

9. Set the transverse distance between the centers of the front of the knees at 160 to 170 mm. (6.3 to 6.7 inches). Center the knee separation with respect to the longitudinal seat cushion marking that was determined item 1.19 or 1.20. (S16.3.3.1.6)

Record Knee Separation \_\_\_\_\_

10. Push rearward on the dummy's knees until the pelvis contacts the seat back, or the backs of the calves contact the seat cushion, whichever occurs first. (S16.3.3.1.6)

Pelvis contacted seat back.

Calves contacted seat cushion.

11. Gently rock the upper torso  $\pm 5$  degrees (approximately 51 mm (2 inches)) side-to-side three times. (S16.3.3.1.7)

12. If needed, extend the legs until the feet do not contact the floor pan. The thighs should

be resting on the seat cushion. (S16.3.3.1.8)

13. Use seat controls to line up the seat markings determined during the completion of item 1 to set the foremost fore-aft position, mid-height position and the seat cushion mid-angle. If the dummy contacts the interior move the seat rearward until a maximum clearance of 5 mm (0.2 inches) is achieved or the seat is in the closest detent position that does not cause dummy contact. (S16.3.3.1.8)

Foremost, mid-height position and the seat cushion mid-angle reached

Dummy contact. Clearance set at maximum of 5mm

Measured Clearance \_\_\_\_\_

Dummy Contact. Seat set at nearest detent position.

Seat position \_\_\_\_ detent positions rearward of foremost (foremost is position zero)

14. If the seat back is adjustable, rotate the seat back forward while holding the thighs in place. Continue rotating the seat back forward until the transverse instrument platform of the dummy head is level  $\pm 0.5$  degrees. If head cannot be leveled using the seat back adjustment, or the seat back is not adjustable, use the lower neck bracket adjustment to level the head. If a level position cannot be achieved, adjust the head as closely as possible to the  $\pm 0.5$  degree range. (S16.3.3.1.9 and S16.3.3.1.10)

(Check All That Apply)

Seat back not adjustable

Seat back not independent of driver side seat back

Head Level Achieved. (Check all that apply)

Head leveled using the adjustable seat back

Head leveled using the neck bracket.

Head Angle \_\_\_\_\_ degrees

Head Level NOT Achieved. (Check all that apply)

Head adjusted using the adjustable seat back

Head adjusted using the neck bracket.

Head Angle \_\_\_\_\_ degrees

15. Verify the pelvis is not interfering with the seat bight. (S16.3.3.1.9)

No interference

Pelvis moved forward the minimum amount so that it is not caught in the seat bight.

16. Verify the dummy abdomen is properly installed. (S16.3.3.1.9)

Abdomen still seated properly into dummy

Abdomen was adjusted because it was not seated properly into dummy

17. Head Angle

N/A, neither the pelvis nor the abdomen were adjusted.

17.1 Head still level (Go to 16)

17.2 Head level adjusted

Head Level Achieved. (Check all that apply)

Head leveled using the adjustable seat back

Head leveled using the neck bracket.

Head Angle \_\_\_\_\_ degrees

Head Level NOT Achieved. (Check all that apply)

Head adjusted using the adjustable seat back

Head adjusted using the neck bracket.

Head Angle \_\_\_\_\_ degrees

18. Measure and set the pelvic angle using the pelvic angle gage TE-2504. The pelvic angle should be 20.0 degrees  $\pm$  2.5 degrees. If the pelvic angle cannot be set to the specified range because the head will not be level or because the dummy will have need major repositioning, adjust the pelvis as closely as possible to the angle range, but keep the head level.

Pelvic angle set to 20.0 degrees  $\pm$  2.5 degrees.

Pelvic angle of 20.0 degrees not achieved, the angular difference was minimized.

Record the pelvic angle. \_\_\_\_\_ degrees

19. Check the dummy for contact with the interior after completing adjustments.

No contact.

Dummy in contact with interior.

Seat moved aft \_\_\_\_\_ mm from the previous position.

Seat moved aft \_\_\_\_\_ detent positions from the previous position.

20. Verify the transverse instrument platform of the dummy head is level  $\pm$  0.5 degrees. Use the lower neck bracket adjustment to level the head. If a level position cannot be achieved, minimize the angle. (S16.3.3.1.9, S16.3.3.1.10, and S16.3.3.1.11)

Head Level Achieved

Head Angle \_\_\_\_\_ degrees

Head Level NOT Achieved.

Head Angle \_\_\_\_\_ degrees

21. Check the dummy to see if additional interior clearance is obtained, allowing the seat to be moved forward. (S16.3.3.1.12)

N/A Bench Seat

N/A Seat already at full forward position.

Clearance unchanged. No adjustments required.

Additional clearance available

Seat moved Forward \_\_\_\_\_ mm from the previous position.

Seat moved Forward \_\_\_\_\_ detent positions from the previous position.

Seat moved Forward, Full Forward position reached.

22. Passenger foot positioning. (Indicate final position achieved) (S16.3.3.2)

22.1 Place feet flat on the toe board; OR (S16.3.3.2.1)

22.2 If the feet cannot be placed flat on the toe board, set the feet perpendicular to the lower leg, and rest the heel as far forward on the floor pan as possible; OR (S16.3.3.2.2)

22.3 If the heels do not touch the floor pan, set the legs as perpendicular to the thighs as possible and set the feet parallel to the floor pan. (S16.3.3.2.2)

\_\_23. Passenger arm/hand positioning. (S16.3.3.3)

\_\_23.1 Place the dummy's upper arms adjacent to the torso with the arm centerlines as close to a vertical longitudinal plane as possible. (S16.3.3.3.1)

\_\_23.2 Place the palms of the dummy in contact with the outer part of the thighs (S16.3.3.3.2)

\_\_23.3 Place the little fingers in contact with the seat cushion. (S16.3.3.3.3)

\_\_24. Adjustable head restraints (S16.3.4)

\_\_N/A, there is no head restraint adjustment

\_\_24.1 If the head restraint has an automatic adjustment, leave it where the system positions the restraint after the dummy is placed in the seat. (S16.3.4.1) Go to 25.

\_\_24.2 Adjust each head restraint vertically so that the horizontal plane determined in item 2 is aligned with the center of gravity (CG) of the dummy head. (S16.3.4.3)

\_\_24.3 If the above position is not attainable, move the vertical center of the head restraint to the closest detent below the center of the head CG. (S16.3.4.3)

\_\_N/A midpoint position attained in previous step

\_\_Headrest set at nearest detent below the head CG

\_\_24.4 If the head restraint has a fore and aft adjustment, place the restraint in the foremost position or until contact with the head is made, whichever occurs first. (S16.3.4.4)

\_\_25. Manual belt adjustment (for tests conducted with a belted dummy) S16.3.5

\_\_N/A, Unbelted test

\_\_25.1 If an adjustable seat belt D-ring anchorage exists, place it in the manufacturer's design position for a 5th percentile adult female. **This information will be supplied by the COTR.** (S16.3.5.1)

Manufacturer's specified position \_\_\_\_\_

\_\_25.2 Place the Type 2 manual belt around the test dummy and fasten the latch. (S16.3.5.2)

\_\_25.3 Ensure that the dummy's head remains as level as possible. (S16.3.5.3)

\_\_25.4 Remove all slack from the lap belt. 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 belt system is equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor. (S16.3.5.4)

**APPENDIX G**  
**REDUNDANT ACCELEROMETERS –**  
**RECOMMENDED PRACTICE**

**APPENDIX G**  
**REDUNDANT HEAD, CHEST, AND FEMUR ACCELEROMETERS-**  
**(RECOMMENDED PRACTICE)**

The following guideline is intended to serve as an interim measure for use in affixing the redundant accelerometers in the head, chest, and femurs of the Hybrid III dummies. Standard procedures for obtaining redundant data are currently being developed. The contractor is expected to closely follow this guideline until such standard procedures are available. Contact the COTR if difficulty arises in meeting the guideline, or more details are needed.

1. The locations of the primary accelerometers, (head, chest, or femur) as specified in the test procedure, shall not be altered as a result of installing the redundant accelerometer set. In addition, the center of gravity (C.G.) of the head, chest, or femur with the redundant accelerometers installed shall stay within the allowable range as indicated in the Hybrid III specification.
2. The weight increase due to installation of the redundant accelerometers in the head, chest, or femur shall be within the allowable weight variation specified for these body regions in the Hybrid III drawing documentation.
3. To simplify and facilitate the installation, the following recommendations are provided:
  - A. Use of SAE572-S4 accelerometers and existing mounting fixtures is desirable because of their light weight.
  - B. Redundant SAE572-S4 accelerometers can be attached directly to the primary one, either head-to-head or back-to-back, and then attach both to one side of the mounting cube.
  - C. Use of spacers between the primary and redundant accelerometers is recommended for better stability. Spacers shall be made of aluminum due to weight considerations.
4. The injury criterion values (HIC, Chest Clip, and Femur Loads) generated by using the redundant data sets shall not deviate more than ten (10) percent from their respective primary injury criterion values.

## **APPENDIX H**

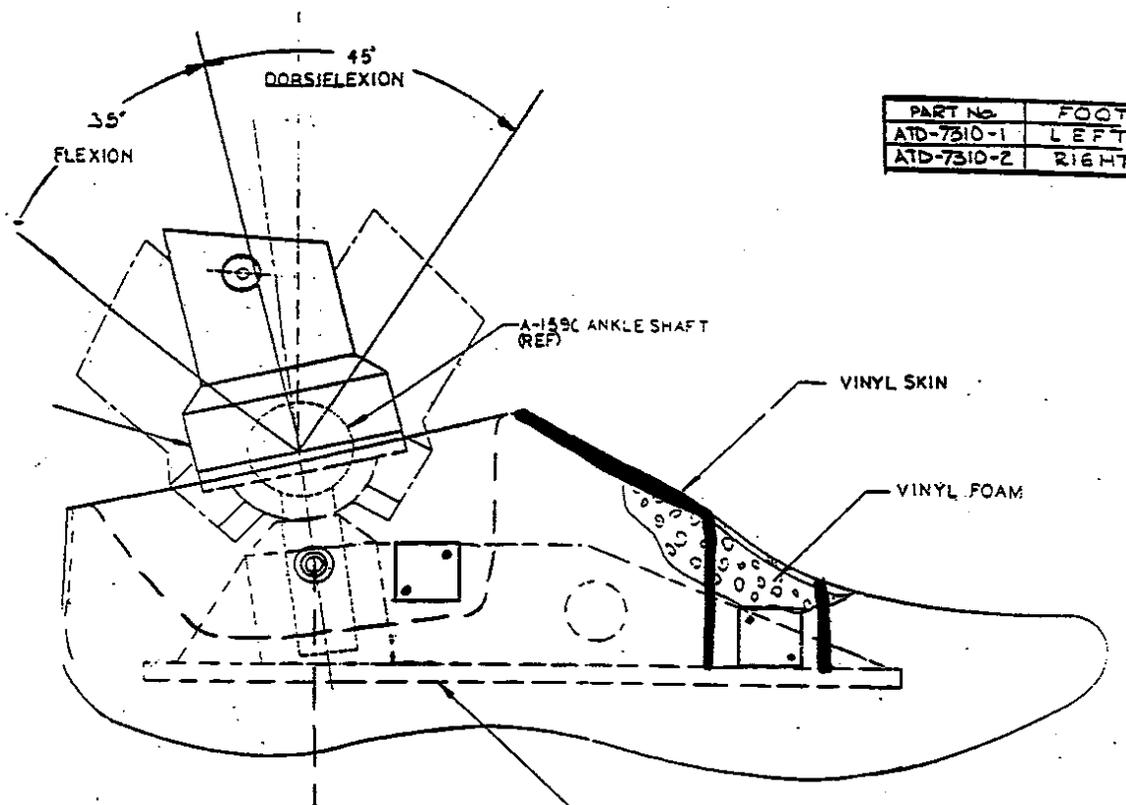
### **FOOT INSTRUMENTATION – RECOMMENDED PRACTICE**

## **APPENDIX H**

### **RECOMMEND PRACTICE - HYBRID III FOOT INSTRUMENTATION**

The Hybrid III Driver and Passenger feet are instrumented to measure acceleration in the X, Y, and Z axis for both the outboard ankle and toe regions as shown in the following diagrams. A tri-axial cube with SAE572-S4 accelerometers is used. The design is easily adapted to the proposed 45-degree ankle.

Easily Adapted to Proposed 45 degree ankle



| PART NO.   | FOOT  |
|------------|-------|
| ATD-7310-1 | LEFT  |
| ATD-7310-2 | RIGHT |

Right shown, ATD-7310-1 (Left) opposite.  
Foam per Dwg. 78051-373.

Skin.  
Model 78051-284(L) & -285 (R) within ± 0.02 in.

| QTY  | PROD     | PART OR              |
|--|----------|----------------------|
| REQD   | NO.      | IDENTIFYING NO.      |
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES |          |                      |
| TOLERANCES ARE:  |          |                      |
| FRACTIONS  | DECIMALS | ANGLES               |
| ± 1/16   | ± .005   | ± .1                 |
| MATERIAL   |          | CONTRACT NO.         |
| HYB III  |          | SEE NOTE             |
| TEST AND   | MADE ON  | APPROVAL             |
| APPLICATION  |          | DO NOT SCALE DRAWING |
|  |          | DATE: TREMAN M.      |
|  |          | DRAWN: J. SHOCKA     |
|  |          | CHECKED:             |

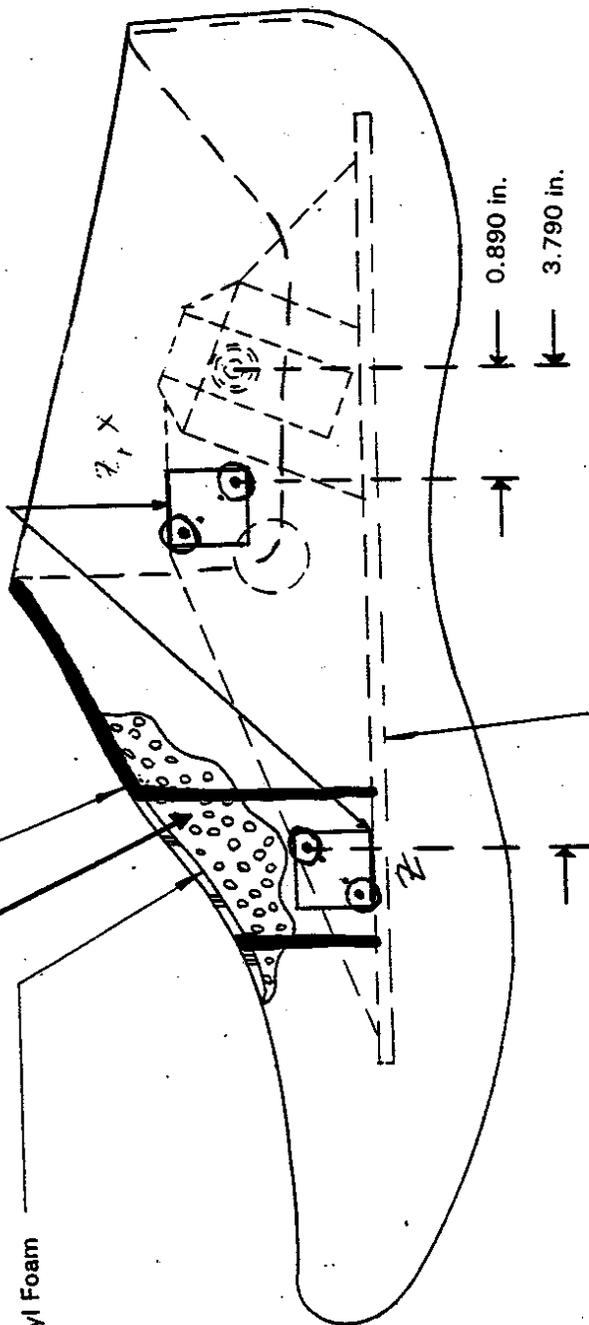
-78051-286  
STRUCTURAL  
ASS'Y

Remove material as  
needed to mount  
cube and route  
cable.

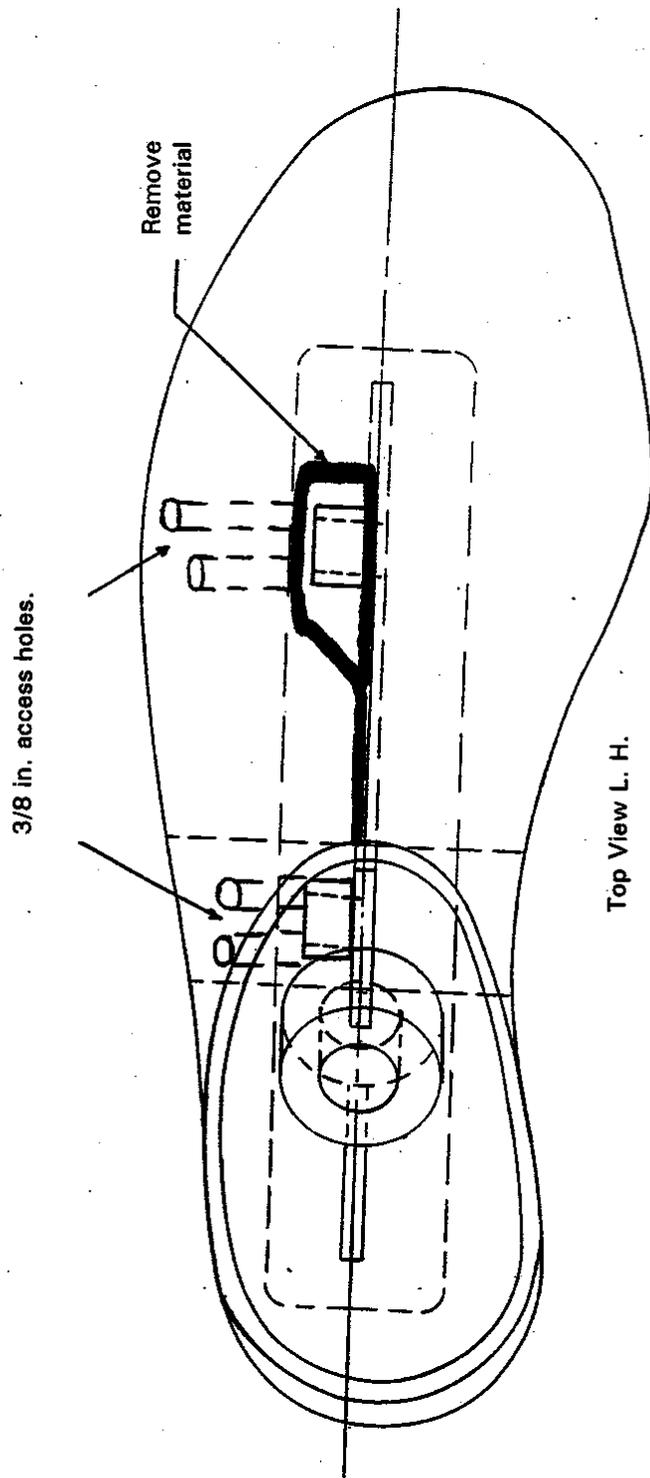
VINYL SKIN

Flush Fit

Vinyl Foam

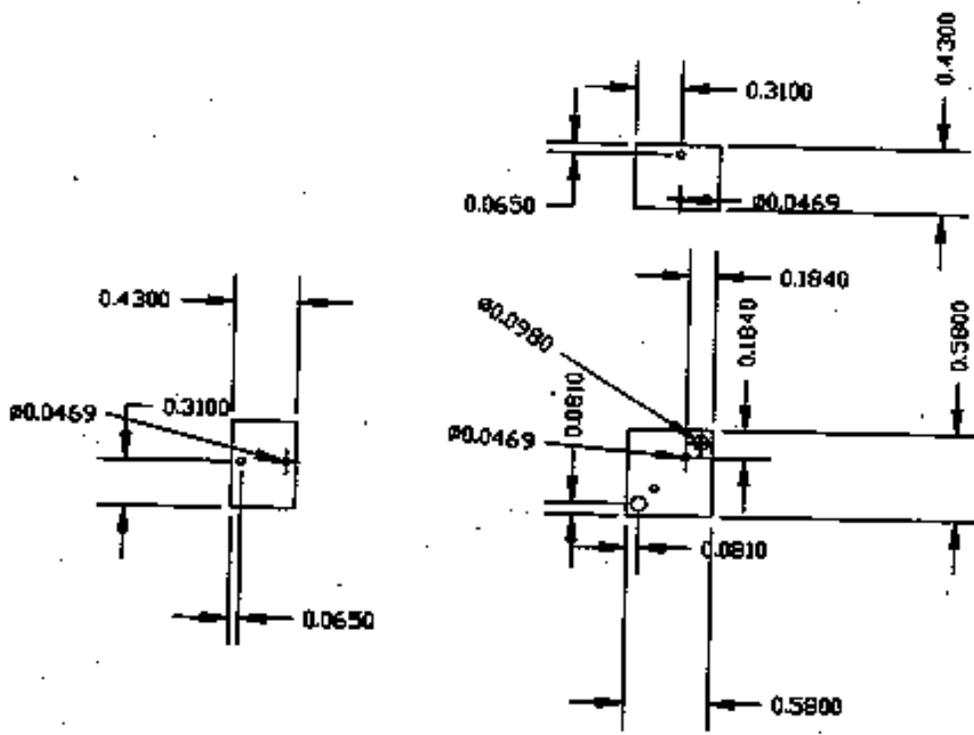


R. A. DENTON  
FOOT ASS'Y. L.H.



Accelerometer cables are routed on top of the foot and from the ankle to the lower leg.

Foot cube.



ALL 0.0469 HOLES ARE TAPPED FOR 0-80 SCREWS  
 ALL DIMENSIONS ARE IN INCHES

# **APPENDIX I**

## **COMPUTER PROGRAMS**

## **APPENDIX I COMPUTER PROGRAMS**

Computer programs related to signal processing may be obtained from the NHTSA website 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,” select the latest version of the program desired.

For questions related to this software, contact:

Office of Crashworthiness Standards  
DOT / NHTSA  
1200 New Jersey Ave, SE  
W43-404 / NVS-110  
Washington, DC 20590  
Telephone No.: (202) 366-1740

## **APPENDIX J**

**FMVSS 212, 219 (PARTIAL), 301, AND 305  
REQUIREMENTS FOR FRONTAL NCAP**

## 1. PURPOSE

The New Car Assessment Program's Frontal Impact Test Procedure is based upon FMVSS 208. This procedure will allow the Office of Crashworthiness Standards (OCWS) to gain supplemental information on the test vehicle.

**All test variables are to be evaluated at NCAP's 35mph (56.3km/h) test vehicle velocity**

## 2. FMVSS 212

### A. GENERAL REQUIREMENTS

This standard establishes windshield retention requirements for motor vehicles during crashes. Vehicles equipped with passive restraints must retain 50 percent of each side of the windshield on each side of the longitudinal centerline after they are subjected to a 56.3kph (35 mph) frontal barrier impact. Vehicles not equipped with passive restraints must retain not less than 75 percent of the windshield during the 56.3kph (35 mph) frontal barrier impact.

It is the contractor's responsibility to follow the most updated FMVSS 212 test procedure when conducting this assessment as part of NCAP testing. The latest published versions of all FMVSS test procedures may be found at:

<http://www.nhtsa.gov/Vehicle+Safety/Test+Procedures>

### B. PROCEDURE

Windshield retention must be checked directly after a frontal barrier impact. Loss of windshield protection can be determined when a piece of paper can pass between the windshield edge and the vehicle body. Photographs of the windshield periphery should be taken before the vehicle is placed in the FMVSS 301 static rollover machine.

## 3. FMVSS 219 (PARTIAL)

### A. GENERAL REQUIREMENTS

This standard specifies limits for the displacement of vehicle components into the windshield area during a crash.

It is the contractor's responsibility to follow the most updated FMVSS 219 test procedure when conducting this assessment as part of NCAP testing. The latest published versions of all FMVSS test procedures may be found at:

<http://www.nhtsa.gov/Vehicle+Safety/Test+Procedures>

|                                      | <b>In “Protected Zone”</b>         | <b>Below “Protected Zone”</b>                  |
|--------------------------------------|------------------------------------|--|
| <b>Vehicle Component Penetration</b> | Maximum of 0.25 inch into template | Must not penetrate inner surface of windshield |

The word “partial” is used since the 219 Styrofoam windshield protected zone template has been eliminated for all NCAP 56.3kph (35mph) frontal impact tests in order that the forward motion of the driver and passenger dummies can be filmed through the vehicle's windshield. However, the lower boundary of the protected zone shall be marked on the windshield glass, which accounts for a partial standard test.

When a passenger car, multipurpose passenger vehicle (MPV), light truck or bus (GVWR of 10,000 pounds or less) traveling longitudinally forward at 35 mph  $\pm$  0.5 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle (PERPENDICULAR FRONTAL IMPACT TEST), no part of the vehicle outside the occupant compartment, except windshield molding and other components designed to be normally in contact with the windshield, shall penetrate the protected zone to a depth of more than 0.25 inch. No such part of the vehicle shall penetrate the inner surface of that portion of the windshield within the Daylight Opening (DLO) below the protected zone.

The protected zone must be checked directly after a frontal barrier impact.

**NOTE: The standard does NOT apply to forward control vehicles, walk-in van-type vehicles, or to open-body-type vehicles with fold-down or removable windshields.**

**B. *PROTECTED ZONE LOWER EDGE MARKING PROCEDURE***

The lower edge of the protected zone is determined as follows:

1. Place a 6.5-inch diameter rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield glazing and the surface of the instrument panel, including padding.
2. Draw the locus of points on the inner surface of the windshield contacted by the sphere across the width of the instrument panel. From the outer most contactable points, extend the locus line horizontally to the edges of the glazing material.

**NOTE: Do not scratch glazing as a method of marking the contact between sphere and windshield.**

3. Draw a line on the inner surface of the windshield below and 0.5 inch distant from the locus line.
4. The lower edge of the protected zone is the longitudinal projection onto the outer surface of the windshield on the line determined in item C.

The protected zone is the space enclosed by the following surfaces:

1. The outer surface of windshield in the pre-crash configuration.
2. The focus of points 3 inches outward along perpendiculars drawn to each point on the outer surface of the windshield.
3. The locus of lines forming a 45° angle with the outer surface of the windshield at each point along the top and side edges of the outer surface of the windshield and the lower edge of the protected zone previously determined, in the plane perpendicular to the edge at that point.

#### 4. FMVSS 301

##### A. GENERAL REQUIREMENTS

This standard specifies requirements for the integrity of motor vehicle fuel systems.

It is the contractor's responsibility to follow the most updated FMVSS 301 test procedure when conducting this assessment as part of NCAP testing. The latest published versions of all FMVSS test procedures may be found at:

<http://www.nhtsa.gov/Vehicle+Safety/Test+Procedures>

##### 1. Frontal Impact -

| <b>TIME</b>                                     | <b>MAX. FLUID SPILLAGE</b> |
|---|----------------------------|
| From impact until vehicle motion ceases         | 1 ounce by weight          |
| For 5 minute period after vehicle motion ceases | 5 ounces by weight         |
| For the next 25 minutes                         | 1 ounce by weight/minute   |

##### 2. Static Rollover -

| TIME  | MAX. FLUID SPILLAGE |
|---|---------------------|
| For 5 minute period from onset of rotation at each 90° position | 5 ounces by weight  |
| For 6th minute  | 1 ounce by weight   |
| For 7th minute (if required)                                    | 1 ounce by weight   |
| For 8th minute (if required)                                    | 1 ounce by weight   |

**B. FACILITY AND EQUIPMENT – PRE-TEST REQUIREMENTS (STATIC ROLLOVER MACHINE)**

The rollover machine must be capable of rotating the barrier-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, with 90° of rotation taking place in any time interval from 1 to 3 minutes. Leakage will be collected for the 5 minute period from the beginning of rotation plus any additional 1 minute collection periods that are required. Containers for the collection of possible Stoddard solvent spillage and a calibrated stopwatch for timing the fluid collection intervals are required. Containers must be labeled before they are photographed.

**C. FUEL SYSTEM INTEGRITY**

After the vehicle impact, fuel system Stoddard solvent leakage will be collected by hand and documented with a real-time (24-30 fps) motion picture camera and stopwatch. The “tea cup method” involves simply placing a collection vessel beneath the leakage source and timing the intervals of several collected volumes. The collected Stoddard solvent samples can subsequently be measured and spillage rates calculated. If the “tea cup method” is used, the test personnel must be in position to scramble to observation points around the test vehicle at the instant the vehicle comes to rest after the impact event.

**NOTE: It is the Contractor’s responsibility to collect any suspect liquids leaking from the vehicle post-test and analyze the contents if necessary.**

**D. STATIC ROLLOVER PROCEDURE**

The Contractor must conduct a static rollover test within 30 minutes after the vehicle impact. The Contractor must keep the test vehicle under constant observation for Stoddard solvent leakage during the transition between impact and static rollover testing.

When the test vehicle is rotated in a fixture on its longitudinal axis to each successive increment of 90°, following an impact crash, Stoddard solvent spillage,

from the onset of rotational motion, shall not exceed a total of 5 ounces by weight for the first 5 minutes of testing at each successive 90° increment. For the remaining testing period, at each increment of 90°, solvent spillage during any 1-minute interval shall not exceed 1 ounce by weight.

#### E. *STATIC ROLLOVER TEST CONDITIONS*

Within 30 minutes after a vehicle impact, the vehicle is rotated in a test fixture about its longitudinal axis, with the axis kept horizontal, to each successive increment of the following, at a uniform rate, with 90° of rotation taking place in any time interval from 1 to 3 minutes.

1. 90°
2. 180°
3. 270°
4. 360°

After reaching each 90° increment, the vehicle is held in that position for 5 minutes.

The rollover machine must be capable of rotating the barrier 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. Leakage will be collected for the 5-minute period from the beginning of rotation plus up to three 1-minute collection periods. Containers for the collection of possible Stoddard solvent spillage and a calibrated stopwatch for timing the fluid collection intervals are required. Containers must be labeled before they are photographed.

### 5. **FMVSS 305**

#### A. *GENERAL REQUIREMENTS*

This standard specifies performance requirements for limitation of electrolyte spillage, retention of propulsion batteries, and electrical isolation of the chassis from the high-voltage system during the crash event. This standard applies to vehicles that use electricity as propulsion power.

It is the contractor's responsibility to follow the most updated FMVSS 305 test procedure when conducting this assessment as part of NCAP testing. The latest published versions of all FMVSS test procedures may be found at:

<http://www.nhtsa.gov/Vehicle+Safety/Test+Procedures>

# **APPENDIX K**

## **METRIC CONVERSIONS**

## **APPENDIX K**

### **NHTSA PREFERRED PRACTICE FOR METRIC CONVERSIONS**

NHTSA is converting to the metric system of measurement. The authority for this conversion is DOT Order 1020.1D, which was issued in response to 5164 of the Omnibus Trade and Competitiveness Act of 1988 (PL 100-418) and Executive Order 12770. The agency's plan for conversion was approved by the Secretary of Transportation on October 21, 1991 and were published on April 21, 1992 (57FR77 14619). This preferred practice provides general guidance for the conversion, and includes a listing of the preferred units for the quantities most frequently used by the agency.

#### **GENERAL GUIDELINES**

1. Safety levels shall not be decreased as a result of a change to the metric system of units.
2. Due consideration will be given to the effects of conversion on the nation's economy, since the intent of PL 100-418 is to improve the competitive position of United States industry.
3. Harmonization considerations will be taken into account where appropriate. Canadian and UK standards will be used as guides where applicable.
4. Conversion will be done on a case by case basis. "Equivalent" rather than "exact" conversion will be given preference except where there is a clear safety need for an exact conversion. Here equivalent means a close nominal value in contrast to exact which means a precise mathematical conversion.
5. Whenever appropriate, procedures for determining the number of significant figures will follow the practice shown in SAE J916, May 1991. To the extent possible, test procedures developed by NHTSA's Office of Enforcement will be used to determine the implied precision required as part of the significant figure determination.
6. SAE J916, May 1991 will be used as the primary source for conversion factors. NIST Special Publication 811 will be used as a backup source.

#### **PREFERRED UNITS**

The following listing shows units preferred for use within NHTSA and the acceptable abbreviation. Most of the units on this list refer to quantities used in mechanical/automotive engineering practice plus some other units normally used by the agency. For quantities used in electrical engineering, heat power engineering, lighting, or quantities not listed, see SAE J916, May 1991.

### METRIC CONVERSION

| WHEN MEASURING               | THE PREFERRED UNITS ARE   |
|------------------------------|---|
| <b>ACCELERATION</b>          |   |
| angular                      | degrees per second squared -preferred<br>radians per second squared -acceptable |
| general                      | meters per second squared   |
| vehicle                      | kilometers per hour per second  |
| of gravity                   | g (Note: this is not an SI unit)  |
| <b>ANGLE</b>                 |   |
| general (planer)             | degrees (Note: this is not an SI unit)  |
| <b>AREA</b>                  |   |
| vehicle frontal area         | square meters   |
| hose flow area               | square centimeters  |
| small land area              | square meters   |
| very large land area         | square kilometers   |
| <b>DENSITY</b>               |   |
| solid or gas                 | kilometers per cubic meter  |
| liquid                       | kilometers per liter  |
| <b>ENERGY</b>                |   |
| heat                         | kilojoules  |
| mechanical                   | joules  |
| <b>FLOW</b>                  |   |
| mass flow rate               | kilometers per second   |
| volume flow rate for liquids | liters per time   |
| volume flow rate for gases   | cubic meters per time   |
| <b>FORCE</b>                 |   |
| general                      | newton  |
| large forces                 | kilonewton  |

| WHEN MEASURING              | THE PREFERRED UNITS ARE       |
|-----------------------------|-------------------------------|
| <b>IMPULSE</b>              |                               |
| general                     | newton seconds                |
| <b>LENGTH</b>               |                               |
| engineering drawings        | millimeters                   |
| motor vehicle dimension     | millimeters or meters         |
| vehicle crash deformations  | centimeters                   |
| short land distance         | meters                        |
| long land distance          | kilometers                    |
| <b>MASS</b>                 |                               |
| small masses                | grams                         |
| large masses                | kilogram                      |
| very large masses           | metric ton                    |
| <b>MOMENTS</b>              |                               |
| second moment of area       | millimeters or centimeters    |
| of force, torque or bending | newton meters                 |
| of inertia                  | gram or kilogram meter square |
| <b>MOMENTUM</b>             |                               |
| general                     | kilograms meters per second   |
| <b>POWER</b>                |                               |
| general                     | watts or kilowatts            |
| <b>PRESSURE</b>             |                               |
| general                     | kilopascals                   |
| <b>STRAIN</b>               |                               |
| general                     | micrometers per meter         |
| <b>STRESS</b>               |                               |
| general                     | megapascals                   |

| <b>WHEN MEASURING</b> | <b>THE PREFERRED UNITS ARE</b>                                  |
|-----------------------|---|
| <b>TEMPERATURE</b>    |   |
| general use           | degrees celsius   |
| absolute              | degrees kelvin  |
| <b>VELOCITY</b>       |   |
| angular               | degrees per second -preferred<br>radians per second -acceptable |
| general               | meters per second   |
| vehicle               | kilometers per hour   |
| <b>VOLUME</b>         |   |
| engine displacement   | liters  |
| liquids in general    | liters  |
| other volumes         | cubic meters  |

## **APPENDIX L**

### **UPPER NECK LOAD CELL POLARITY CHECK**

## APPENDIX L

### PROCEDURE FOR CHECKING DUMMY UPPER AND LOWER NECK LOAD CELL POLARITY FOR THE HYBRID III 50<sup>TH</sup> AND 5<sup>TH</sup> PERCENTILE

#### **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 load cell 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.

#### **SAE J211 Procedure:**

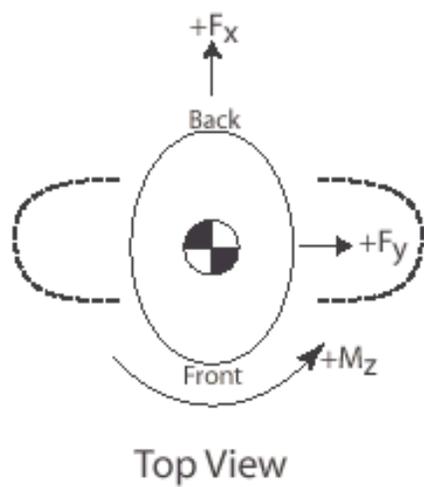
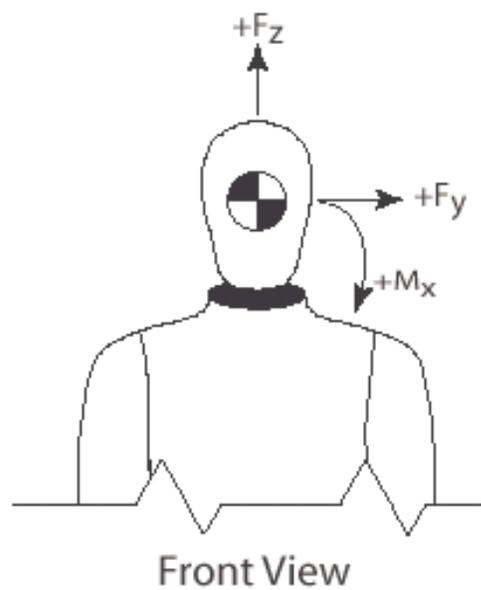
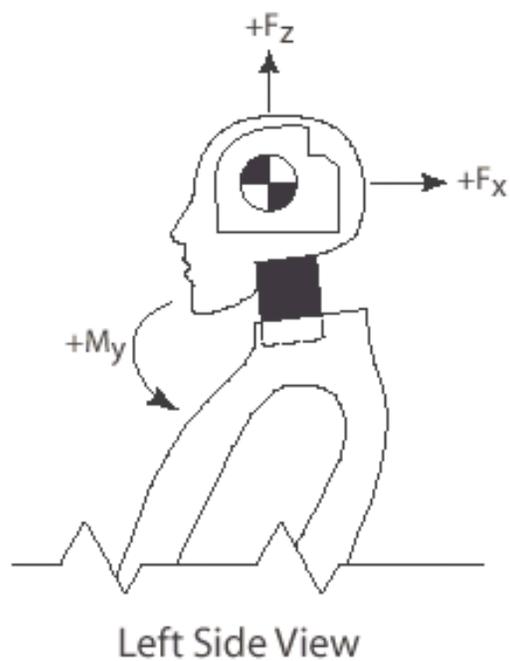
The body coordinate system used for reference is attached to the dummy and is x positive pointing forward, y positive pointing to the right, and z positive pointing down.

To check the polarity of the upper and lower neck load cells, the head and chest must be moved in opposite directions to make a measurable force in the neck. Moving the head rearward and the chest forward should result in a positive  $F_x$ . Moving the head left and the chest right should result in a positive  $F_y$ . Lifting the head upward and the chest downward should result in a positive  $F_z$ .

A similar methodology is applied with determining the polarity of the moment measuring load cells. Moving the left ear toward the left shoulder should result in a positive  $M_x$ . Moving the chin toward the sternum results in a positive  $M_y$  and moving the chin toward the left shoulder will have a positive  $M_z$ .

If any of these motions do not result in a positive reading, the polarity needs to be changed to agree with the sign convention. (A sign change in the software may be the simplest solution.)

## Dummy Upper Neck and Lower Neck Load Cell Polarity Check





## **APPENDIX M**

### **HEAD NINE-ACCELEROMETER ARRAY POLARITY CHECK**

**APPENDIX M**

**PROCEDURE FOR CHECKING AND  
RECORDING DUMMY ACCELEROMETER POLARITY  
FOR THE HIII 50<sup>TH</sup> AND 5<sup>TH</sup> 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 SAE 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 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, then 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 modifications 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 position blows to the back side, left side, and top will produce positive accelerations relative to its +x, +y, and +z directions, respectfully. 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 **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 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.

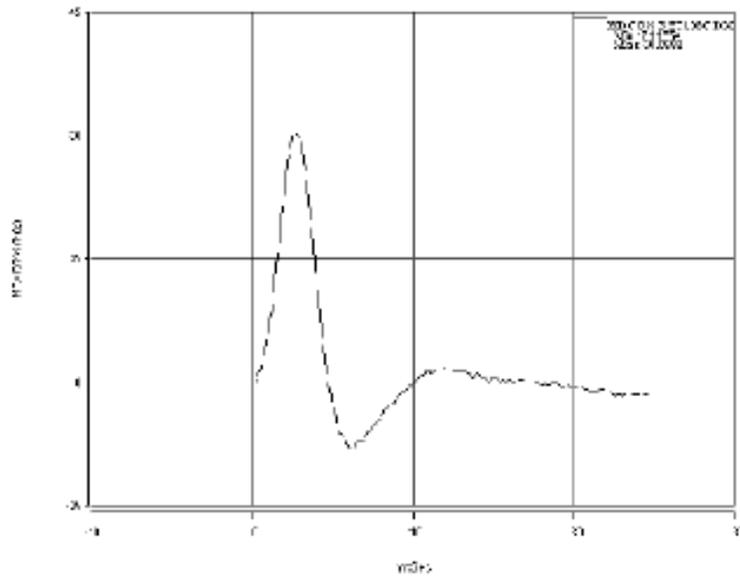


Figure 1 – Response of X Axis Accelerometer Data Channel from blow to rear of head showing desired positive polarity

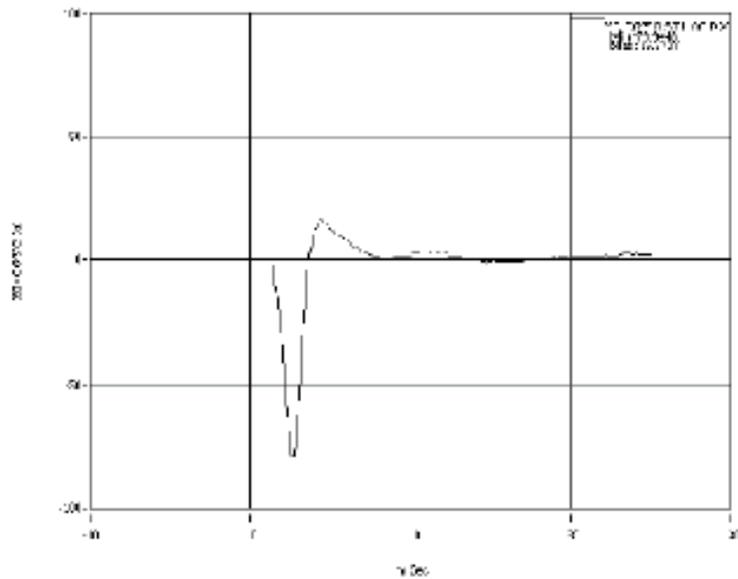


Figure 2 – Response of Y Axis Accelerometer Data Channel from blow to left side of head showing incorrect (negative ) polarity

| Polarity Check Data Sheet For X - Axis Accelerometers |                         |                  |   |   |  |
|---|-------------------------|------------------|---|---|--|
| Dummy Type: _____                                     |                         | Serial No. _____ |   | Date: _____                               |  |
| Component   | Channel Output<br>( g ) |                  | Orientation<br>of Most<br>Positive<br>Value<br>(FU or FD) | J211 Orientation for<br>Positive Polarity | Negative<br>Channels to<br>be Reversed<br>In Data<br>Acquisition<br>System |
|   | Orientation             |                  |   |   |  |
|   | Face Down (FD)          | Face Up<br>(FU)  |   |   |  |
| Head C.G.   |                         |                  |   | FU  |  |
| Head C.G.<br>Redundant<br>NAAH*                       |                         |                  |   | FU  |  |
| Head Top<br>NAAH*                                     |                         |                  |   | FU  |  |
| Head Left<br>NAAH*                                    |                         |                  |   | FU  |  |

\* NAAH - Indicates Nine Accelerometer Array Head

| Polarity Check Data Sheet For Y - Axis Accelerometers |                              |                               |  |   |  |
|---|------------------------------|-------------------------------|--|---|--|
| Dummy Type: _____                                     |                              | Serial No. _____              |  | Date: _____                               |  |
| Component   | Channel Output<br>( g )      |                               | Orientation<br>of Most<br>Positive<br>Value<br>(RSU or<br>RSD) | J211 Orientation for<br>Positive Polarity | Negative<br>Channels to<br>be Reversed<br>In Data<br>Acquisition<br>System |
|   | Orientation                  |                               |  |   |  |
|   | Right Shoulder<br>Down (RSD) | Right Shoulder<br>Up<br>(RSU) |  |   |  |
| Head C.G.   |                              |                               |  | RSU                                       |  |
| Head C.G.<br>Redundant<br>NAAH*                       |                              |                               |  | RSU                                       |  |
| Head Top<br>NAAH*                                     |                              |                               |  | RSU                                       |  |
| Head Front<br>NAAH*                                   |                              |                               |  | RSU                                       |  |

\* NAAH - Indicates Nine Accelerometer Array Head

| Polarity Check Data Sheet For Z - Axis Accelerometers |                       |                  |  |  |  |
|---|-----------------------|------------------|--|--|--|
| Dummy Type: _____                                     |                       | Serial No. _____ |  | Date: _____                                  |  |
| Component   | Channel Output<br>(g) |                  | Orientation of<br>Most Positive<br>Value<br>(U or D) | J211<br>Orientation for<br>Positive Polarity | Negative<br>Channels to<br>be Reversed In<br>Data<br>Acquisition<br>System |
|   | Orientation           |                  |  |  |  |
|   | Upright<br>(U)        | Lean Down<br>(D) |  |  |  |
| Head C.G.   |                       |                  |  | D  |  |
| Head C.G.<br>Redundant<br>NAAH*                       |                       |                  |  | D  |  |
| Head Left<br>NAAH*                                    |                       |                  |  | D  |  |
| Head Front<br>NAAH*                                   |                       |                  |  | D  |  |

\* NAAH - Indicates Nine Accelerometer Array Head

**APPENDIX N**  
**TEST DELIVERABLES AND REPORT GUIDELINES**

**NEW CAR ASSESSMENT PROGRAM REPORT GUIDELINES**  
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## 1. TEST DELIVERABLES AND REPORTING REQUIREMENTS

### 1.1 MONTHLY STATUS REPORTS

The contractor shall submit a Monthly Vehicle Status Report to the COTR. The form can be found in **Section 3, Forms**, in this document. The report shall be submitted until all vehicles or items of equipment are disposed of.

### 1.2 APPARENT TEST FAILURE

An apparent test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturday and Sundays excluded). A Laboratory Notice of Test Failure (located in Section 3 of this document) with a copy of the particular NCAP test data sheet(s) and preliminary data plot(s) shall be included. In the event of a test failure, a post-test calibration check of some of the 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 Office of Crashworthiness Standards (OCWS).

### 1.3. NCAP TEST 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. QUICKLOOK REPORT

The Quicklook Report is a preliminary summary of the test that should be e-mailed to the OCWS within 24 hours of the impact event. The Quicklook Report should detail all relevant injury criteria, vehicle information, airbag deployment, and evidence of FMVSS 208, FMVSS 212, FMVSS 219, FMVSS 301, and FMVSS 305 (if applicable) compliance, and should include relevant data traces. Also, anything interesting or out of the ordinary should be included in the Quicklook Report in a comments section. A sample Quicklook Report is included as Form 5 in this document.

#### B. DATA TAPE

Within three (3) working days of the test, the Contractor shall email the NHTSA the test data 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 "ENTRÉE for Windows" and select the latest version of the program.

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.

#### C. QUICKLOOK PACKAGE

The Quicklook Package is a .zip file that includes all of the information necessary for quality control review. It is uploaded to an FTP site for review by the OCWS. This data is a summary of the test and includes the data tape, all photographs, and all videos, as well as a copy of the Quicklook Report previously e-mailed to the OCWS. The filename for the Quicklook Package should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><NCAP>QC.zip

The contractor will also provide website-related material in a folder within this file. The contractor will provide a .jpg image of the vehicle impact appropriate for use on the website. This photo should be a duplicate of photo number 75 in the Frontal NCAP photo list found in **Section 3** of this document. The photo should be labeled as follows:

<Model Year><Make><Model>Frontal Impact Event for web.jpg

It should also be 227 pixels wide by 127 pixels tall, landscape (horizontal) orientation, and of a high image quality.

In this same folder, the contractor will also use Camera No. 1, the Real-Time Left Overall Camera, as described in Section 9 of the main procedure, to provide a web-ready video of the impact event in .wmv format. This film should be labeled as follows:

<Model Year><Make><Model>Frontal Impact Event.wmv

#### D. FTP WEBSITE

To expedite data transfer between the Contractor and NHTSA, a File Transfer Protocol (FTP) website will be made available to Contractors. The Quicklook Package (see above **Section 1.3, C**) is required to be uploaded via FTP five (5) working days after the test has been completed. The agency will then retrieve the data to begin the quality control process.

##### (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 1<sup>st</sup> of each month. Any FTP client can be used to access and upload data.

(2) **LOADING TEST DATA**

The Quicklook Package 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 provide **ONE** (1) .zip file per test via the FTP website. Upload the .zip file 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 FTP administrator if one has been identified; otherwise, contact the COTR.**

E. **DRAFT TEST REPORT**

Contractors are required to submit to the OCWS via e-mail a draft Final Test Report, an electronic copy in .pdf or .doc form, within two weeks of the test being conducted. The Contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the test program.

F. **FINAL TEST REPORT AND DELIVERABLES**

Contractors are required to review and proofread all Final Test Reports and related test materials 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 Contractor shall upload a final version of the associated test data, photos, and videos (high speed and real-time) as a .zip file to the FTP site within two weeks of receiving preliminary test report corrections from the OCWS. The format for its filename should be as follows:

<NHTSANO><Model Year><Make & Model><Body><NCAP>Final.zip

The following is a summary of all NCAP test deliverable requirements:

| <b>Crash Test Deliverable</b>  | <b>Procedure Section</b> | <b>File Format &amp; Naming Convention</b>   | <b>Time Requirement</b>   | <b>Submit Via</b>           | <b>Submit To</b> |
|--|--------------------------|--|---|-----------------------------|------------------|
| Quicklook Report   | 12.5, A                  | .pdf with filename format:<br><NHTSANO><br><ModelYear><br><Make&Model> <Body><br><NCAP/SINCAP/PINCAP> Quicklook.pdf      | One (1) day from test   | Email                       | OCWS             |
| Data Tape  | 12.5, B                  | .zip with filename format:<br><NHTSANO> <Model Year> <Make & Model> <Body><br><NCAP/SINCAP/PINCAP> Datatape.zip          | Three (3) business days from test                                     | Email                       | OCWS             |
| Quality Control Package: web photo and video requirements, high speed and real time videos, and photos | 12.5, C                  | .zip with filename format:<br><NHTSANO> <Model Year> <Make & Model> <Body><br><NCAP/SINCAP/PINCAP> QCPackage.zip         | Five (5) business days from test                                      | FTP                         | FTP              |
| Preliminary Test Report  | 12.5, E                  | .pdf with filename format:<br><NHTSANO><br><ModelYear><br><Make&Model> <Body><br><NCAP/SINCAP/PINCAP> DraftReport.pdf    | Two (2) weeks from test date  | Email/FTP depending on size | OCWS/FTP         |
| Final Deliverables: Final Test Report, photos, and high speed and real time videos                     | 12.5, F                  | .zip with filename format:<br><NHTSANO> <Model Year> <Make & Model> <Body><br><NCAP/SINCAP/PINCAP> FinalDeliverables.zip | Two (2) weeks after receiving corrections to preliminary test report. | FTP                         | FTP              |

G. TEST REPORT REQUIREMENTS

The final test report and associated documentation (including photographs and videos) is relied upon as the chronicle of the NCAP test. The final documentation and data will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The contractor should use detailed descriptions of all NCAP test events. Any events that are not directly associated with the NCAP but are of technical interest should also be included. The contractor should include as much detail as possible in the report.

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

H. FIRST THREE PAGES

1. Front Cover - The information required on the cover is as follows:

a. Final Report Number, such as NCAP-ABC-XX-001

where - -

|             |  |
|-------------|--|
| <b>NCAP</b> | is the test  |
| <b>ABC</b>  | are the initials for the laboratory  |
| <b>XX</b>   | are the last two digits of the fiscal year of the test program   |
| <b>001</b>  | is the test number for that fiscal year (001 for the 1st test conducted in the fiscal year, 002 for the 2nd test, 003for the 3rd test, etc.) |

b. Final Report Title and Subtitle, such as

NEW CAR ASSESSMENT PROGRAM (NCAP)  
 Frontal Barrier Impact Test  
 \*\*\*\*\*  
 World Motors Corporation  
 200X XYZ 4-door sedan  
 NHTSA No. CX0401

c. Contractor's Name and Address, such as

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

**NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (C) AND (D)**

- d. Date of Final Report completion
- e. The words "FINAL REPORT"
- f. The sponsoring agency's name and address as follows:

U. S. DEPARTMENT OF TRANSPORTATION  
 National Highway Traffic Safety Administration  
 Office of Crashworthiness Standards  
 1200 New Jersey Ave, SE  
 Room W43-410  
 Washington, DC 20590

- 2. First Page After Front Cover - A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

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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: \_\_\_\_\_

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

Block No. 1 - REPORT NO.

NCAP-ABC-XX-001

Block No. 2 - GOVERNMENT ACCESSION NUMBER

Leave blank

Block No. 3 - RECIPIENT'S CATALOG NUMBER

Leave blank

Block No. 4 - TITLE AND SUBTITLE

Final Report of NEW CAR ASSESSMENT PROGRAM Testing  
of a 20XX World XYZ Deluxe 4-door sedan  
NHTSA No. CX0401

Block 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 Engineer

Block No. 8 - PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block No. 9 - PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories  
405 Main Street  
Detroit, MI 48070

Block No. 10 - WORK UNIT NUMBER

Leave blank

Block No. 11 - CONTRACTOR GRANT NUMBER

DTNH22-0X-D-1 2345

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Block No. 13 - TYPE OF REPORT AND PERIOD COVERED

Final Test Report  
Feb. 15 to Mar. 15, 20XX

Block No. 14 - SPONSORING AGENCY CODE

NVS-111

Block No. 15 - SUPPLEMENTARY NOTES

Leave blank

Block No. 16 - ABSTRACT

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 200X XYZ Deluxe 4-door sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at the ABC Laboratories facility in Detroit, Michigan, on November 15, 200X.

The impact velocity of the vehicle was 56.1 km/h, and the ambient temperature at the barrier face at the time of impact was 28°C. The target vehicle post-test maximum crush was 351 mm at \_\_\_\_\_. The test vehicle's performance is as follows:

| Measurement Description                   | Driver ATD |           |        | Pass. ATD |           |        |
|---|------------|-----------|--------|-----------|-----------|--------|
|   | Units      | Threshold | Result | Units     | Threshold | Result |
| Head Injury Criteria (HIC <sub>15</sub> ) | N/A        | 700       |        | N/A       | 700       |        |
| Maximum Chest Compression                 | mm         | 63        |        | mm        | 52        |        |
| Nij                                       | n/a        | 1         |        | n/a       | 1         |        |
| Neck Tension                              | Newtons    | 4170      |        | Newtons   | 2620      |        |
| Neck Compression                          | Newtons    | 4000      |        | Newtons   | 2520      |        |
| Left Femur Force                          | Newtons    | 10008     |        | Newtons   | 6805      |        |
| Right Femur Force                         | Newtons    | 10008     |        | Newtons   | 6805      |        |

Block No. 17 - KEY WORDS

35 mph Frontal Barrier Impact test  
New Car Assessment Program (NCAP)

Block No. 18 - DISTRIBUTION STATEMENT

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Add appropriate number

Block No. 22 - PRICE

Leave blank

## 2. SAMPLE TEST REPORT LAYOUT

Draft and final NCAP Test Reports shall have the following layout for standardization purposes:

| Section        |  | Page No. |
|----------------|--|----------|
| 1              | Purpose and Summary of the Test                              | X        |
| 2              | Occupant and Vehicle Information / Data Sheets               | X        |
|                |  |          |
| Data Sheet No. |  | Page No. |
| 1              | General Test and Vehicle Parameter Data                      | X        |
| 2              | Seat Adjustment, Fuel System, and Steering Wheel Data        | X        |
| 3              | Dummy Longitudinal Clearance Dimensions                      | X        |
| 4              | Dummy Lateral Clearance Dimensions                           | X        |
| 5              | Seat Belt Positioning Data                                   | X        |
| 6              | High-Speed Camera Locations and Data                         | X        |
| 7              | Vehicle Accelerometer Locations                              | X        |
| 8              | Photographic Reference Target Locations                      | X        |
| 9              | Load Cell Locations on Fixed Barrier                         | X        |
| 10             | Test Vehicle Summary of Results                              | X        |
| 11             | Post-Test Observations                                       | X        |
| 12             | Vehicle Profile Measurements                                 | X        |
| 13             | Accident Investigation Division Data                         | X        |
| 14             | Vehicle Intrusion Measurements                               | X        |
| 15             | Summary of FMVSS 212, FMVSS 219 (Partial) Data, and 301 Data | X        |
| 16             | FMVSS 301 Static Rollover Results                            | X        |
| 17             | Dummy/Vehicle Temperature Stabilization Chart                | X        |
|                |  |          |
| Appendix       |  | Page No. |
| A              | Photographs  | AX       |
| B              | Dummy Response Data Traces                                   | BX       |
| C              | Dummy Calibration and Performance Verification Data          | CX       |

## REPORT AREA 1: PURPOSE AND SUMMARY OF TEST

### PURPOSE

This area briefly outlines the purpose for conducting the frontal impact test and states the appropriate test procedure followed during the test. The following is provided as an example:

*This «Speed» km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNHXX-XX-D-XXXXX. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.*

*The «Speed» km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure.*

### SUMMARY

*A load cell barrier consisting of 36 load cells was impacted by a «Year» «Make» «Model» «BodyStyle» at a velocity of «Speed» km/h. The test was performed at XXX Engineering on «Date». Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.*

*One real-time camera and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.*

*One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5<sup>th</sup> percentile female ATD was placed in the right-front passenger according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.*



|                          |  |  |  |  |  |  |  |  |
|--------------------------|--|--|--|--|--|--|--|--|
| (5 <sup>th</sup> Female) |  |  |  |  |  |  |  |  |
|--------------------------|--|--|--|--|--|--|--|--|

## REPORT AREA 2: DATA SHEETS

Data sheets can be found in Section 3 of this Appendix. For purposes of consistency, it is highly suggested that exact replicas of these sheets are inserted into the Final Test Report. The Contractor may expand upon the data sheets if desired; however, the data must be presented in the order listed on page N13 under "SAMPLE TEST REPORT LAYOUT." Any additional inclusions **MUST** be placed **after** the required sheets.

### REPORT AREA 3: PHOTOGRAPHS

The following photographs should be included as Appendix A of the final test report, two photos per page. A vehicle information placard, identifying the test vehicle, test date, and NHTSA number, along with an indication of whether the photo was taken pre-test or post-test, shall clearly appear in each photograph. A time/date stamp on each photo is also highly recommended.

The following photographs shall be labeled as indicated. The text in parenthesis is for clarification purposes only and **need not be included**. If additional photographs are needed to satisfy the requirements of report Appendix A, including but not limited to photographs required for FMVSS 305 testing, subsequent photos should be lettered and labeled appropriately.

For example, if the laboratory would like to provide more than one photograph of the dummy cable routing configuration pre-test, the photographs should be labeled as follows:

- 027 – Pre-test Dummy Cable Routing (required photo)
- 027a – Pre-test Dummy Cable Routing (additional view)

- No. 001 Load Cell Location (photograph of vehicle behind mock load cell wall)
- No. 002 Load Cell Wall (photograph of barrier pre-test)
- No. 003 Manufacturer's Label (photograph of certification label, include a photograph of the reduced load carrying capacity as No. 003a, if applicable)
- No. 004 Tire Placard (photograph of tire placard)
- No. 005 <Model Year><Make><Model> Frontal As Delivered
- No. 006 Left Rear 3-4 View, as Received
- No. 007 Pre-test Front View of Test Vehicle
- No. 008 Post-test Front View of Test Vehicle
- No. 009 Pre-test Left View of Test Vehicle (taken with vehicle at barrier)
- No. 010 Post-test Left View of Test Vehicle (taken without moving vehicle post-test)
- No. 011 Pre-test Right View of Test Vehicle
- No. 012 Post-test Right View of Test Vehicle
- No. 013 Pre-test Right Front 3-4 View
- No. 014 Post-test Right Front 3-4 View
- No. 015 Pre-test Left Rear 3-4 View (taken with vehicle at barrier)
- No. 016 Post-test Left Rear 3-4 View (taken without moving vehicle post-test)
- No. 017 Pre-test Windshield View (looking through windshield at dummies)

- No. 018 Post-test Windshield View (looking through windshield at dummies)
- No. 019 Pre-test Engine Compartment View
- No. 020 Post-test Engine Compartment View
- No. 021 Pre-test Fuel Filler Cap View
- No. 022 Post-test Fuel Filler Cap View
- No. 023 Pre-test Front Underbody View<sup>1</sup>
- No. 024 Post-test Front Underbody View<sup>1</sup>
- No. 025 Pre-test Rear Underbody View<sup>1</sup>
- No. 026 Post-test Rear Underbody View<sup>1</sup>
- No. 027 Pre-test Dummy Cable Routing
- No. 028 Post-test Dummy Cable Routing
- No. 029 Pre-test Driver Dummy Front View (taken through the windshield, directly in front of the driver with the camera parallel to the longitudinal centerline of the vehicle)
- No. 030 Post-test Driver Dummy Front View (taken through the windshield, directly in front of the driver with the camera parallel to the longitudinal centerline of the vehicle)
- No. 031 Pre-test Driver Dummy Window View (taken through the left window with the camera perpendicular to the longitudinal centerline of the vehicle)
- No. 032 Post-test Driver Dummy Window View (taken through the left window with the camera perpendicular to the longitudinal centerline of the vehicle)
- No. 033 Pre-test Driver Dummy and Vehicle Interior View (taken with the door open)
- No. 034 Post-test Driver Dummy and Vehicle Interior View (taken with the door open)
- No. 035 Pre-test Driver's Seat Fore-Aft Markings (taken with the door open and in such a way that any seat positioning marks may be seen)
- No. 036 Post-test Driver's Seat Fore-Aft Markings (taken with the door open and in such a way that any seat positioning marks may be seen)
- No. 037 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. 038 Post-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. 039 Pre-test Driver Dummy Feet (taken with the door open)
- No. 040 Post-test Driver Dummy Feet (taken with the door open)
- No. 041 Pre-test Driver's Side Knee Bolster (without dummy present)
- No. 042 Post-test Driver's Side Knee Bolster (without dummy present)
- No. 043 Pre-test Driver's Side Floorpan
- No. 044 Post-test Driver's Side Floorpan
- No. 045 Post-Test Driver Dummy Face
- No. 046 Post-test Driver Dummy Contact With Airbag
- No. 047 Post-test Driver Dummy Contact With Headrest
- No. 048 Pre-test View of the Steering Wheel (do NOT disassemble any parts to take this photograph)
- No. 049 Post-test View of the Steering Wheel (do NOT disassemble any parts to take this photograph)
- No. 050 Pre-test Passenger Dummy Front View (taken through the windshield, directly in front of the passenger with the camera parallel to the longitudinal centerline of the vehicle)
- No. 051 Post-test Passenger Dummy Front View (taken through the windshield, directly in front of the passenger with the camera parallel to the longitudinal centerline of the vehicle)
- No. 052 Pre-test Passenger Dummy Window View (taken through the right window with the camera perpendicular to the longitudinal centerline of the vehicle)
- No. 053 Post-test Passenger Dummy Window View (taken through the right window with the camera perpendicular to the longitudinal centerline of the vehicle)
- No. 054 Pre-test Passenger Dummy and Vehicle Interior View (taken with the door open)
- No. 055 Post-test Passenger Dummy and Vehicle Interior View (taken with the door open)
- No. 056 Pre-test Passenger's Seat Fore-Aft Markings (taken with the door open and in such a way that any seat positioning marks may be seen)
- No. 057 Post-test Passenger's Seat Fore-Aft Markings (taken with the door open and in such a way that the seat positioning marks may be seen)

- No. 058 Pre-Test View of Belt Anchorage for 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. 059 Post-Test View of Belt Anchorage for 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. 060 Pre-test Passenger Dummy Feet (taken with the door open)
- No. 061 Post-test Passenger Dummy Feet (taken with the door open)
- No. 062 Pre-test Passenger's Side Knee Bolster (glove compartment without dummy present)
- No. 063 Post-test Passenger's Side Knee Bolster (glove compartment without dummy present)
- No. 064 Pre-test Passenger's Side Floorpan
- No. 065 Post-test Passenger's Side Floorpan
- No. 066 Post-test Passenger Dummy Contact With \_\_\_\_\_ (as applicable, include and label pictures of all dummy chalk marks transferred to the airbag(s), headrest, vehicle interior, etc.)
- No. 067 Photograph of ballast installed in vehicle
- No. 068 Post-test Stoddard solvent spillage location view, if required
- No. 069 Post-test Speed Trap Read-out
- No. 070 Vehicle at 0° on Static Rollover Device
- No. 071 Vehicle at 90° on Static Rollover Device
- No. 072 Vehicle at 180° on Static Rollover Device
- No. 073 Vehicle at 270° on Static Rollover Device
- No. 074 Vehicle at 360° on Static Rollover Device
- No. 075 <Model Year><Make><Model> Frontal Impact Event
- No. 076 Monroney Label Photograph

<sup>1</sup>**NOTE:** *The underbody views should include the following vehicle components: fuel pump, fuel lines, sender unit, fuel tank filler pipe and any other visible fuel system components.*

**NOTE:** **The numbering convention/filenames shown above must be maintained. It is deliberate and intended to keep the photos in a specific order when sorting photos electronically.**

#### REPORT AREA 4: DUMMY RESPONSE DATA TRACES

The following data traces should be included as Appendix B of the Final Test Report:

| Fig. No. | List of Data Plots Provided In The Test Report          | Page No. |
|----------|---|----------|
| 1        | Driver Head X Acceleration vs. Time Primary             | X        |
| 2        | Driver Head Y Acceleration vs. Time Primary             | X        |
| 3        | Driver Head Z Acceleration vs. Time Primary             | X        |
| 4        | Driver Head Resultant Acceleration vs. Time Primary     | X        |
| 5        | Driver Chest X Deflection vs. Time                      | X        |
| 6        | Driver Chest X Acceleration vs. Time Primary            | X        |
| 7        | Driver Chest Y Acceleration vs. Time Primary            | X        |
| 8        | Driver Chest Z Acceleration vs. Time Primary            | X        |
| 9        | Driver Chest Resultant Acceleration vs. Time Primary    | X        |
| 10       | Driver Upper Neck Force X vs. Time Primary              | X        |
| 11       | Driver Upper Neck Force Z vs. Time Primary              | X        |
| 12       | Driver Upper Neck Moment Y vs. Time Primary             | X        |
| 13       | Driver Nij vs. Time Primary                             | X        |
| 14       | Driver Left Femur Force vs. Time                        | X        |
| 15       | Driver Right Femur Force vs. Time                       | X        |
| 16       | Passenger Head X Acceleration vs. Time Primary          | X        |
| 17       | Passenger Head Y Acceleration vs. Time Primary          | X        |
| 18       | Passenger Head Z Acceleration vs. Time Primary          | X        |
| 19       | Passenger Head Resultant Acceleration vs. Time Primary  | X        |
| 20       | Passenger Chest X Deflection vs. Time                   | X        |
| 21       | Passenger Chest X Acceleration vs. Time Primary         | X        |
| 22       | Passenger Chest Y Acceleration vs. Time Primary         | X        |
| 23       | Passenger Chest Z Acceleration vs. Time Primary         | X        |
| 24       | Passenger Chest Resultant Acceleration vs. Time Primary | X        |
| 25       | Passenger Upper Neck Force X vs. Time Primary           | X        |
| 26       | Passenger Upper Neck Force Z vs. Time Primary           | X        |
| 27       | Passenger Upper Neck Moment Y vs. Time Primary          | X        |

|    |                                      |   |
|----|--------------------------------------|---|
| 28 | Passenger Nij vs. Time Primary       | X |
| 29 | Passenger Left Femur Force vs. Time  | X |
| 30 | Passenger Right Femur Force vs. Time | X |

**The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)**

Driver Head X Acceleration Redundant  
 Driver Head Y Acceleration Redundant  
 Driver Head Z Acceleration Redundant  
 Driver Upper Neck Force Y  
 Driver Upper Neck Moment X  
 Driver Upper Neck Moment Z  
 Driver Chest X Acceleration Redundant  
 Driver Chest Y Acceleration Redundant  
 Driver Chest Z Acceleration Redundant  
 Driver Pelvis X  
 Driver Pelvis Y  
 Driver Pelvis Z  
 Driver Left Femur Redundant  
 Driver Right Femur Redundant  
 Driver Left Upper Tibia Moment X  
 Driver Left Upper Tibia Moment Y  
 Driver Left Upper Tibia Force Z  
 Driver Left Lower Tibia Moment X  
 Driver Left Lower Tibia Moment Y  
 Driver Left Lower Tibia Force Z  
 Driver Right Upper Tibia Moment X  
 Driver Right Upper Tibia Moment Y  
 Driver Right Upper Tibia Force Z  
 Driver Right Lower Tibia Moment X  
 Driver Right Lower Tibia Moment Y  
 Driver Right Lower Tibia Force Z  
 Driver Left Foot Fore Z  
 Driver Left Foot Aft X  
 Driver Left Foot Aft Z  
 Driver Right Foot Fore Z  
 Driver Right Foot Aft X  
 Driver Right Foot Aft Z  
 Driver Shoulder Belt Force  
 Driver Lap Belt Force  
 Passenger Head X Acceleration Redundant  
 Passenger Head Y Acceleration Redundant  
 Passenger Head Z Acceleration Redundant  
 Passenger Upper Neck Force X

Passenger Upper Neck Force Z  
Passenger Upper Neck Moment Y  
Passenger Chest X Acceleration Redundant  
Passenger Chest Y Acceleration Redundant  
Passenger Chest Z Acceleration Redundant  
Passenger Pelvis X  
Passenger Pelvis Y  
Passenger Pelvis Z  
Passenger Left Femur Redundant  
Passenger Right Femur Redundant  
Passenger Left Upper Tibia Moment X  
Passenger Left Upper Tibia Moment Y  
Passenger Left Upper Tibia Force Z  
Passenger Left Lower Tibia Moment X  
Passenger Left Lower Tibia Moment Y  
Passenger Left Lower Tibia Force Z  
Passenger Right Upper Tibia Moment X  
Passenger Right Upper Tibia Moment Y  
Passenger Right Upper Tibia Force Z  
Passenger Right Lower Tibia Moment X  
Passenger Right Lower Tibia Moment Y  
Passenger Right Lower Tibia Force Z  
Passenger Left Foot Fore Z  
Passenger Left Foot Aft X  
Passenger Left Foot Aft Z  
Passenger Right Foot Fore Z  
Passenger Right Foot Aft X  
Passenger Right Foot Aft Z  
Passenger Shoulder Belt Force  
Passenger Lap Belt Force  
Left Rear Seat Crossmember X  
Left Rear Seat Crossmember Z  
Right Rear Seat Crossmember X  
Right Rear Seat Crossmember Z  
Left Rear Seat Crossmember X Redundant  
Right Rear Seat Crossmember X Redundant  
Vehicle Engine Top X  
Vehicle Engine Bottom X  
Load Cell Barrier A1-A9  
Load Cell Barrier B1-A9  
Load Cell Barrier C1-A9  
Load Cell Barrier D1-A9

**REPORT AREA 5: DUMMY CALIBRATION AND PERFORMANCE VERIFICATION**

Data sheets from Frontal NCAP Laboratory Test Procedure **Appendix A** (Part 572E (50th Male) Dummy Performance Calibration Test Procedure) and **Appendix B** (Part 572O (5th Female) Dummy Performance Calibration Test Procedure) shall be used to document dummy calibration in Appendix C of the final test report. A copy of Appendix C should also be uploaded to the FTP site along with the Quicklook Package.

**REPORT AREA 6: TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION**

A list of test equipment and instrumentation used during the event, along with calibration data, is not needed for the test report. However, the contractor should be prepared to provide this information should the COTR request it.

### **3. DATA SHEETS**

Data sheets are provided as tools 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 the data in the order outlined in this Section.

**DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: \_\_\_\_\_ NHTSA No.: \_\_\_\_\_  
 Test Program: \_\_\_\_\_ Test Date: \_\_\_\_\_

**TEST VEHICLE INFORMATION**

**TEST VEHICLE OPTIONS**

|                             |  |                                 |  |
|-----------------------------|--|---------------------------------|--|
| NHTSA No.                   |  | Traction Control System (TCS)   |  |
| Model Year                  |  | Power Steering                  |  |
| Make                        |  | Power Window Auto-Reverse       |  |
| Model                       |  | Driver Frontal Airbag           |  |
| Body Style                  |  | Driver Curtain Airbag           |  |
| VIN                         |  | Driver Head/Torso Airbag        |  |
| Body Color                  |  | Driver Torso Airbag             |  |
| Odometer Reading (km/mi)    |  | Driver Torso/Pelvis Airbag      |  |
| Engine Displacement (L)     |  | Driver Pelvis Airbag            |  |
| Type/No. Cylinders          |  | Driver Knee Airbag              |  |
| Engine Placement            |  | Front Pass. Frontal Airbag      |  |
| Transmission Type           |  | Front Pass. Curtain Airbag      |  |
| Transmission Speeds         |  | Front Pass. Head/Torso Airbag   |  |
| Overdrive                   |  | Front Pass. Torso Airbag        |  |
| Final Drive                 |  | Front Pass. Torso/Pelvis Airbag |  |
| Roof Rack                   |  | Front Pass. Pelvis Airbag       |  |
| Sunroof/T-Top               |  | Front Pass. Knee Airbag         |  |
| Running Boards              |  | Driver Pretensioner             |  |
| Tilt Steering Wheel         |  | Driver Load Limiter             |  |
| Power Seats                 |  | Front Pass. Pretensioner        |  |
| Anti-Lock Brakes (ABS)      |  | Front Pass. Load Limiter        |  |
| Automatic Door Locks (ADLs) |  | Other                           |  |

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) |  |
|                     |  | GAWR Rear (kg)  |  |

**VEHICLE SEATING AND WEIGHT CAPACITY**

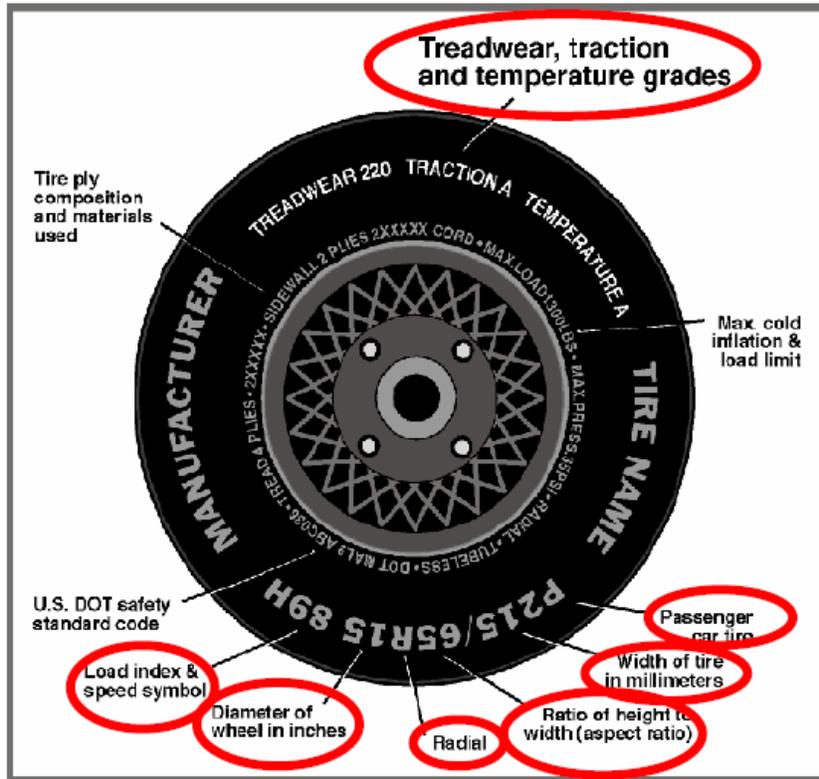
| Measured Parameter      | Front | Rear | Third | Total |
|-------------------------|-------|------|-------|-------|
| Type of Seats           |       |      |       |       |
| Number of Occupants     |       |      |       |       |
| Capacity Wt. (VCW) (kg) |       |      |       |       |
| Cargo Wt. (RCLW) (kg)   |       |      |       |       |

## DATA SHEET NO. 1 (CONTINUED) - GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: \_\_\_\_\_ NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_ Test Date: \_\_\_\_\_

Collect items circled in red, 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: \_\_\_\_\_ NHTSA No.: \_\_\_\_\_  
 Test Program: \_\_\_\_\_ Test Date: \_\_\_\_\_

**TEST VEHICLE WEIGHTS**

|        | Units | As Delivered (UVW) (Axle) |      |       | As Tested (ATW) (Axle) |      |       |
|--------|-------|---------------------------|------|-------|------------------------|------|-------|
|        |       | Front                     | Rear | Total | Front                  | Rear | Total |
| Left   | kg    |                           |      |       |                        |      |       |
| Right  | kg    |                           |      |       |                        |      |       |
| Ratio  | %     |                           |      |       |                        |      |       |
| Totals | kg    |                           |      |       |                        |      |       |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                      | Units | Value |
|---|-------|-------|
| Total Delivered Weight (UVW)            | kg    |       |
| Weight of 1 P572E ATD & 1 P572O ATD     | kg    |       |
| Rated Cargo/Luggage Weight (RCLW)       | kg    |       |
| Calculated Vehicle Target Weight (TVTW) | kg    |       |

**TEST VEHICLE ATTITUDES AND CG**

|              | Units | LF | RF | LR | RR | CG (aft of front axle) |
|--------------|-------|----|----|----|----|------------------------|
| As Delivered | mm    |    |    |    |    |                        |
| As Tested    | mm    |    |    |    |    |                        |
| Post Test    | mm    |    |    |    |    |                        |

**GENERAL TEST VEHICLE DATA**

| Measurement Description                 | Units | Value |
|---|-------|-------|
| Total Vehicle Wheel Base                | mm    |       |
| Total Vehicle Length at Left Side       | mm    |       |
| Total Vehicle Length at Centerline      | mm    |       |
| Total Vehicle Length at Right Side      | mm    |       |
| Weight of Ballast in Cargo Area         | kg    |       |
| Weight of Vehicle Components Removed    | kg    |       |
| Amount of Stoddard Solvent in Fuel Tank | L     |       |

**LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:** \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**DATA SHEET NO.1 (CONTINUED) - GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

|    | <b>Elements</b>                       | <b>Pre-Test<br/>(mm)</b> |
|----|---------------------------------------|--------------------------|
| 1  | Total Length                          |                          |
| 2  | Total Width                           |                          |
| 3  | Bumper Top Height                     |                          |
| 4  | Bumper Bottom Height                  |                          |
| 5  | Longitudinal Member Top Height        |                          |
| 6  | Distance Between Longitudinal Members |                          |
| 7  | Longitudinal Member Width             |                          |
| 8  | Engine Top Height                     |                          |
| 9  | Engine Bottom Height                  |                          |
| 10 | Engine and Gearbox Width              |                          |
| 11 | Front Bumper-Engine Distance          |                          |
| 12 | Front Shock Absorber Fixing Height    |                          |
| 13 | Bonnet Leading Edge Height            |                          |
| 14 | Front Shock Absorber Fixing Width     |                          |
| 15 | Front Bumper – Front Axle Distance    |                          |
| 16 | Front Axle – A Pillar Distance        |                          |
| 17 | A- Pillar – B-Pillar Distance         |                          |
| 18 | B-Pillar – Rear Axle Distance         |                          |
| 19 | B-Pillar – C-Pillar Distance          |                          |
| 20 | Roof Sill Bottom Height               |                          |
| 21 | Roof Sill Top Height                  |                          |
| 22 | Floor Sill Bottom Height              |                          |
| 23 | Floor Sill Top Height                 |                          |

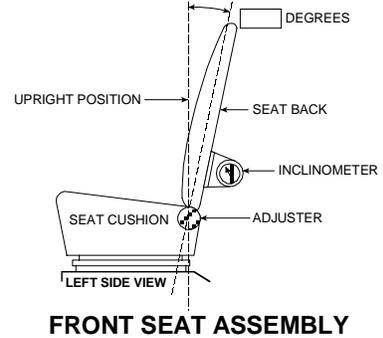
## DATA SHEET NO. 2 - SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

### NOMINAL DESIGN RIDING POSITION

For adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.



|                            | Deg. |
|----------------------------|------|
| Driver seat back angle:    |      |
| Passenger seat back angle: |      |

### SEAT FORE/AFT POSITIONS

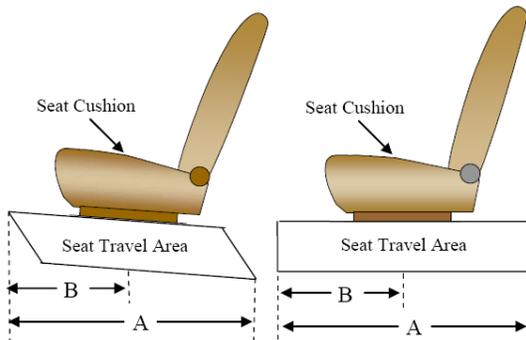
Describe the method used of determining seat fore/aft positions. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

|                | Total Fore/Aft Travel | Placed in Position # |
|----------------|-----------------------|----------------------|
| Driver Seat    |                       |                      |
| Passenger Seat |                       |                      |

### SEAT BELT UPPER ANCHORAGE

Describe the method of positioning seat belt upper anchorages. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

|                | Total # of Positions | Placed in Position # |
|----------------|----------------------|----------------------|
| Driver Seat    |                      |                      |
| Passenger Seat |                      |                      |



**DATA SHEET NO. 2 (CONTINUED) - SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

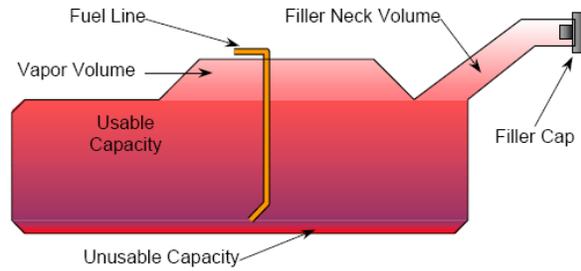
NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

**FUEL TANK CAPACITY**

|                                    | Liters |
|------------------------------------|--------|
| Usable Capacity of "Standard Tank" |        |
| Usable Capacity of "Optional Tank" |        |
| 92%-94% of Usable Capacity         |        |
| Actual Amount of Solvent Used      |        |
| 1/3 of Usable Capacity             |        |

Describe the fuel system - what type of fuel pump, details about how it operates, etc.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



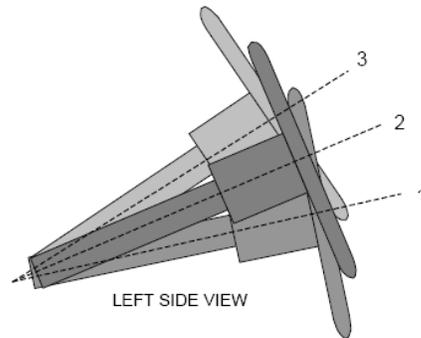
VEHICLE FUEL TANK ASSEMBLY

**STEERING COLUMN ADJUSTMENT**

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion.

Describe how this measurement was taken.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



STEERING COLUMN ASSEMBLY

**STEERING COLUMN POSITIONS**

|                                   | Degrees | Fore/Aft Position (mm) |
|-----------------------------------|---------|------------------------|
| Lowermost position No. 1          |         |                        |
| Geometric center position No. 2   |         |                        |
| Uppermost position No. 3          |         |                        |
| Telescoping Steering Wheel Travel |         |                        |
| Test Position                     |         |                        |

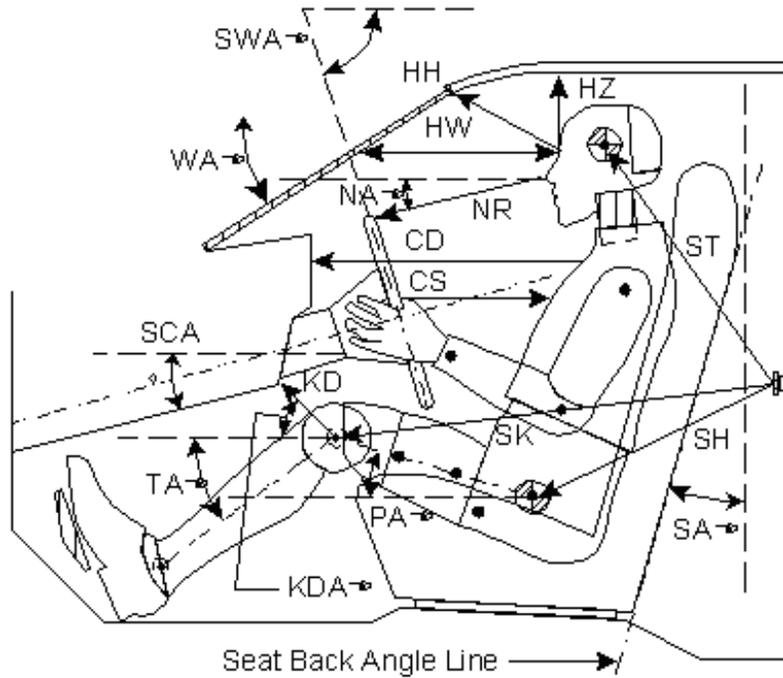
**DATA SHEET NO. 3 - DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_



| Code | Measurement Description            | Driver      |          | Passenger   |           |
|------|------------------------------------|-------------|----------|-------------|-----------|
|      |                                    | Length (mm) | Angle(°) | Length (mm) | Angle (°) |
| WA°  | Windshield Angle                   |             |          |             |           |
| SWA° | Steering Wheel Angle               |             |          |             |           |
| SCA° | Steering Column Angle              |             |          |             |           |
| SA°  | Seat Back Angle (on headrest post) |             |          |             |           |
| HZ   | Head to Roof (Z)                   |             |          |             |           |
| HH   | Head to Header                     |             |          |             |           |
| HW   | Head to Windshield                 |             |          |             |           |
| NR   | Nose to Rim                        |             |          |             |           |
| CD   | Chest to Dash                      |             |          |             |           |
| CS   | Chest to Steering Hub              |             |          |             |           |
| RA   | Rim to Abdomen                     |             |          |             |           |
| KDL  | Left Knee to Dash                  |             |          |             |           |
| KDR  | Right Knee to Dash                 |             |          |             |           |
| PA°  | Pelvic Angle                       |             |          |             |           |
| TA°  | Tibia Angle                        |             |          |             |           |
| SK   | Striker to Knee                    |             |          |             |           |
| ST   | Striker to Head                    |             |          |             |           |
| SH   | Striker to H-Point                 |             |          |             |           |

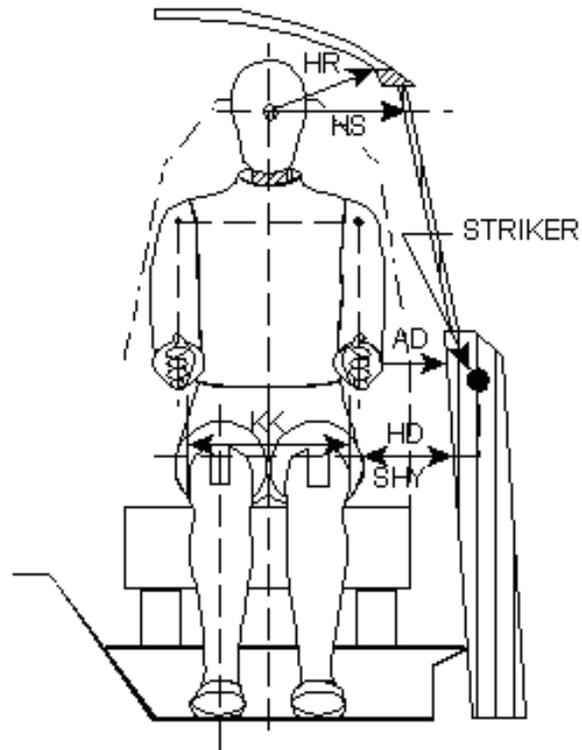
**DATA SHEET NO. 4 - DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_



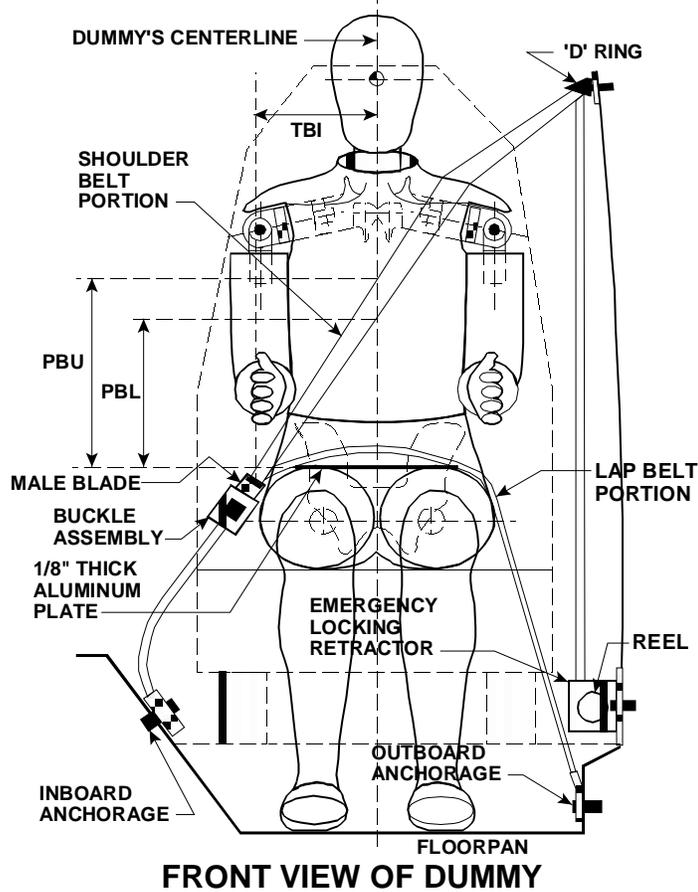
| Code | Description                      | Driver | Passenger |
|------|----------------------------------|--------|-----------|
| AD   | Arm to Door                      |        |           |
| HD   | H-Point to Door                  |        |           |
| HR   | Head to Side Header              |        |           |
| HS   | Head to Side Window              |        |           |
| KK   | Knee to Knee                     |        |           |
| SHY  | Striker to H-Point (Y Direction) |        |           |
| AA   | Ankle to Ankle                   |        |           |

**DATA SHEET NO. 5 - SEAT BELT POSITIONING DATA**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

**SEAT BELT POSITIONING DATA**



**SEAT BELT POSITIONING MEASUREMENTS**

| Measurement Description                                  | Units | Driver | Passenger |
|--|-------|--------|-----------|
| <b>PBU</b> — Top surface of reference to belt upper edge | mm    |        |           |
| <b>PBL</b> — Top surface of reference to belt lower edge | mm    |        |           |

**BELT LENGTH DATA**

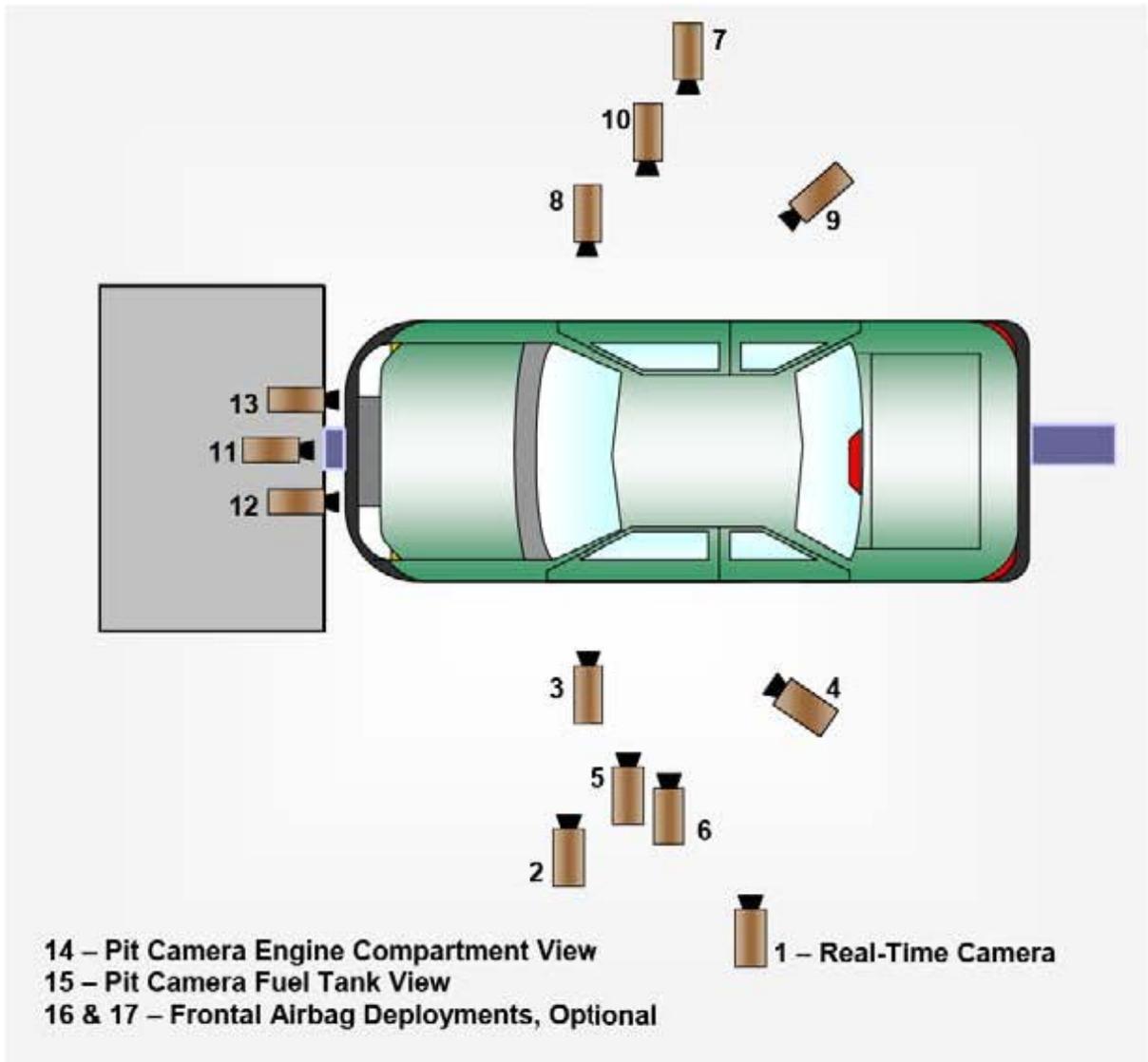
| Measurement Description                          | Units | Driver | Passenger |
|--|-------|--------|-----------|
| Shoulder belt length as measured on ATD          | mm    |        |           |
| Lap Belt Length as measured on ATD               | mm    |        |           |
| Remainder of belt on reel                        | mm    |        |           |
| Total belt length for continuous webbing systems | mm    |        |           |

### DATA SHEET NO. 6 - HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: \_\_\_\_\_  
Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
Test Date: \_\_\_\_\_

#### CAMERA POSITIONS FOR FRONTAL IMPACTS



**DATA SHEET NO. 6 (CONTINUED) - HIGH-SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

**CAMERA LOCATIONS**

| No. | Camera View                         | Location (mm) |   |   | Lens (mm) | Speed (fps) |
|-----|-------------------------------------|---------------|---|---|-----------|-------------|
|     |                                     | X             | Y | Z |           |             |
| 1   | Real-Time Left Overall              |               |   |   |           |             |
| 2   | Driver Close-Up                     |               |   |   |           |             |
| 3   | Left Front Half                     |               |   |   |           |             |
| 4   | Left Angle                          |               |   |   |           |             |
| 5   | Steering Column - Top               |               |   |   |           |             |
| 6   | Steering Column - Bottom            |               |   |   |           |             |
| 7   | Right Overall                       |               |   |   |           |             |
| 8   | Passenger Close-Up                  |               |   |   |           |             |
| 9   | Right Angle                         |               |   |   |           |             |
| 10  | Right Front Half                    |               |   |   |           |             |
| 11  | Windshield                          |               |   |   |           |             |
| 12  | Driver Windshield                   |               |   |   |           |             |
| 13  | Passenger Windshield                |               |   |   |           |             |
| 14  | Pit Front                           |               |   |   |           |             |
| 15  | Pit Rear                            |               |   |   |           |             |
| 16  | Onboard Driver Airbag (Optional)    |               |   |   |           |             |
| 17  | Onboard Passenger Airbag (Optional) |               |   |   |           |             |

## \* COORDINATES:

+X = forward of impact plane

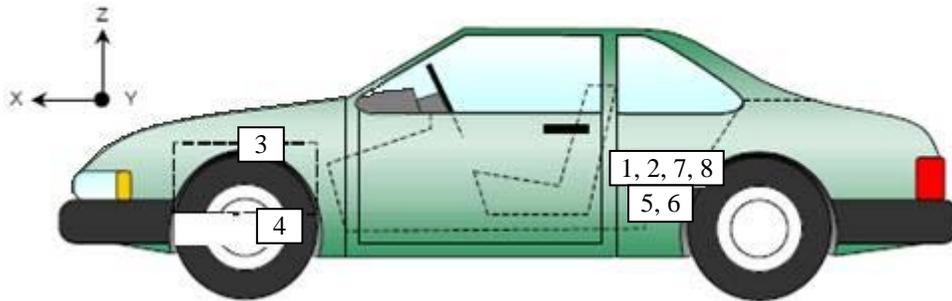
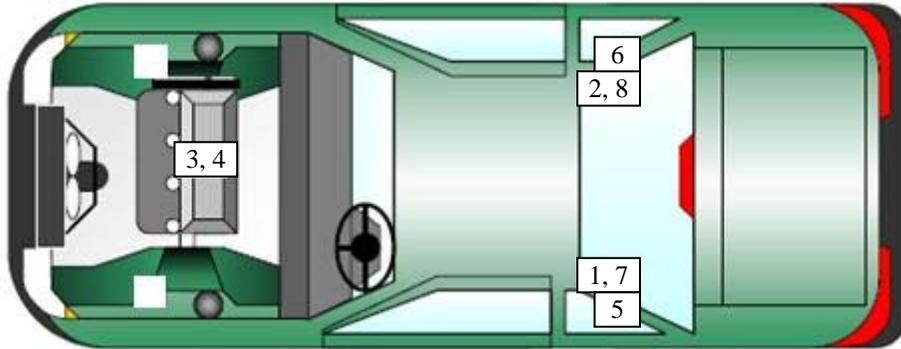
+Y = right of monorail center

+Z = into ground

**DATA SHEET NO. 7 - VEHICLE ACCELEROMETER DATA**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_



**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

| No. | Accelerometer Location                          | Measurements (mm) |   |   |
|-----|---|-------------------|---|---|
|     |   | X                 | Y | Z |
| 1   | Left Rear Accelerometer - x Direction           |                   |   |   |
| 2   | Right Rear Accelerometer - x Direction          |                   |   |   |
| 3   | Engine Top x                                    |                   |   |   |
| 4   | Engine Bottom x                                 |                   |   |   |
| 5   | Left Rear Accelerometer - z Direction           |                   |   |   |
| 6   | Right Rear Accelerometer - z Direction          |                   |   |   |
| 7   | Left Rear Accelerometer - x Direction Redundant |                   |   |   |
| 8   | Right Rear Accelerometer- x Direction Redundant |                   |   |   |

Reference Points: x – Rear Surface of Vehicle (+ forward)  
 y – Vehicle Centerline (+ to right)  
 z – Ground Plane (+ down)

**DATA SHEET NO. 8 - PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: \_\_\_\_\_

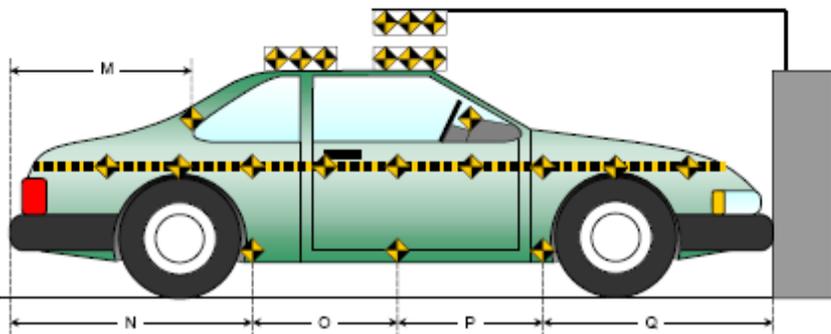
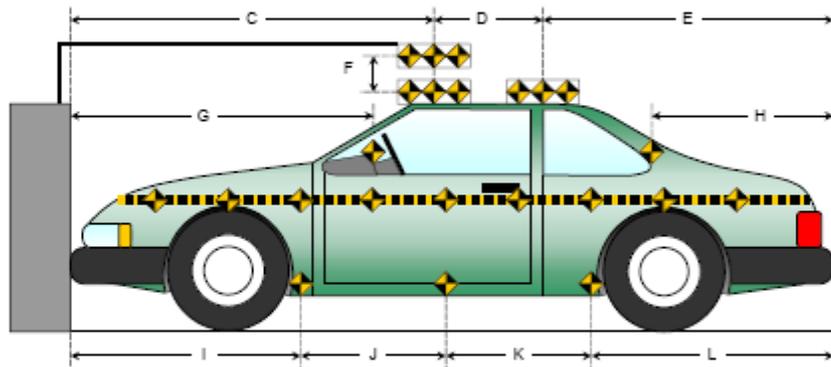
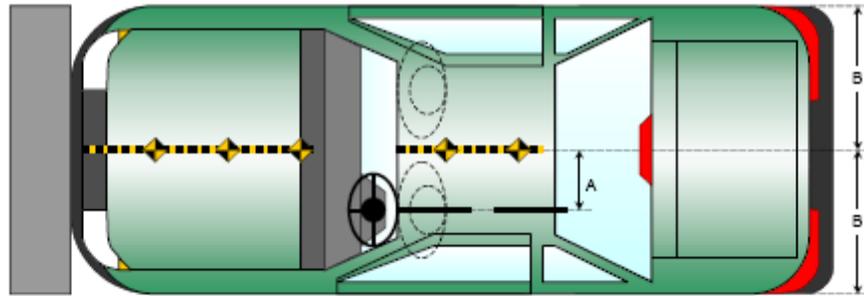
NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

| Item | Value |
|------|-------|
| A    |       |
| B    |       |
| C    |       |
| D    |       |
| E    |       |
| F    |       |
| G    |       |
| H    |       |
| I    |       |
| J    |       |
| K    |       |
| L    |       |
| M    |       |
| N    |       |
| O    |       |
| P    |       |
| Q    |       |

All units in millimeters

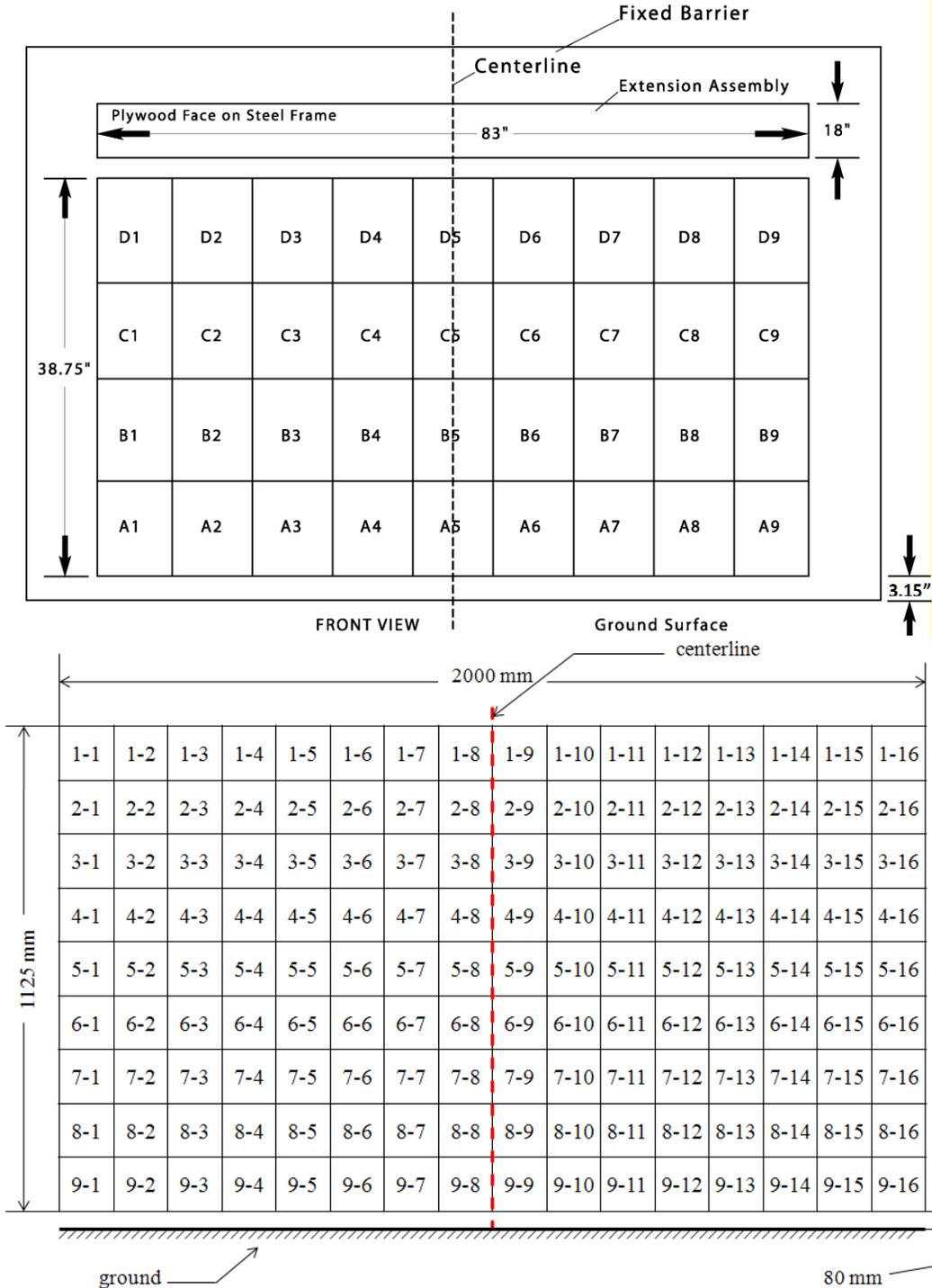


**DATA SHEET NO. 9 - LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

*Insert Schematic of Load Cell Barrier as Applicable*



**DATA SHEET NO. 10 -TEST VEHICLE SUMMARY OF RESULTS**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

**INSTRUMENTATION**

| <b>Instrumentation</b>           | <b>Number of Channels Collected</b> |
|----------------------------------|-------------------------------------|
| Driver Dummy Accelerometers      |                                     |
| Passenger Dummy Accelerometers   |                                     |
| Vehicle Structure Accelerometers |                                     |
| <b>Total</b>                     |                                     |

**CAMERA COVERAGE**

| <b>Type of Camera</b>      | <b>Number Used in this Test</b> |
|----------------------------|---------------------------------|
| High-Speed Vehicle Onboard |                                 |
| High-Speed Offboard        |                                 |
| Real-Time Panning          |                                 |
| <b>Total</b>               |                                 |

**DATA SHEET NO. 11 - POST-TEST OBSERVATIONS**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

**TEST DUMMY INFORMATION AND CONTACT LOCATIONS**

| Description           | Driver | Passenger |
|-----------------------|--------|-----------|
| Dummy Type/Serial No. |        |           |
| Head Contact          |        |           |
| Upper Torso Contact   |        |           |
| Lower Torso Contact   |        |           |
| Left Knee Contact     |        |           |
| Right Knee Contact    |        |           |

**DOOR OPENING AND SEAT TRACK INFORMATION**

| Description           | Driver | Passenger |
|-----------------------|--------|-----------|
| Locked/Unlocked Doors |        |           |
| Front Door Opening    |        |           |
| Rear Door Opening     |        |           |
| Seat Track Shift (mm) |        |           |
| Seat Back Failure     |        |           |

**POST-TEST STRUCTURAL OBSERVATIONS**

| Critical Areas of Performance | Observations and Conclusions |
|-------------------------------|------------------------------|
| Windshield Damage             |                              |
| Window Damage                 |                              |
| Other Notable Effects         |                              |

**VEHICLE REBOUND FROM BARRIER**

| Measured Parameter | Units | Value |
|--------------------|-------|-------|
| Left Side          | mm    |       |
| Center             | mm    |       |
| Right Side         | mm    |       |
| Average            | mm    |       |

**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

| Restraint Type                         | Driver (Occupant 1) |          | Passenger (Occupant 2) |          |
|--|---------------------|----------|------------------------|----------|
|  | Installed           | Deployed | Installed              | Deployed |
| Front Airbag                           |                     |          |                        |          |
| *Indicate side airbag type in vehicle* |                     |          |                        |          |
| *Indicate side airbag type in vehicle* |                     |          |                        |          |
| Knee Airbag                            |                     |          |                        |          |
| Seat Belt Pretensioner                 |                     |          |                        |          |
| Seat Belt Load Limiter                 |                     |          |                        |          |
| Other                                  |                     |          |                        |          |

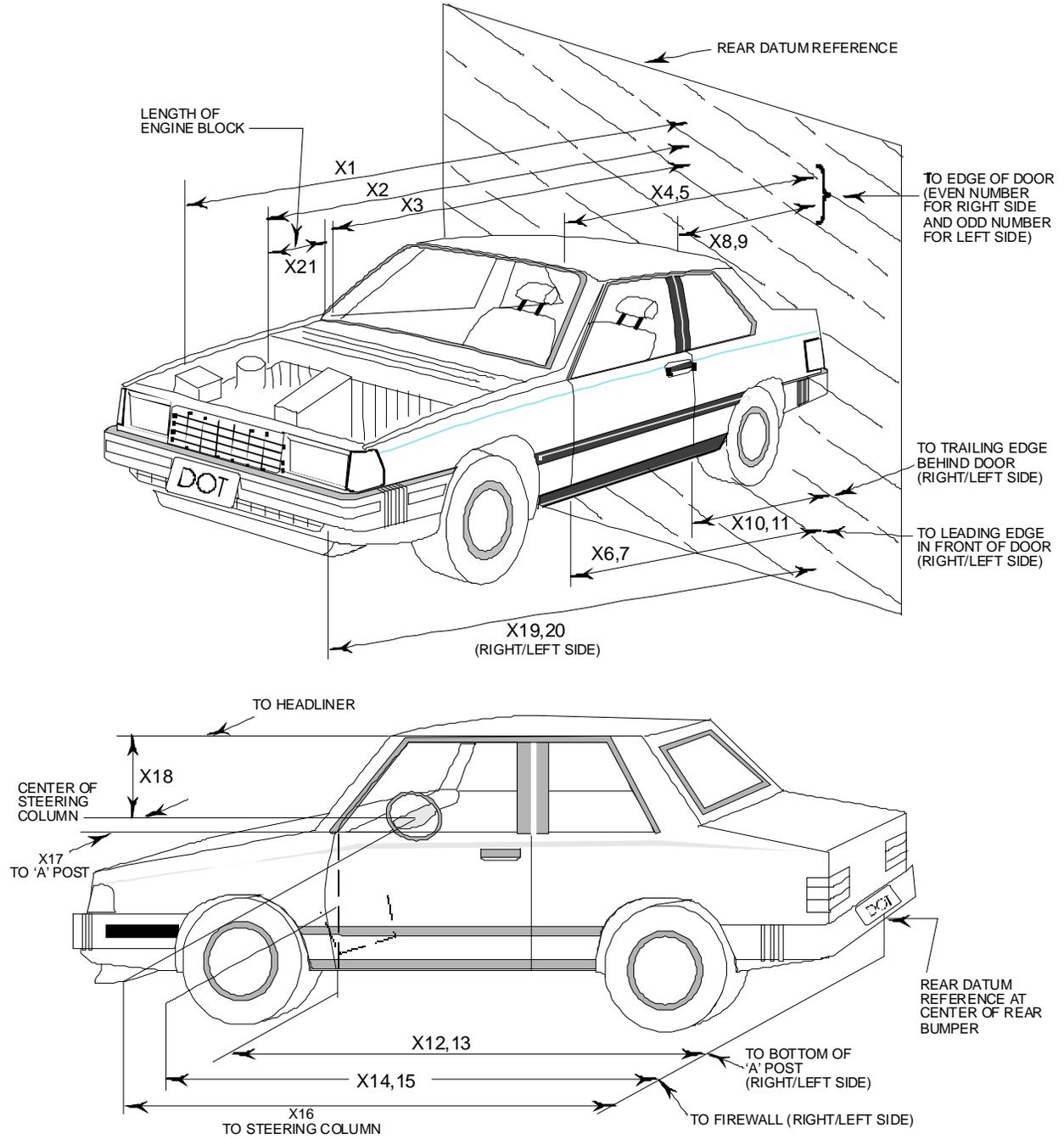
### DATA SHEET NO. 12 - VEHICLE PROFILE MEASUREMENTS

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_



**DATA SHEET NO. 12 (CONTINUED) - VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

| No. | Measurement Description                           | Pre-Test | Post-Test | Difference |
|-----|---|----------|-----------|------------|
| 1   | Total Length of Vehicle at Centerline             |          |           |            |
| 2   | Rear Surface of Vehicle (RSOV) to Front of Engine |          |           |            |
| 3   | RSOV to Firewall                                  |          |           |            |
| 4   | RSOV to Upper Leading Edge of Right Door          |          |           |            |
| 5   | RSOV to Upper Leading Edge of Left Door           |          |           |            |
| 6   | RSOV to Lower Leading Edge of Right Door          |          |           |            |
| 7   | RSOV to Lower Leading Edge of Left Door           |          |           |            |
| 8   | RSOV to Upper Trailing Edge of Right Door         |          |           |            |
| 9   | RSOV to Upper Trailing Edge of Left Door          |          |           |            |
| 10  | RSOV to Lower Trailing Edge of Right Door         |          |           |            |
| 11  | RSOV to Lower Trailing Edge of Left Door          |          |           |            |
| 12  | RSOV to Bottom of "A" Post of Right Side          |          |           |            |
| 13  | RSOV to Bottom of "A" Post of Left Side           |          |           |            |
| 14  | RSOV to Firewall, Right Side                      |          |           |            |
| 15  | RSOV to Firewall, Left Side                       |          |           |            |
| 16  | RSOV to Steering Column                           |          |           |            |
| 17  | Center of Steering Column to "A" Post             |          |           |            |
| 18  | Center of Steering Column to Headliner            |          |           |            |
| 19  | RSOV to Right Side of Front Bumper                |          |           |            |
| 20  | RSOV to Left Side of Front Bumper                 |          |           |            |
| 21  | Length of Engine Block                            |          |           |            |
| RD  | RSOV to Right Side of Dash Panel                  |          |           |            |
| CD  | RSOV to Center of Dash Panel                      |          |           |            |
| LD  | RSOV to Left Side of Dash Panel                   |          |           |            |

All Dimensions in mm

**DATA SHEET NO. 13 - ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

**VEHICLE INFORMATION**

VIN: \_\_\_\_\_  
 Vehicle Size Category: \_\_\_\_\_

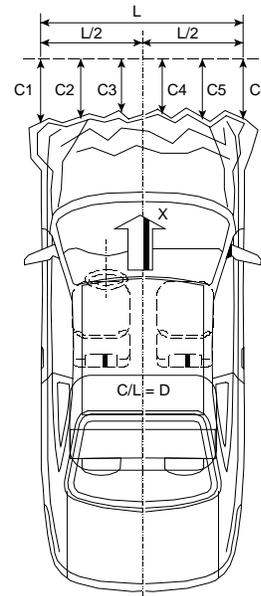
Wheelbase: \_\_\_\_\_  
 Test Weight (kg): \_\_\_\_\_

**ACCELEROMETER DATA**

Accelerometer Locations: \_\_\_\_\_  
 Cal. Procedure/Interval: \_\_\_\_\_  
 Integration Algorithm: \_\_\_\_\_  
 Linearity: \_\_\_\_\_  
 Impact Velocity (km/h): \_\_\_\_\_  
 Velocity Change (km/h): \_\_\_\_\_  
 Time of Separation (ms): \_\_\_\_\_

**CRUSH PROFILE**

Collision Deformation Classification: \_\_\_\_\_  
 Midpoint of Damage: \_\_\_\_\_  
 Damage Region Length (mm): \_\_\_\_\_  
 Impact Mode: \_\_\_\_\_



| No. | Measurement Description    | Units | Pre-Test | Post-Test | Difference |
|-----|----------------------------|-------|----------|-----------|------------|
| C1  | Crush zone 1 at left side  | mm    |          |           |            |
| C2  | Crush zone 2 at left side  | mm    |          |           |            |
| C3  | Crush zone 3 at left side  | mm    |          |           |            |
| C4  | Crush zone 4 at right side | mm    |          |           |            |
| C5  | Crush zone 5 at right side | mm    |          |           |            |
| C6  | Crush zone 6 at right side | mm    |          |           |            |
| L   | C1 to C6                   | mm    |          |           |            |

**DATA SHEET NO. 14 - VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

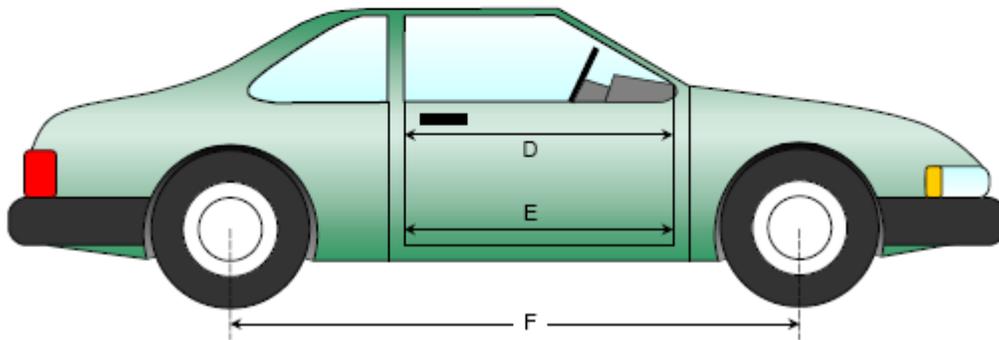
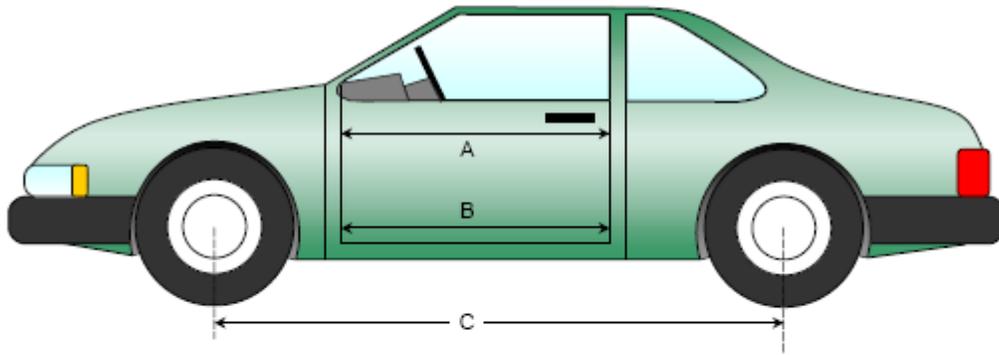
Test Date: \_\_\_\_\_

**DOOR OPENING WIDTH**

| Item | Description      | Units | Pre-Test | Post-Test | Difference |
|------|------------------|-------|----------|-----------|------------|
| A    | Left Side Upper  | mm    |          |           |            |
| B    | Left Side Lower  | mm    |          |           |            |
| D    | Right Side Upper | mm    |          |           |            |
| E    | Right Side Lower | mm    |          |           |            |

**WHEELBASE MEASUREMENTS**

| Item | Description          | Units | Pre-Test | Post-Test | Difference |
|------|----------------------|-------|----------|-----------|------------|
| C    | Left Side Wheelbase  | mm    |          |           |            |
| F    | Right Side Wheelbase | mm    |          |           |            |



**DATA SHEET NO.14 (CONTINUED) - VEHICLE INTRUSION MEASUREMENTS**

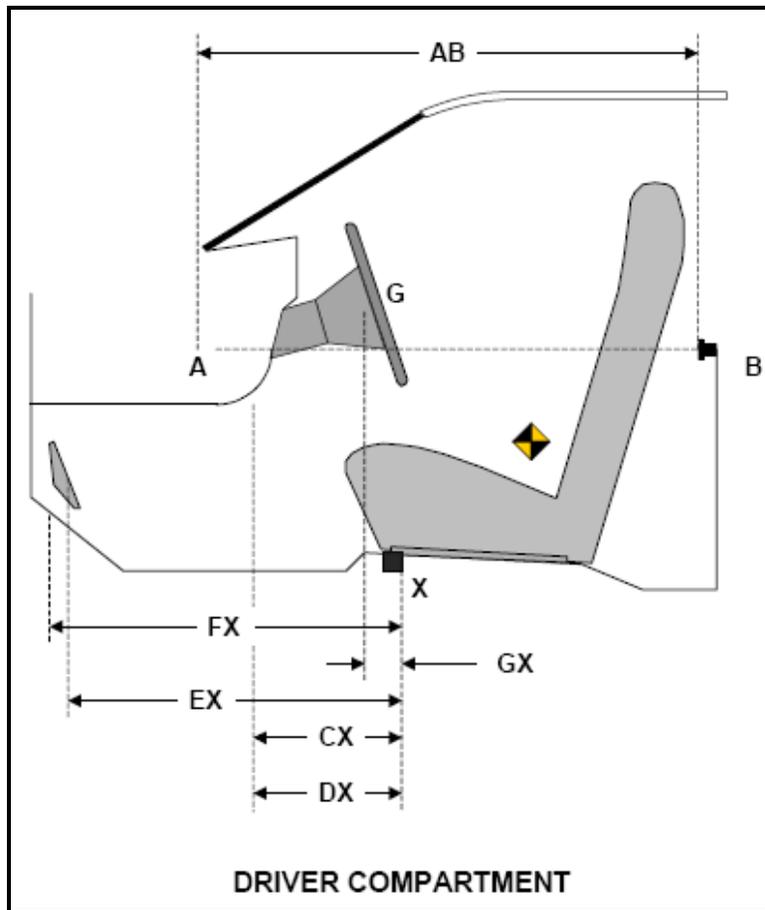
Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_

**DRIVER COMPARTMENT INTRUSION**

| Item | Description                              | Units | Pre-Test | Post-Test | Difference |
|------|--|-------|----------|-----------|------------|
| AB   | Door Opening (Inside Window Jam)         | mm    |          |           |            |
| CX   | Left Knee Bolster to X                   | mm    |          |           |            |
| DX   | Right Knee Bolster to X                  | mm    |          |           |            |
| EX   | Brake Pedal to X                         | mm    |          |           |            |
| FX   | Foot Rest to X                           | mm    |          |           |            |
| GX   | Center of Steering Column Wheel Hub to X | mm    |          |           |            |

*X = Front of Seat Track (Stationary)*



**DATA SHEET NO. 15 - SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

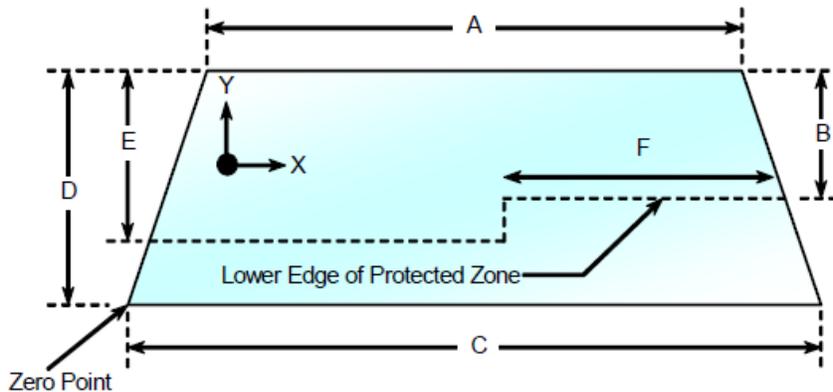
Please provide windshield mounting details. \_\_\_\_\_

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: \_\_\_\_\_

**WINDSHIELD PERIPHERY MEASUREMENTS**

| Measurement | Pre-Test (mm) | Post-Test (mm) | % Retention |
|-------------|---------------|----------------|-------------|
| Left Side   |               |                |             |
| Right Side  |               |                |             |
| Total       |               |                |             |



FRONT VIEW OF WINDSHIELD

| Item | Units | Value |
|------|-------|-------|
| A    | mm    |       |
| B    | mm    |       |
| C    | mm    |       |
| D    | mm    |       |
| E    | mm    |       |
| F    | mm    |       |

**AREAS OF PROTECTED ZONE FAILURES**

A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

**DATA SHEET NO. 15 (CONTINUED) - SUMMARY OF FMVSS 212, 219 (PARTIAL),  
AND 301 DATA**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

Temperature at Time of Impact: \_\_\_\_\_

Test Time: \_\_\_\_\_

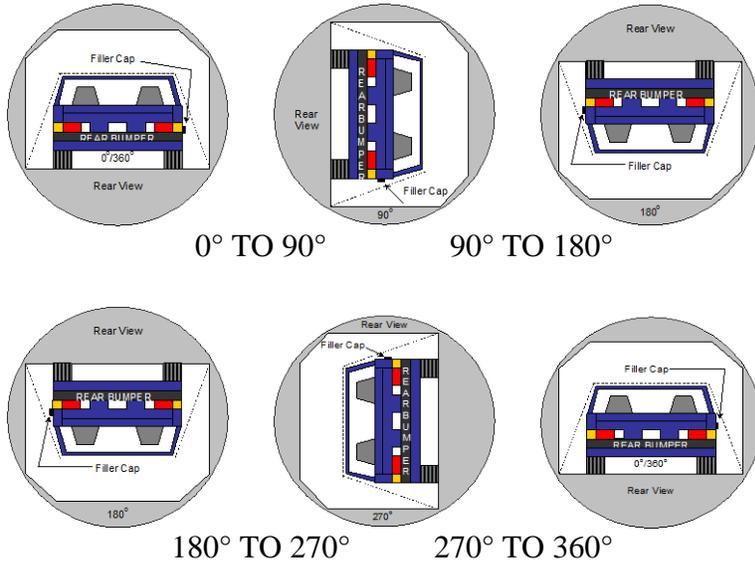
**Stoddard Solvent Spillage Measurements**

- A. From impact until vehicle motion ceases: \_\_\_\_\_ oz.  
(maximum allowable = 1 oz.)
- B. For the 5-minute period after motion ceases: \_\_\_\_\_ oz.  
(maximum allowable = 5 oz.)
- C. For the following 25 minutes: \_\_\_\_\_ oz.  
(maximum allowable = 1 oz./minute)
- D. Spillage: \_\_\_\_\_

**DATA SHEET NO. 16 - FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: \_\_\_\_\_  
 Test Program: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_  
 Test Date: \_\_\_\_\_



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

**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 301 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° |                 |              |                |               |

**SOLVENT SPILLAGE LOCATION TABLE**

| Test Phase   | Spillage Location |
|--------------|-------------------|
| 0° to 90°    |                   |
| 90° to 180°  |                   |
| 180° to 270° |                   |
| 270° to 360° |                   |

**DATA SHEET NO. 17 - DUMMY/VEHICLE TEMPERATURE STABILIZATION**

Test Vehicle: \_\_\_\_\_

NHTSA No.: \_\_\_\_\_

Test Program: \_\_\_\_\_

Test Date: \_\_\_\_\_

Please place the temperature stabilization chart/data in this space.

#### 4. 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 discarded.

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. 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

A “Quicklook Report” of pertinent test data should be prepared and sent via e-mail to pertinent NHTSA personnel within twenty-four (24) hours of test completion.

**FORM NO. 1 - TEST VEHICLE INFORMATION**

NCAP Frontal, Side MDB, and Side Pole Tests

Vehicle Model Year and Make: \_\_\_\_\_

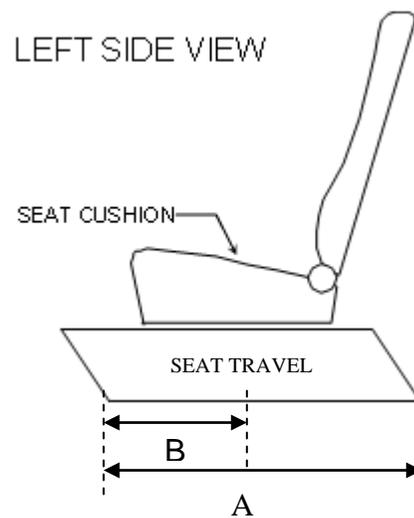
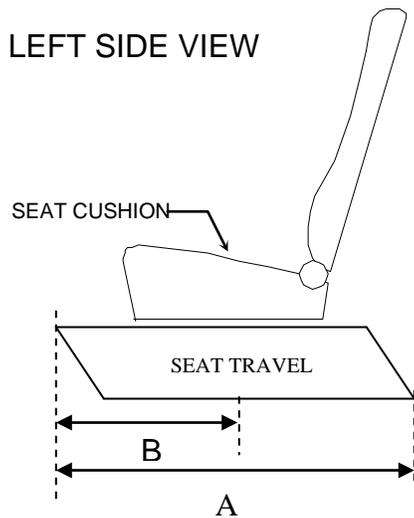
Vehicle Model and Body Style: \_\_\_\_\_

**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 50<sup>th</sup> male and the Side NCAP 50<sup>th</sup> 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 POSITIONING FOR ALL NCAP 50<sup>TH</sup> PERCENTILE MALE DUMMIES

SEAT OTHER NCAP



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 (50<sup>th</sup> Male Driver), FMVSS 208 S16.2.10.3 (5<sup>th</sup> Female Front Passenger), FMVSS 214 S8.3.1.3 (50<sup>th</sup> Male Driver), FMVSS 214 S10.3.2.3 (5<sup>th</sup> Female Driver), and FMVSS 214 S8.3.3.3 (5<sup>th</sup> 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 <sup>th</sup> percentile male): |  |
| Side impact test detent* (50 <sup>th</sup> percentile male):    |  |
| Side impact test detent* (5 <sup>th</sup> 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 <sup>th</sup> percentile male): |  |
| Complete range of travel as determined for Side NCAP (mm):                                  |  |
| Side impact test distance from the foremost position (50 <sup>th</sup> percentile male):    |  |
| Side impact test distance from the foremost position (5 <sup>th</sup> 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 <sup>th</sup> Male |            |                        |
|  |            |                        |
| Side Impact – 50 <sup>th</sup> Male    |            |                        |
|  |            |                        |
| Side Impact – 5 <sup>th</sup> 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 <sup>th</sup> Male |             |                        |
|  |             |                        |
| Side Impact – 50 <sup>th</sup> Male    |             |                        |
|  |             |                        |
| Side Impact – 5 <sup>th</sup> 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** (5<sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup><br>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 <sup>th</sup><br>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** (5<sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> Female |            |                        |
|                                      |            |                        |

**1.3D** Provide any other instructions for positioning the rear seat at the required test position:

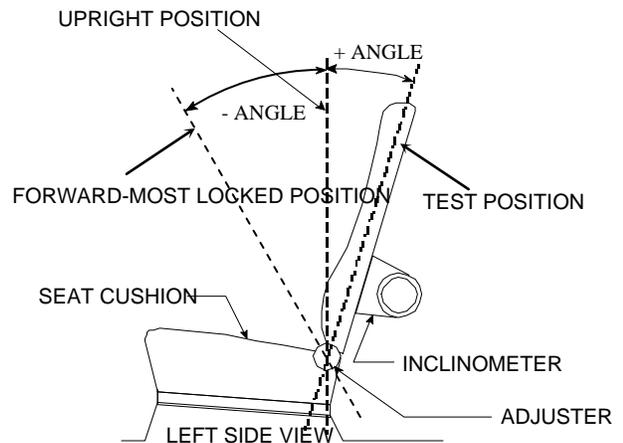
Side MDB: \_\_\_\_\_  
 \_\_\_\_\_

**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 <sup>th</sup> Male |       |
| Side Impact – 50 <sup>th</sup> Male    |       |
| Side Impact – 5 <sup>th</sup> 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 50<sup>th</sup> male dummy, the seat back angle will be set to the Nominal Design Position. For the side impact test with the 5<sup>th</sup> female dummy, the seat back angle will be determined by the related dummy seating procedure.)

| Dummy                                     | Angle |
|---|-------|
| Frontal Impact – 50 <sup>th</sup><br>Male |       |
| Side Impact – 50 <sup>th</sup> Male       |       |
| Side Impact – 5 <sup>th</sup> Female      |       |

For the 50<sup>th</sup> 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 (5<sup>th</sup> 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 <sup>th</sup><br>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 <sup>th</sup><br>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 2<sup>nd</sup> Row Seat** (5<sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> Female |       |

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2.4 3<sup>rd</sup> Row Seat** (side impact only)

The seat should be set to accommodate a 5<sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> Female |       |

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

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**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 <sup>th</sup> Male  |                            |  |                                      |                    |
| Driver/Front Passenger – 5 <sup>th</sup> Female |                            |  |                                      |                    |
| Rear Passenger - 5 <sup>th</sup> 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:

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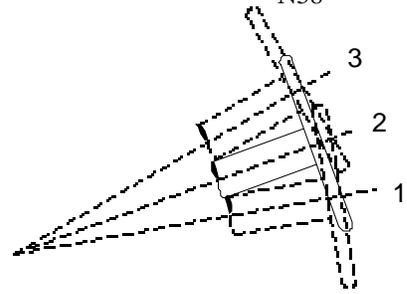
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5. **STEERING COLUMN AND WHEEL ADJUSTMENTS**

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

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|  |  |
|--|--|
| 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).)

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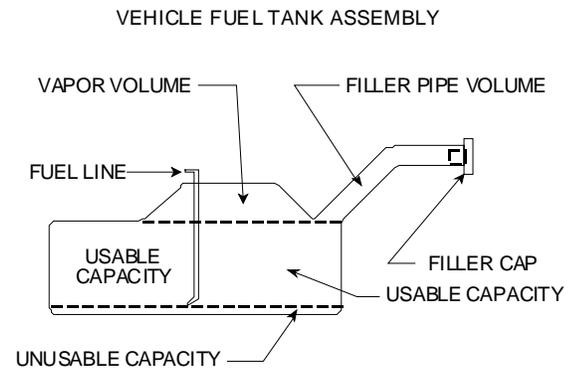
**7. DUMMY MEASUREMENTS FOR THE 50<sup>TH</sup> MALE AND 5<sup>TH</sup> FEMALE**

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:

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Suggested methods for draining:

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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:

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Provide a drawing (or description) that shows the undercarriage view and/or location of the fuel tank.

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**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 5<sup>th</sup> percentile female or 50<sup>th</sup> 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.

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**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.

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**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.

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**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 tests: 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:

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Side MDB NCAP test:

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Side Pole NCAP test

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**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:

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Side MDB NCAP test:

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Side Pole NCAP test:

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## 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.



**FORM NO. 2 - REPORT OF VEHICLE CONDITION**

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**

Remarks:

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

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Explanation for equipment removal:

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Test vehicle condition:

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| Position              | 1                      |                 | 2                                     |                 | 3   | 4                        | 5                           |
|-----------------------|------------------------|-----------------|---------------------------------------|-----------------|---|--------------------------|-----------------------------|
|                       | Is Seat Track Movable? | Power or Manual | Is Adjacent Window in Good Condition? | Power or Manual | Adjacent Door Works Properly/In Good Condition? | Is Seat Airbag Deployed? | Is Curtain Airbag Deployed? |
|                       | Yes/No/N<br>A          |                 | Yes/No                                |                 | Yes/No/NA                                       | Yes/No/N<br>A            | 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:

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RECORDED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
APPROVED BY: \_\_\_\_\_

**FORM NO. 3 - LABORATORY NOTICE OF TEST FAILURE  
FRONTAL IMPACT PROTECTION**

**TEST DATE:** \_\_\_\_\_

**LABORATORY:** \_\_\_\_\_

**CONTRACT NO:** \_\_\_\_\_; **DELV. ORDER NO:** \_\_\_\_\_

**LAB PROJECT ENGINEER'S NAME:** \_\_\_\_\_

**VEH.MY/MAKE/MODEL:** \_\_\_\_\_

**VEHICLE BODY STYLE:** \_\_\_\_\_; **BUILD DATE:** \_\_\_\_\_

**NHTSA NO.:** \_\_\_\_\_; **VIN:** \_\_\_\_\_

**DUMMY #:** \_\_\_\_\_

**TEST FAILURE DESCRIPTION:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**S214 REQUIREMENT, PARAGRAPH §:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**NOTIFICATION TO NHTSA (COTR):** \_\_\_\_\_

**DATE:** \_\_\_\_\_ **BY:** \_\_\_\_\_

**REMARKS:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**FORM NO. 4 - MONTHLY VEHICLE STATUS REPORT**

**NCAP**

**DATE OF REPORT:** \_\_\_\_\_

| <b>No.</b> | <b>Vehicle NHTSA No., Make and Model</b> | <b>Date of Delivery</b> | <b>Odometer Reading</b> | <b>Test Complete Date</b> | <b>Vehicle Shipment Date</b> | <b>Odometer Reading</b> |
|------------|--|-------------------------|-------------------------|---------------------------|------------------------------|-------------------------|
| 1          |  |                         |                         |                           |                              |                         |
| 2          |  |                         |                         |                           |                              |                         |
| 3          |  |                         |                         |                           |                              |                         |
| 4          |  |                         |                         |                           |                              |                         |
| 5          |  |                         |                         |                           |                              |                         |
| 6          |  |                         |                         |                           |                              |                         |
| 7          |  |                         |                         |                           |                              |                         |
| 8          |  |                         |                         |                           |                              |                         |
| 9          |  |                         |                         |                           |                              |                         |
| 10         |  |                         |                         |                           |                              |                         |
| 11         |  |                         |                         |                           |                              |                         |
| 12         |  |                         |                         |                           |                              |                         |
| 13         |  |                         |                         |                           |                              |                         |
| 14         |  |                         |                         |                           |                              |                         |

**FORM NO. 5 – SAMPLE QUICKLOOK REPORT**

Laboratory Name and Logo

**QUICKLOOK REPORT**  
 56 km/h (35 mph) Frontal Impact NCAP Rigid Barrier Test  
 Model Year/Make/Model/Trimline/Body Style/NHTSA No. MXXXXX  
 Test Date (Month, Day, Year)

| Injury Reading                   | Units   | Driver, 50th Percentile Male |       |    |    | Passenger, 5th Percentile Female |       |    |    |
|----------------------------------|---------|------------------------------|-------|----|----|----------------------------------|-------|----|----|
|                                  |         | Limit                        | Value | t1 | t2 | Limit                            | Value | t1 | t2 |
| HIC 15                           | None    | 700                          |       |    |    | 700                              |       |    |    |
| Nij                              | None    | 1                            |       |    |    | 1                                |       |    |    |
| Upper Neck Force Z (Tension)     | Newtons | 4170                         |       |    |    | 2620                             |       |    |    |
| Upper Neck Force Z (Compression) | Newtons | 4000                         |       |    |    | 2520                             |       |    |    |
| Upper Neck Moment Y (Flexion)    | Newtons | 310                          |       |    |    | 155                              |       |    |    |
| Upper Neck Moment Y (Extension)  | Newtons | 135                          |       |    |    | 67                               |       |    |    |
| Chest Displacement               | mm      | 63                           |       |    |    | 52                               |       |    |    |
| 3ms Chest Clip                   | Gs      | 60                           |       |    |    | 60                               |       |    |    |
| Femur Force, Left                | N       | 10000                        |       |    |    | 6800                             |       |    |    |
| Femur Force, Right               | N       | 10000                        |       |    |    | 6800                             |       |    |    |

|                                | Test Particulars |       |               |       |
|--------------------------------|------------------|-------|---------------|-------|
|                                | Metric Units     |       | English Units |       |
|                                | Units            | Value | Units         | Value |
| Vehicle Impact Velocity        | km/h             |       | mph           |       |
| Vehicle Curb Weight            | kg               |       | lbs           |       |
| Vehicle Test Weight            | kg               |       | lbs           |       |
| As Delivered Vehicle Width     | mm               |       | Inches        |       |
| As Delivered Vehicle Wheelbase | mm               |       | Inches        |       |
| As Delivered Vehicle Length    | mm               |       | Inches        |       |

| Standards Measured Post-Test              |           |
|---|-----------|
| 212 - Windshield Periphery Retention      | Pass/Fail |
| 219 (partial) - Windshield Zone Intrusion | Pass/Fail |
| 301- Fuel System Integrity                | Pass/Fail |

|                         | Vehicle Safety Features |           |
|-------------------------|-------------------------|-----------|
|                         | Driver                  | Passenger |
| Pretensioners           | Yes/No                  | Yes/No    |
| Load Limiters           | Yes/No                  | Yes/No    |
| Adjustable Belt Anchors | Yes/No                  | Yes/No    |
| ABS                     | Yes/No                  |           |
| ADLs                    | Yes/No                  |           |

|              | Airbag Deployment |           |                      |           |
|--------------|-------------------|-----------|----------------------|-----------|
|              | Driver (P1)       |           | Front Passenger (P2) |           |
|              | Deployment        | Mount     | Deployment           | Mount     |
| Front        | Yes/No/NA         | St. Wheel | Yes/No/NA            | Dash      |
| Knee         | Yes/No/NA         | Dash/N/A  | Yes/No/NA            | Dash/N/A  |
| Side Torso   | Yes/No/NA         | Seat/Door | Yes/No/NA            | Seat/Door |
| Side Curtain | Yes/No/NA         | Header    | Yes/No/NA            | Header    |

| Test Vehicle Doors             |           |
|--------------------------------|-----------|
| Can Disable ADLs Using Owner's | Yes/No/NA |
| Doors Locked (Pre-Test)        | Yes/No/NA |
| Doors Latched (Post-Test)      | Yes/No/NA |

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## **APPENDIX O**

**-RESERVED-**

## **APPENDIX P**

### **LOAD CELL BARRIER CONFIGURATIONS**

## APPENDIX P LOAD CELL BARRIERS

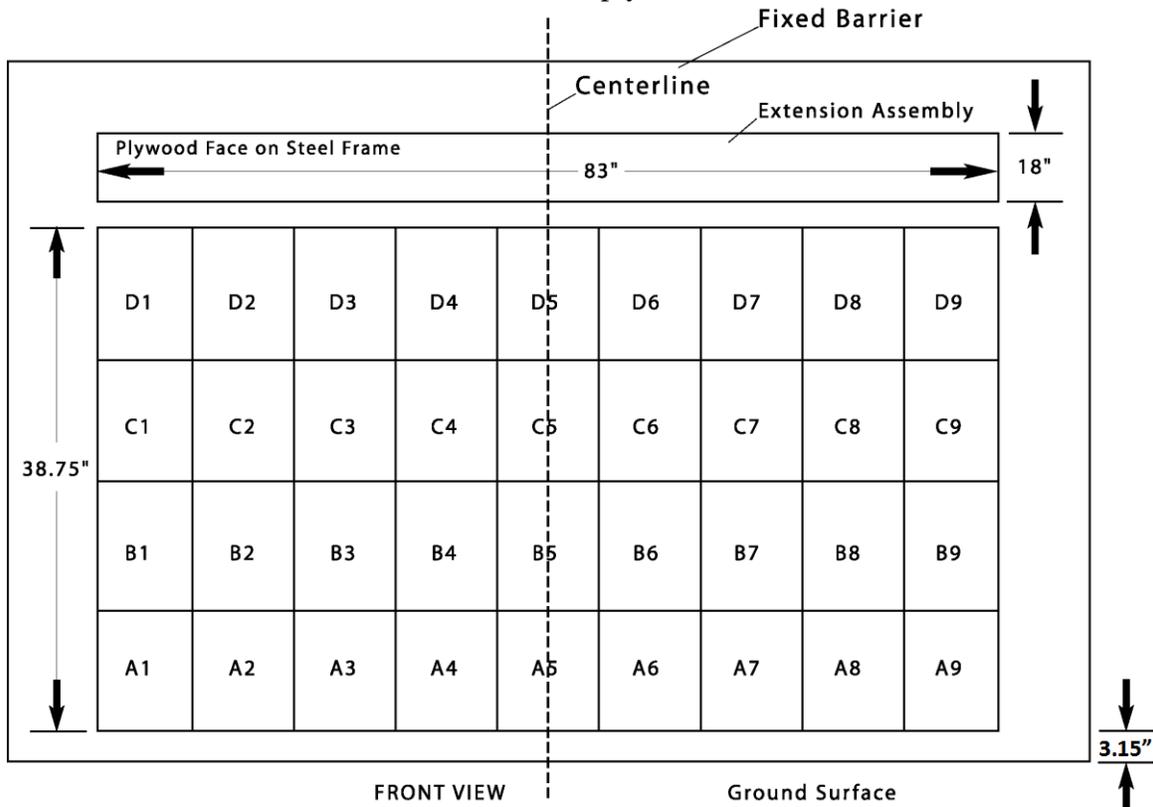
### 1. PURPOSE

In conjunction with NHTSA’s compatibility research activities, frontal NCAP tests may be used as a means of collecting data through load cells mounted to the rigid barrier wall. In these cases, an array of load cells will be provided to the contractor. The type and amount of load cells furnished will dictate their installation on the rigid barrier wall. The following serves to describe a few typical load cell wall arrangements.

### 2. 36-LOAD CELL BARRIER

One typical load cell wall contains 36 load cells, 250mm x 250mm in size, arranged in 4 rows of 9 load cells in each as seen in **Figure 1**. The load cells are single-axis and record force in the x-direction.

An 18 x 83-inch extension can be added to the top of the load cell barrier illustrated (as seen in **Figure 1**) to prevent vehicle hood override. The rigid steel frame shall be faced with ¾-inch thick plywood.

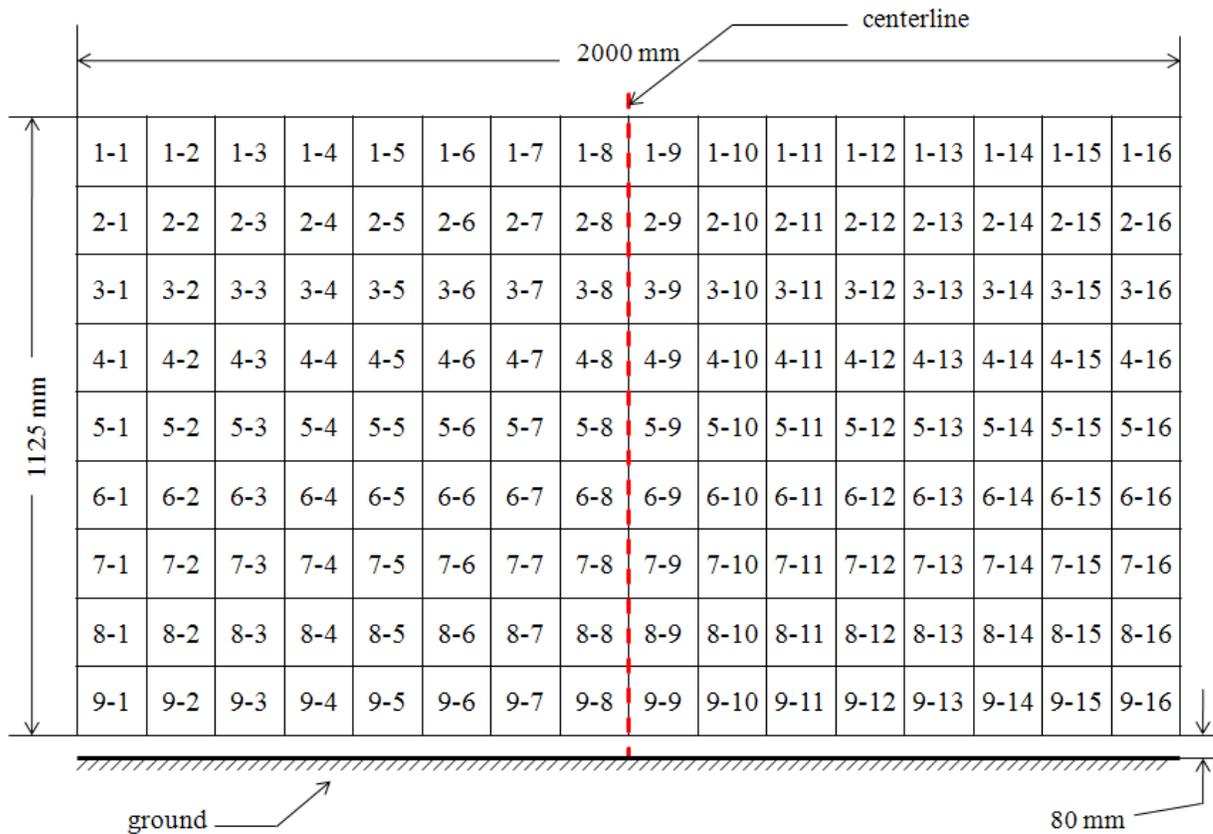


**Figure 1 - Load Cell Locations on a 36-Load Cell Barrier with Plywood Height Extension**

**3. HIGH RESOLUTION 144-LOAD CELL BARRIER**

Another load cell wall NHTSA may furnish contains 144 load cells, 125mm x 125mm in size, arranged in 9 rows of 16 load cells in each as seen in **Figure 2**. The load cells are multi-axis and record force in the x-direction.

An 18 x 83-inch extension can be added to the top of the load cell barrier illustrated (seen in **Figure 1**) to prevent vehicle hood override. The rigid steel frame shall be faced with 3/4-inch thick plywood.



**Figure 2: Load Cell Locations on a 144-Load Cell High Resolution Barrier**

**4. OTHER LOAD CELL BARRIERS**

NHTSA may also furnish high resolution, multi-axis load cells for use in frontal NCAP testing. These load cells record force in the x-direction as well as moments about the y-axis and z-axis. Their installation configuration will be specified by the COTR when they are furnished.