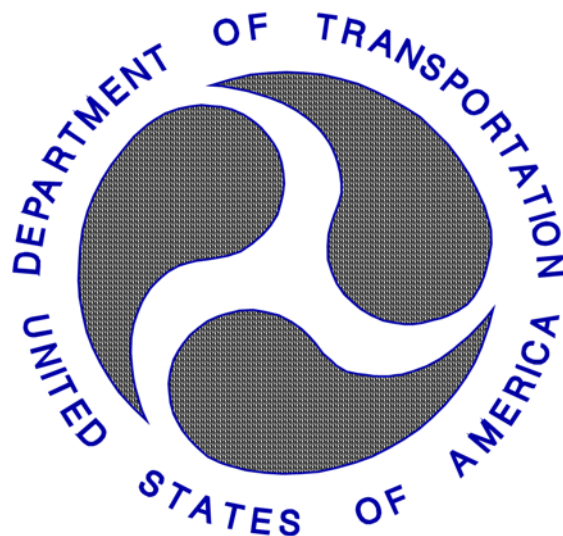


U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY PROCEDURE for NEW CAR ASSESSMENT PROGRAM FULL FRONTAL RIGID BARRIER IMPACT TESTING



May 2018

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FULL FRONTAL RIGID BARRIER IMPACT TESTING
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REVISION CONTROL LOG
FOR NCAP LABORATORY
TEST PROCEDURES

FRONTAL RIGID BARRIER IMPACT TEST

TEST PROCEDURE		NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
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	08/10/2013		08/10/2013	Minor changes to test procedure. Overhaul of data processing Section 12.2, added suggested data trace order, updated documentation film requirements, added item CC (Floor Mats) to Section 11.1, updated Form 1, test photo list, and Appendix P.
05	10/18/2015		10/18/2015	Minor changes and editorial corrections. Removal of former EDR requirements. Minor changes to photo, video, and other reporting requirements.
06	05/10/2018		10/01/2019	Major reformatting along with updates to load cell barrier, ATD instrumentation, high speed camera layout, photo, tow system, and reporting requirements. Change in terminology from ATD calibration to ATD qualification.

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 Representative (COR) and resolve the discrepancy prior to the start of NCAP testing.

Every Contractor is required to submit a detailed internal test procedure to the COR 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 COR 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 COR.

NOTE: These 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. They may not include all of the related FMVSS minimum performance requirements. Recognizing applicable test tolerances, these procedures may also specify test conditions that are more or less severe than the minimum requirements of any related standards.

2. GENERAL REQUIREMENTS

2.1 *FULL FRONTAL RIGID BARRIER TEST*

This NCAP laboratory test procedure is primarily 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 COR.

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

Since the New Car Assessment Program's (NCAP's) full frontal rigid barrier impact test procedure is based on FMVSS No. 208, the assessment of certain FMVSS parameters during NCAP testing allows the OCWS to gain supplemental information on the test vehicle. The following sections detail some of the additional evaluations required as part of full frontal NCAP testing.

NOTE: All variables are to be evaluated at NCAP's 35mph (56.3km/h) full frontal rigid barrier test vehicle velocity.

2.2 *INDICANT FMVSS NO. 212, WINDSHIELD MOUNTING*

A. GENERAL REQUIREMENTS

When a vehicle is subject to a full frontal rigid barrier NCAP test, the windshield mounting of the vehicle shall retain NOT LESS than the minimum portion of the windshield periphery as follows:

1. Vehicles equipped with automatic occupant (passive) restraint systems shall retain not less than 50% of the portion of the windshield periphery on each side of the vehicle longitudinal centerline.
2. Vehicles NOT equipped with automatic occupant restraint systems shall retain not less than 75% of the windshield periphery.

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. PROCEDURE

The following test condition shall apply: The windshield mounting material and all vehicle components in direct contact with the mounting material are at any temperature between -9.4 °C and 43.3 °C. Temperature measurement shall be made 15 minutes before the frontal impact test.

Windshield retention must be checked directly after a full frontal rigid 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 No. 301 static rollover machine.

The Contractor should complete the related data sheet in **Appendix I** and include it with the test report.

2.3 *INDICANT FMVSS NO. 219, WINDSHIELD ZONE INTRUSION (PARTIAL)*

A. GENERAL REQUIREMENTS

When a vehicle is subject to a full frontal rigid barrier test as defined by FMVSS No. 219, 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 6 mm (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 word “partial” is used since the FMVSS No. 219 Styrofoam windshield protected zone template is eliminated for all NCAP 56.3 km/h (35 mph) full frontal rigid barrier impact tests so 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.

The windshield must be checked directly after a full frontal rigid 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.

2.4 *INDICANT FMVSS NO. 301, FUEL SYSTEM INTEGRITY*

A. GENERAL REQUIREMENTS: BARRIER IMPACT

When a vehicle is subject to a full frontal rigid barrier NCAP test, fuel spillage shall not exceed 28 g from impact until motion of the vehicle has ceased, and shall not exceed a total of 142 g in the 5- minute period following cessation of motion. For the subsequent 25-minute period, fuel spillage during any 1 minute interval shall not exceed 28 g. This standard applies to passenger cars, and to MPVs, trucks and buses that use fuel with a boiling point above 0°C.

B. GENERAL REQUIREMENTS – STATIC ROLLOVER

Prior to conducting any static rollover test, ATDs should be removed from the vehicle. The Contractor must conduct a static rollover test within 45 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 1ounce by weight.

2.5 *INDICANT FMVSS NO. 305, ELECTRIC POWERED VEHICLES: ELECTROLYTE SPILLAGE AND ELECTRICAL SHOCK PROTECTION*

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

It is the contractor's responsibility to follow the most updated test procedure when conducting this assessment as part of NCAP testing.

When a vehicle is subject to a full frontal rigid barrier NCAP test, it shall **NOT**:

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

Prior to conducting any static rollover test, ATDs should be removed from the vehicle. The Contractor must conduct a static rollover test within 45 minutes after the vehicle impact. The Contractor must keep the test vehicle under constant observation for electrolyte leakage during the transition between impact and static rollover testing.

2.6 *ADDITIONAL TESTING*

The COR may also direct the Contractor to conduct additional testing on vehicles involved in full frontal rigid barrier testing.

A. SIDE AIR BAG OUT OF POSITION (SAB-OOP) TESTING

At the COR's direction, the Contractor may be asked to perform out-of-position air bag testing on any vehicle provided. The contractor should follow *Laboratory Test Procedure for New Car Assessment Program Side Air Bag Out-of-Position Testing* when conducting these tests.

B. REAR SEAT TESTING

At the COR's direction, the Contractor may be asked to perform frontal NCAP testing with the addition of certain rear seat occupants, including adult ATDs or child restraints and ATDs. The contractor should follow *Laboratory Test Procedure for New Car Assessment Program Rear Seat Research Testing* when conducting these tests.

2.7 METRIC SYSTEM OF MEASUREMENT

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

Accordingly, this OCWS laboratory test procedure includes revisions to comply with governmental directives in using the metric system. For any testing equipment that is not available for direct measurement in metric units, the test laboratory shall calculate the exact metric equivalent by means of a conversion factor carried out to at least five significant digits before rounding consistent with the specified metric requirement.

All final NCAP test reports are required to include metric measurements.

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

3. SECURITY

The Contractor shall provide appropriate security measures to protect NCAP test vehicles, dummies, load cell barriers, and any Government-furnished property (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 COR) 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.

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.

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 COR. Individual data plots cannot be viewed by manufacturer representatives until they are reviewed by NHTSA personnel and granted express permission by the COR.

- 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 at the vehicle manufacturer's request 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 COR, 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 COR. 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 qualification 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 COR 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 COR.

6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS

6.1 TOW ROAD

- A. **Option 1:** The tow road should be at least 152 m (500 feet) in length and terminate at the face of the non-energy-absorbing barrier as shown in **Figure 1**. The first 61 m (200 feet) (approximate) from the head of the tow road will be used to accelerate the test vehicle up to the specified velocity without exceeding 0.30g, which could affect the positioning of the P572 test dummies in the test vehicle. The next 30 m (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 61 m (200 feet, approximate) of tow road will be used for test vehicle speed stabilization.

The width of the tow road should be approximately 2.4 to 4.3 m (8 to 14 feet) and should be straight and level so that the test vehicle does not oscillate vertically in excess of 0.29g (SAE J211/Mar 95 filter class 60).

Option 2: A tow road that is shorter than the length described in *Option 1* may be approved for use in frontal NCAP testing if the Contractor demonstrates that test vehicles can be smoothly and reliably accelerated to target speed without exceeding 0.30g and without affecting the position of the P572 test dummies in the test vehicle. Because a shorter tow road may have less distance available for vehicle stabilization at constant velocity, the contractor is expected to use an electronic feedback control system to accelerate the vehicle according to a preprogrammed velocity profile. The system shall automatically abort the test (without operator intervention) if, at any time, the speed deviates from the velocity profile to any degree that will threaten achieving target speed given there is adequate distance to stop the test without damage to the vehicle. The width of the tow road should be approximately 2.4 to 4.3 m (8 to 14 feet) and should be straight and level so that the test vehicle does not oscillate vertically in excess of 0.29g (SAE J211/Mar 95 filter class 60). If a tow road that is shorter than the length described in *Option 1* is proposed, the Contractor shall submit a minimum of the following information to the COR for approval:

1. At least two representative acceleration plots of sample vehicle tests with a target test speed equal to the frontal NCAP test. The plots should reflect the entire duration of the tow event, from the beginning of vehicle movement to barrier impact for:
 - a. One “average” NCAP test weight vehicle (example: 4 door sedan or small SUV/crossover)
 - b. One “maximum” NCAP test weight vehicle (example: large full size pickup)
2. A complete description of the feedback control system including data and/or plots that demonstrate:
 - a. The system can reliably accelerate a vehicle following a preprogrammed velocity profile.
 - b. The vehicle speed is monitored continuously and maintained within a corridor throughout entire tow event.
 - c. The vehicle will be traveling at or near constant velocity and within ± 0.80 km/h of the target velocity prior to and at impact.
3. A complete description of the system’s abort approach and capability, which should include the ability to abort automatically in the case of nonconformance with item 2 of this list.

COR approval of the tow system does not absolve the contractor from the retest requirements described in Section 13.1 in the case of an invalid test.

B. A photographic pit will be located under 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 transparent material that allows for use of pit cameras.

2. The covering and its supports shall be of sufficient strength in case the vehicle structure comes 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

To prepare the vehicle for crash testing in any weather, the Contractor shall have a temperature-controlled building large enough to house the test vehicle and allow for government, vehicle manufacturer, and laboratory personnel to move around as needed. The building climate control must maintain 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 the test vehicle impacts 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 or video footage of the test speed readout must show the impact speed in km/h, to two decimal places ONLY. Test data submitted without a photograph and/or video footage of the test speed readout, or displaying a primary test speed that does not conform to this range, may ultimately be considered nonconforming.***

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

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

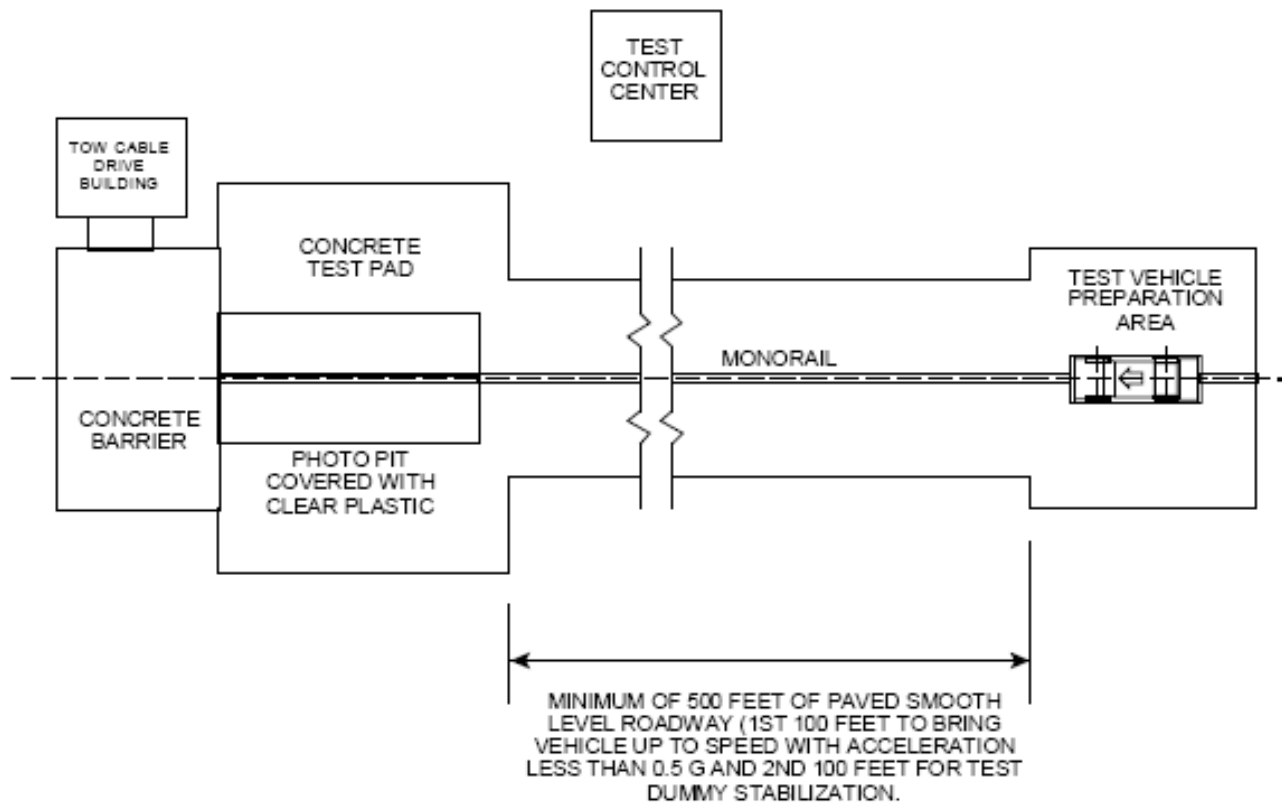


Figure 1 - Typical Frontal NCAP Rigid Barrier Impact Test Facility

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, 1.8 m high, 1.8 m thick, and 3.7 m wide (6 feet high, 6 feet thick, and 12 feet wide), weighing approximately 45,000 kg (100,000 pounds). Any 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 $56.30 \text{ km/h} \pm 0.80 \text{ km/h}$, 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 those timing devices shall be accurate to within plus or minus $.08 \text{ km/h}$ (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 I, 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 COR 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 vehicle's speed is outside the velocity range specified below. If the Contractor is capable of documenting the velocity recorded by this third device, it may also be 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 without physical damage to the vehicle.
- B. An aborted test can be restarted only after notification is given to the COR, 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 FMVSS No. 301 and/or FMVSS No. 305 tests, 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. Ninety degrees (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) are located in the vehicle cargo area.
8. The Contractor shall check for damage that may have occurred during transit. The COR 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 (50th Percentile Male) test dummies and Part 572 Subpart O (5th 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 provided to the Contractor with instrumentation unless other arrangements are agreed upon. Typically, 50th Percentile Male and 5th Percentile Female ATDs will be provided with the following instrumentation:

Sensor Location	Sensor Type	Axis	Y Axis Units	Description
Head CG	Accelerometer	X	Gs	Head CG Acceleration X - Primary and Redundant
Head CG	Accelerometer	Y	Gs	Head CG Acceleration Y - Primary and Redundant
Head CG	Accelerometer	Z	Gs	Head CG Acceleration Z - Primary and Redundant
Head CG	Angular Rate Sensor	X	degrees/second	Head CG Angular Velocity X
Head CG	Angular Rate Sensor	Y	degrees/second	Head CG Angular Velocity Y
Head CG	Angular Rate Sensor	Z	degrees/second	Head CG Angular Velocity Z

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Upper Neck	Load Cell	X	Newton	Upper Neck Force X
Upper Neck	Load Cell	Y	Newton	Upper Neck Force Y
Upper Neck	Load Cell	Z	Newton	Upper Neck Force Z
Upper Neck	Load Cell	X	Newton-meter	Upper Neck Moment X
Upper Neck	Load Cell	Y	Newton-meter	Upper Neck Moment Y
Upper Neck	Load Cell	Z	Newton-meter	Upper Neck Moment Z
Chest	Accelerometer	X	Gs	Chest Acceleration X - Primary and Redundant
Chest	Accelerometer	Y	Gs	Chest Acceleration Y - Primary and Redundant
Chest	Accelerometer	Z	Gs	Chest Acceleration Z - Primary and Redundant
Chest	Potentiometer	X	millimeters	Chest Deflection X
Pelvis	Accelerometer	X	Gs	Pelvis Acceleration X
Pelvis	Accelerometer	Y	Gs	Pelvis Acceleration Y
Pelvis	Accelerometer	Z	Gs	Pelvis Acceleration Z
Left Femur	Load Cell	Z	Newton	Left Femur Force Z - Primary and Redundant
Right Femur	Load Cell	Z	Newton	Right Femur Force Z - Primary and Redundant
Left Tibia - Upper	Load Cell	X	Newton-meter	Left Upper Tibia Moment X
Left Tibia - Upper	Load Cell	Y	Newton-meter	Left Upper Tibia Moment Y
Left Tibia - Upper	Load Cell	Z	Newton	Left Upper Tibia Force Z
Left Tibia - Lower	Load Cell	X	Newton-meter	Left Lower Tibia Moment X
Left Tibia - Lower	Load Cell	Y	Newton-meter	Left Lower Tibia Moment Y
Left Tibia - Lower	Load Cell	Z	Newton	Left Lower Tibia Force Z
Right Tibia - Upper	Load Cell	X	Newton-meter	Right Upper Tibia Moment X
Right Tibia - Upper	Load Cell	Y	Newton-meter	Right Upper Tibia Moment Y
Right Tibia - Upper	Load Cell	Z	Newton	Right Upper Tibia Force Z
Right Tibia - Lower	Load Cell	X	Newton-meter	Right Lower Tibia Moment X
Right Tibia - Lower	Load Cell	Y	Newton-meter	Right Lower Tibia Moment Y
Right Tibia - Lower	Load Cell	Z	Newton	Right Lower Tibia Force Z
Left Foot -Aft	Accelerometer	X	Gs	Left Foot Aft Acceleration X
Left Foot -Aft	Accelerometer	Z	Gs	Left Foot Aft Acceleration Z
Left Foot - Fore	Accelerometer	Z	Gs	Left Foot Fore Acceleration X
Right Foot -Aft	Accelerometer	X	Gs	Right Foot Aft Acceleration X
Right Foot -Aft	Accelerometer	Z	Gs	Right Foot Aft Acceleration Z
Right Foot - Fore	Accelerometer	Z	Gs	Right Foot Fore Acceleration Z
Lap Belt Load	Load Cell	NA	Newton	Lap Belt Force
Shoulder Belt Load	Load Cell	NA	Newton	Shoulder Belt Force

For a list of typical instrumentation provided with various child dummies, reference

Laboratory Test Procedure for New Car Assessment Program Rear Seat Research Testing.

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 their respective appendices to this procedure:

Appendix D and **Appendix E**. 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 qualification. The COR will be kept informed of the dummies' conditions so that replacement parts can be provided.

The Contractor shall keep detailed records for each dummy, describing parts replaced and the results of qualification tests.

7.3 *LOAD CELL BARRIER*

To collect crash tests forces and/or moments, NCAP may provide a load cell barrier to the contract laboratory. Alternatively, NCAP may ask that the Contractor use one of its own barriers, if available, to collect similar data. Details on some typical load cell barriers can be found in **Appendix H, Load Cell Barriers**.

7.4 *RESTRAINT DEACTIVATION FOR TEST VEHICLES*

After a government-furnished vehicle is crashed, prior to its disposal, and upon authorization by the COR, the Contractor shall render all its restraints inactive. This includes safely deploying all undeployed air bags and seat belt pretensioners. Large sections of webbing from each seat belt should be removed and discarded.

Within 14 days of receiving authorization from the COR, the Contractor should complete restraint deactivation activities and submit **Form 6** of **Appendix I, Vehicle Air Bag and Restraint Deactivation and Removal**. The COR reserves the right to exempt any full vehicle and/or individual restraints from restraint deactivation.

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. Exceptions to this requirement are barrier load cells, which are calibrated at the request of the COR, and ATD and vehicle instrumentation, which are calibrated according to the following schedule:
1. Accelerometers shall be calibrated at a minimum of every six (6) 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 (12) 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).
 3. Potentiometers shall be calibrated at a minimum of every six (6) 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 potentiometer (whichever comes sooner).
- C. All measuring and test equipment and measuring standards will be labeled with the following information:
1. Date and place of last calibration
 2. Date of next scheduled calibration
 3. Name of the technician or commercial facility performing the calibration
 4. Full-scale measurement range
 5. Accuracy and tolerance over the entire measurement range (or within the range used for testing)
- 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 COR. The history of the record shall be updated in an electronic file. The calibration system will need the acceptance of the COR 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 to the COR upon request.
- H. Anthropomorphic test devices (ATDs) shall be qualified before and after every NCAP test. The pre- and post-test qualification data shall be submitted with both the Quality Control Package (see **Appendix I**) and the final report. The suite of post-test qualification checks conducted after an NCAP test may serve as the pre-test qualification checks for the next test the dummy is used in, provided the ATD is used within 8 weeks.

It is acceptable to submit a *post-test* qualification set that does not meet all requirements and/or corridors, as long as the issues with the ATD or instrumentation are investigated and rectified prior to it being used in the next test. The failed post-test qualification should be included in all deliverables. However, prior to the next NCAP test, the ATD must undergo re-qualification until all body regions achieve a passing result. The COR should also be notified of the failed qualification result as soon as possible. The pre-test data for the subsequent NCAP test using that ATD **MUST** show compliance with all qualification requirements.

NOTE: In the event an ATD body region exceeds the performance standards required by FMVSS No. 208, that region on the ATD must also be inspected for damage prior to being requalified.

- I. The Contractor-Furnished data acquisition system (DAS) 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 accelerations, 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 COR'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 GFP 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 COR 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 AND VIDEO REQUIREMENTS

Video files should be submitted to the FTP site in MPEG-4 format with a standard or generally available “codec”. Other types of files can be used if approved by the COR and formatted using a standard or generally available “codec.”

Real Time Cameras

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 included with the Quality Control Package.

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 50 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.
- F. The vehicle interior may require auxiliary on-board lighting to ensure adequate exposure.

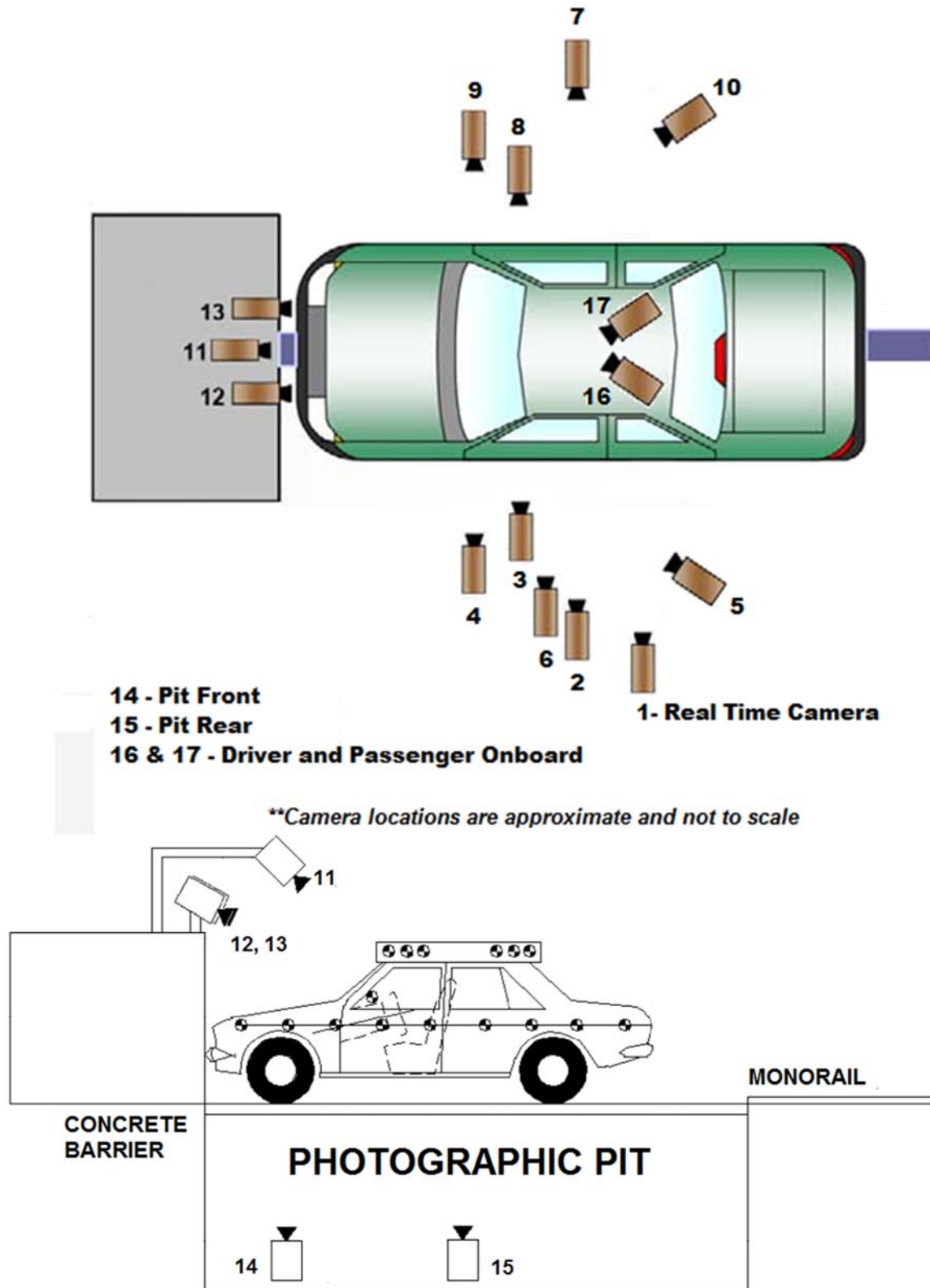


Figure 2 - Camera Positions for Frontal Impacts, Overhead and Left Side Views

- Camera 1** Filename: **Camera No. 1 – REAL-TIME LEFT OVERALL**
Real-time (24-30 fps) offboard camera positioned to follow the test vehicle (on its left side) down the tow road, across the photographic pit, and into the barrier face.
- Camera 2** Filename: **Camera No. 2 – LEFT OVERALL**
High-speed left side view camera to cover the entire left 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 3** Filename: **Camera No. 3 - DRIVER CLOSE-UP**
High-speed offboard camera positioned to capture 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 FRONT HALF**
High-speed offboard camera positioned to capture 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 5** Filename: **Camera No. 5 – LEFT ANGLE**
High-speed offboard camera positioned at an angle to document the driver air bag deployment and movement of the driver dummy during the impact event.
- Camera 6** Filename: **Camera No. 6 – STEERING COLUMN**
High-speed offboard camera positioned to document the movement of the vehicle's steering column/wheel assembly relative to the roof and door/side reference targets during the impact event. The driver's side window should be visible throughout the view. 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 offboard camera positioned to capture 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 offboard camera positioned to capture the passenger 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 9** Filename: **Camera No. 9 – RIGHT FRONT HALF**
High-speed camera positioned to capture the vehicle's right 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 10** Filename: **Camera No. 10 – RIGHT ANGLE**
High-speed offboard camera positioned at an angle to document the passenger air bag deployment and movement of the passenger dummy during the impact event.
- Camera 11** Filename: **Camera No. 11 – WINDSHIELD**
High-speed offboard overhead camera positioned directly above the vehicle's windshield centerline to cover the windshield area and as much of the hood as possible 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 camera mounted above the barrier face to document the movement of the driver dummy during the impact event and windshield zone intrusion. A polarizing filter may be used to eliminate windshield glare.
- Camera 13** Filename: **Camera No. 13 – PASSENGER WINDSHIELD**
High-speed camera mounted above the barrier face to document the movement of the passenger dummy during the impact event and windshield zone intrusion. A polarizing filter may be used to eliminate windshield glare.
- Camera 14** Filename: **Camera No. 14 – PIT FRONT***
High-speed offboard camera positioned in the photographic pit 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 offboard camera positioned in the photographic pit beneath the vehicle's fuel tank to document any Stoddard solvent spillage.
- Camera 16** Filename: **Camera No. 16 – DRIVER ONBOARD**
High-speed camera mounted in any feasible onboard location, but normally to the roof, over and behind the driver dummy's inboard

(right) shoulder such that air bag deployment is documented. Onboard cameras such as this one may require auxiliary lighting to achieve adequate exposure.

Camera 17 Filename: **Camera No. 17 – PASSENGER ONBOARD**
 High-speed camera mounted in any feasible onboard location, but normally to the roof, over and behind the passenger dummy’s inboard (left) shoulder such that air bag deployment is documented. Onboard cameras such as this one may require auxiliary lighting to achieve adequate exposure.

NOTE: At the COR’s discretion, 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 that chalking ATD body parts may contact, such as the lower instrument panel, glove box, upper door trim panels, center stack, etc., shall be painted with flat white paint. All controls, displays, or indicator lights shall **NOT** be painted and must be visible prior to testing. Footage of each occupant’s air bag indicator light cycling properly is required for the test documentation video.
- 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 colors (pink, green, blue, orange, etc.).
- C. Parts of the anthropomorphic testing devices shall be coated with a colored chalk/water solution 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

DUMMY/VEHICLE PART	DRIVER	PASSENGER
Nose	Red	Yellow
Lips	Red	Yellow
Face	Blue	Red
Top of Head	Yellow	Blue
Back of Head	Red	Yellow
Left Knee	Red	Yellow
Right Knee	Blue	Blue (FMVSS No. 208 uses Red)

Lower Steering Wheel Rim	Red	N/A
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NOTE: Face chalk should extend below the chin.

- D. The driver dummy's and passenger dummy's clothes shall be in contrasting colors so that the motion of each dummy can be identified during video analysis. Dummy clothes should be free of residual chalk marks from prior testing.
- 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. In the absence of a fuel port, the opening and closing of the vehicle's charging port door should be documented instead. Document both in the case of a plug-in hybrid electric vehicle. This footage shall appear in the documentation video as specified in **Sections 9.7 and 9.8.**

A 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

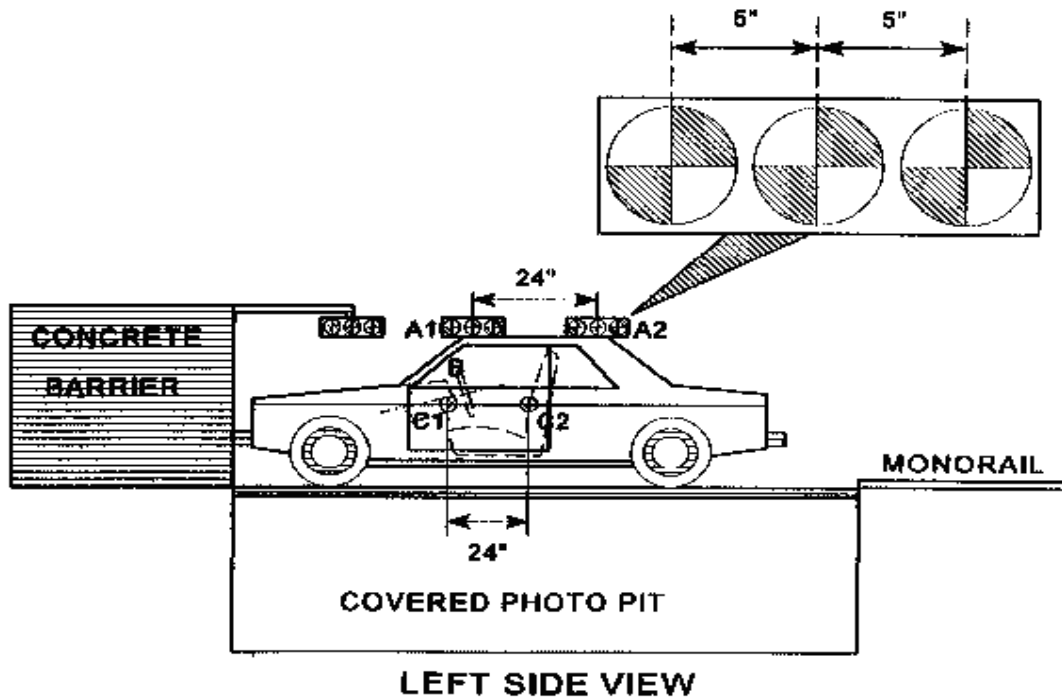


Figure 3 - Reference Photo Targets

PHOTOGRAPHIC DOCUMENTATION... Continued

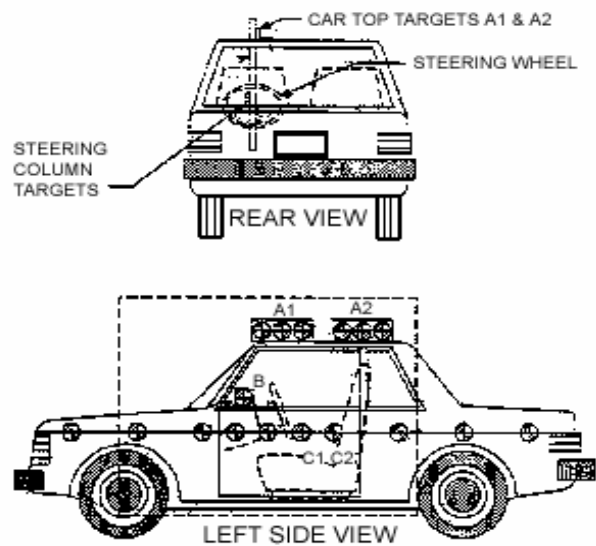


Figure 4 - Reference Photo Targets, Cont'd

- 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 the top of the hood, roof, and deck lid. Also apply tape down both sides of the 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 both sides of their heads 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, along with an indication of whether the view shown is pre- or post-test:

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 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 NAME
 NHTSA No. MXXXXXXXXX
 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 face)
- 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
 - i. Show electric charging plug if no gas cap exists
 - 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 driver air bag indicator light
 - h. Cycling of passenger air bag indicator light
 - i. Door closings
- C. Real-Time Pan Coverage
- a. Speed trap readout
 - i. Show primary and redundant speeds in km/h
- 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 second “burst” during the 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 equipment or vehicle testing anomalies. Additional footage required by any supplemental tests conducted along with the frontal NCAP test should be included here. If the Contractor has concerns about whether a test issue should be included, please contact the COR.
- G. “The End”

9.9 *STILL PHOTOGRAPHS*

Clear and properly focused digital still photographs in .jpg format with minimum dots-per-inch (DPI) of 300 shall be taken to document the test. A 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 relevant 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 Quality Control Package. In addition, the photos should be labeled in Appendix A of the final test report. A list of required photographs with their labeling convention can be found in **Section 2.3** of **Appendix I** to this procedure.

10. **DEFINITIONS**

The Contractor shall check the Code of Federal Regulations for the most recent definitions of the following terms. A citation is provided after each definition not specified in FMVSS No. 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 95th 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

At the start of a contract, testing shall not begin until the COR approves the Contractor's in-house test procedure.

Prior to conducting any NCAP test, the Contractor shall:

1. Verify the training of technicians for performance of this test,
2. Verify the calibration status of test equipment,
3. Review applicable revisions of NCAP test procedures (frontal, side MDB, or side pole), and
4. Review vehicle Owner's Manual (or equipment mfg. instructions).

11.1 TEST VEHICLE PREPARATION

A. TEST VEHICLE INFORMATION

Using the owner's manual, certification labels, information provided by the COR 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 NHTSA)
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 NO. 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

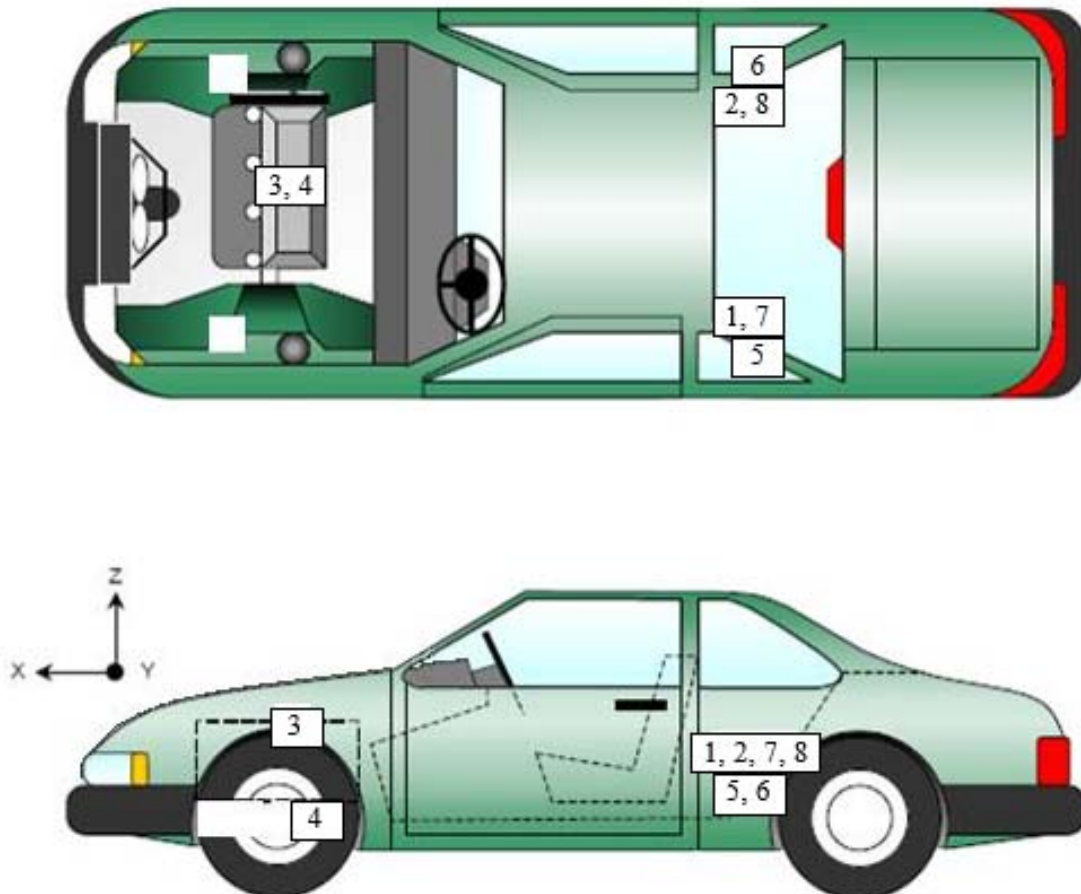


Figure 5 - Vehicle Accelerometer Locations

- 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.

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 COR.
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. These are the “As-Delivered” attitude measurements.

I. CALCULATION OF VEHICLE TARGET TEST WEIGHT

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

$$\text{RCLW} = \text{VCW} - (68 \text{ kg} \times \text{DSC})$$

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. These are the “Fully Loaded” attitude measurements.

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) and 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 center it over the longitudinal centerline of the vehicle and obtain the proportion of axle weight indicated by the gross axle weight ratings.
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 COR.

NOTE: Any additional ballast should be placed in the trunk or rear cargo carrying area (such as the rear cargo area of a hatchback or SUV, or the bed of a pickup truck). If you are unclear as to whether a ballast location qualifies as a cargo carrying area, please contact the COR. If it is impossible or overly burdensome to place ballast weight in the trunk or rear cargo carrying area of a vehicle, contact the COR for guidance prior to executing the test.

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 (TVT_W)* 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 COR to confirm the removal of vehicle components. If no components were provided with the vehicle setup information, the Contractor must also contact the COR 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. These are the “As Tested” attitude measurements.

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** to this document, **Driver and Passenger Dummy Seating and Positioning Procedures** for a check list pertaining to the proper procedures.

O. SETTING THE SEATS

Prior to setting the front seating positions, consult **Appendix F** to this document, **Driver**

and Passenger Dummy Seating and Positioning Procedures, for a check list pertaining to the proper procedure.

NOTE: If a seat track latching verification procedure is included with the Form 1 provided by the COR, ensure that procedure is followed.

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. **50th Male Dummy** – Place adjustable anchorages in the nominal adjustment position in accordance with the manufacturer’s data supplied by the COR on **Form 1** in **Section 4** of **Appendix I**.
2. **5th Female Dummy** – Place adjustable anchorages in the nominal adjustment position in accordance with the manufacturer’s data supplied by the COR on **Form 1** in **Section 4** of **Appendix I**.

T. WINDOWS

1. Place the driver’s and passenger’s front windows in the fully open position. Place all other windows and vents in the fully closed position unless otherwise specified by the COR.
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 than 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 9.8** of this document, documentation of the 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 “Air bag Readiness Indicator” shows the air bag system as being functional. Also, as

indicated in **Section 9.8** of this document, documentation of the functioning air bag indicator lights with a real-time camera should be included as part of the documentation movie.

BB. LAP AND SHOULDER BELT LOAD CELLS

1. Belt load cells, if allowed by the vehicle manufacturer per the COR-provided **Form 1**, shall be mounted on the front outboard lap and shoulder belts (up to 4 load cell units are required for a test with two front-seat occupants, using two per occupant). **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. These may also be omitted per the instructions provided by the vehicle manufacturer on **Form 1** via the COR.
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 COR via the vehicle's setup information (**Form 1**) such that during the frontal crash test, they do not come in contact with anything other than the belt to which they are attached. These may also be omitted per the instructions provided by the vehicle manufacturer on **Form 1** via the COR.
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 $\frac{3}{4}$ -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 COR for instructions on whether or not to run the test with any shoulder or lap belt load cells.

CC. FLOOR MATS

If the vehicle is equipped with optional all-weather (rubber) floor mats, remove them from the vehicle prior to the test. If the vehicle is equipped with carpeted floor mats, or if all-weather floor mats are standard equipment, place them in their proper locations prior to the test.

11.2 DUMMY PREPARATION, POSITIONING, AND PLACEMENT

- A. Place a properly clothed and qualified 50th percentile male (in accordance with **Appendix A** to this procedure) and a properly clothed and qualified 5th percentile female (in

accordance with **Appendix B** to this procedure) 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 ± 3 mm). Record measurements on the applicable data sheet.

DUMMY MEASUREMENT FOR FRONT SEAT PASSENGERS

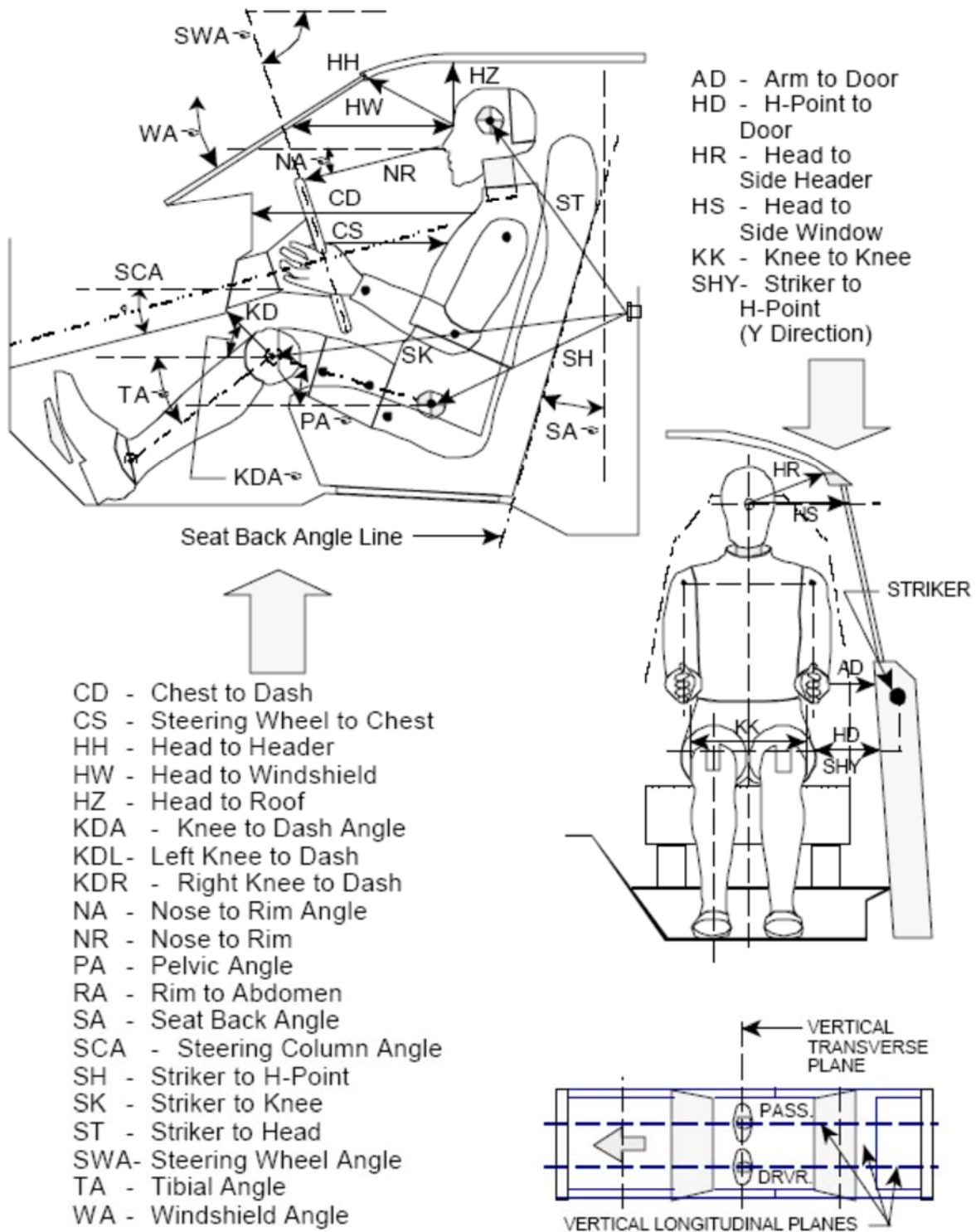


Figure 6 - Dummy Measurements for Front Seat Passengers

C. DUMMY LONGITUDINAL CLEARNCE DIMENSIONS (see **Figure 6** and additional diagrams i through xi below)

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

1. **HH - Head to Header** - Take 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** - Take 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** - Take 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** - Take 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** - Take from the bottommost point of the steering wheel rim horizontally rearward to the dummy. Use a level.
7. **NR - Nose to Rim** - Take 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** - Take 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** – Take these measurements 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** - Take 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** -Measure from the bolt on the outer biceps to the first point it hits on the door.
3. **HD - H-point to Door** -Take 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** - Take 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 COR via the manufacturer. If the manufacturer instructions aren't clear enough, contact the COR.
2. **PA - Pelvic or Femur Angle** - Insert the pelvic angle gauge into the H-point gauging hole on the Hybrid III dummies and take 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** - Measure 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.

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.

- 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 qualification procedures are attached as **Appendices A and B**. The pre- and post-test qualification charts for each dummy used in a vehicle barrier impact test shall be submitted in the preliminary and final test reports. Dummies shall be qualified before and after every NCAP test. Each qualification should be available electronically (in ASCII format) to the COR if requested. The post-test qualification obtained after a vehicle test

can be used as the pre-test qualification for a subsequent test as long as the dummy will be used in a frontal NCAP test within 8 weeks of that qualification. In the event that a body region exceeds the performance standards set forth in FMVSS No. 208, that region on the ATD must be requalified. The pre-test qualifications and qualification check shall be submitted with the final report. All electronic data collected for all dummy qualifications 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 COR.
- I. It is recommended that dummies are rotated from one test to another. For example, if two 5th female dummies and two 50th 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 position 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 H** 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 7)**
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.

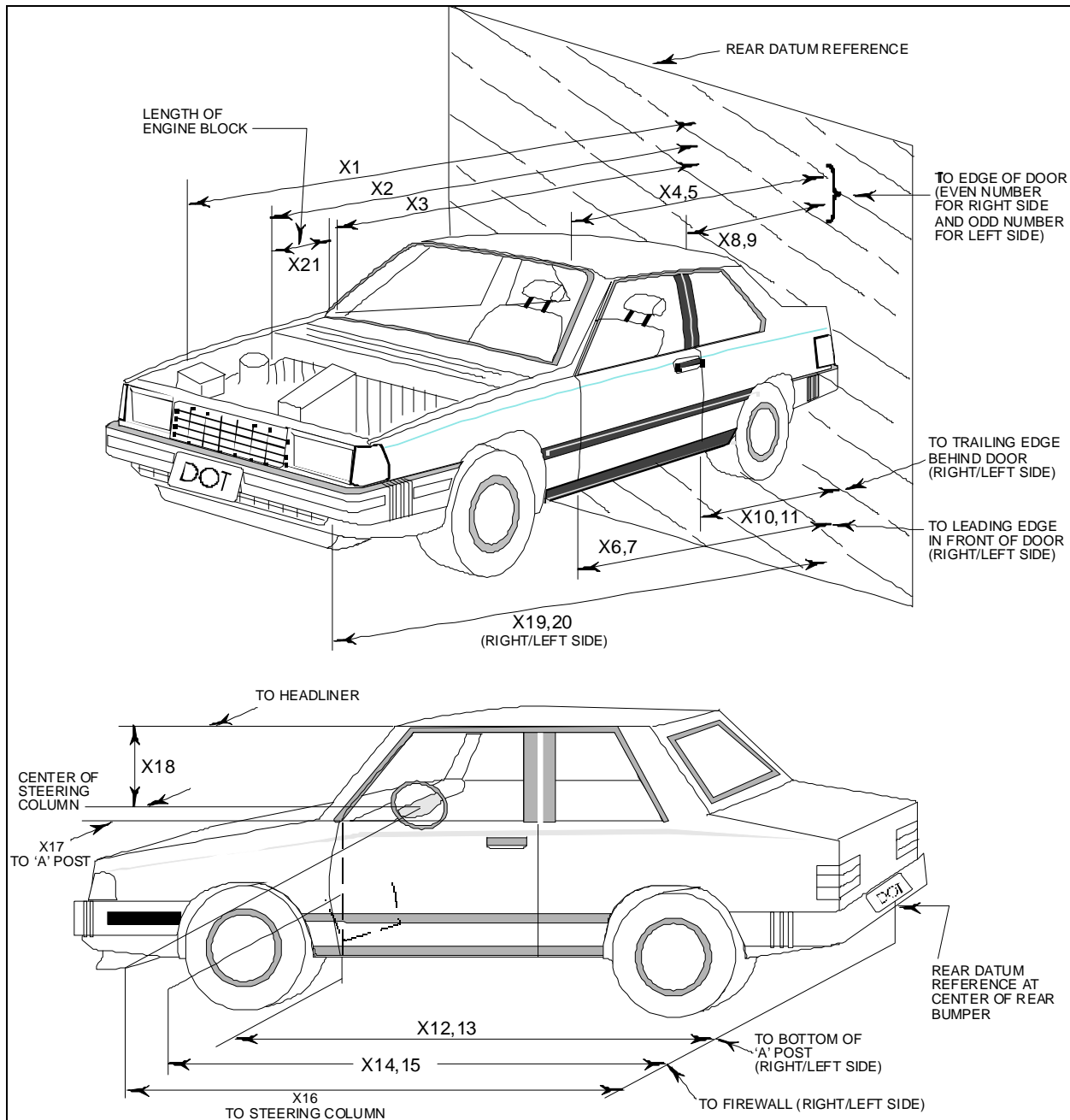


Figure 7 - Exterior Vehicle Measurements

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.

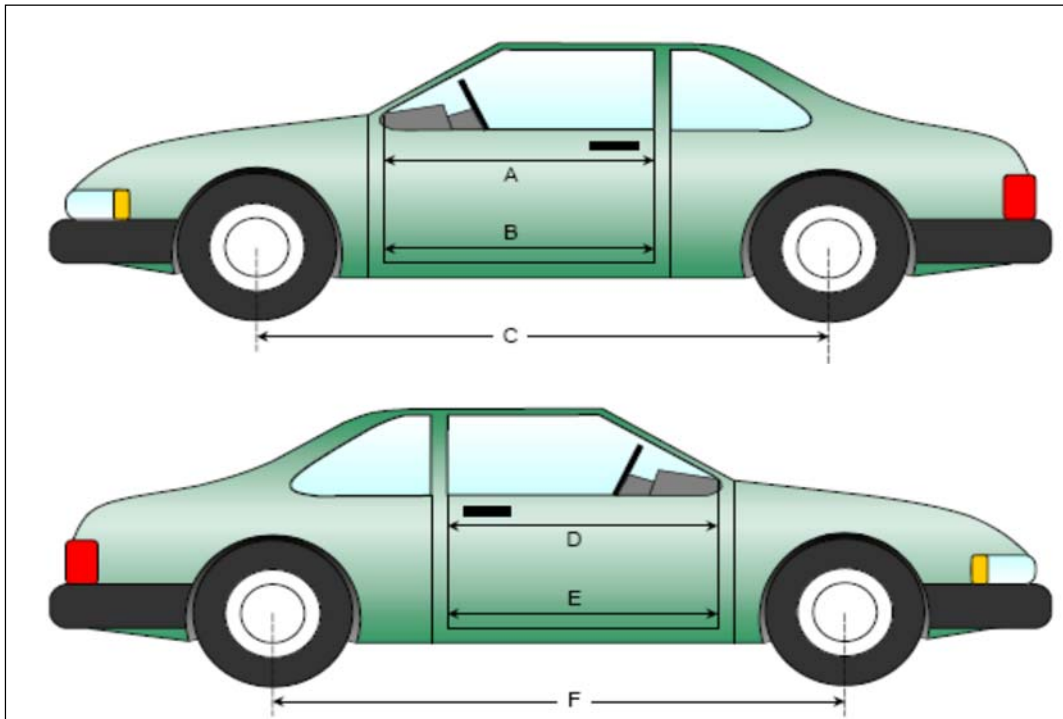


Figure 8 - Door Opening Width and Wheelbase Measurements

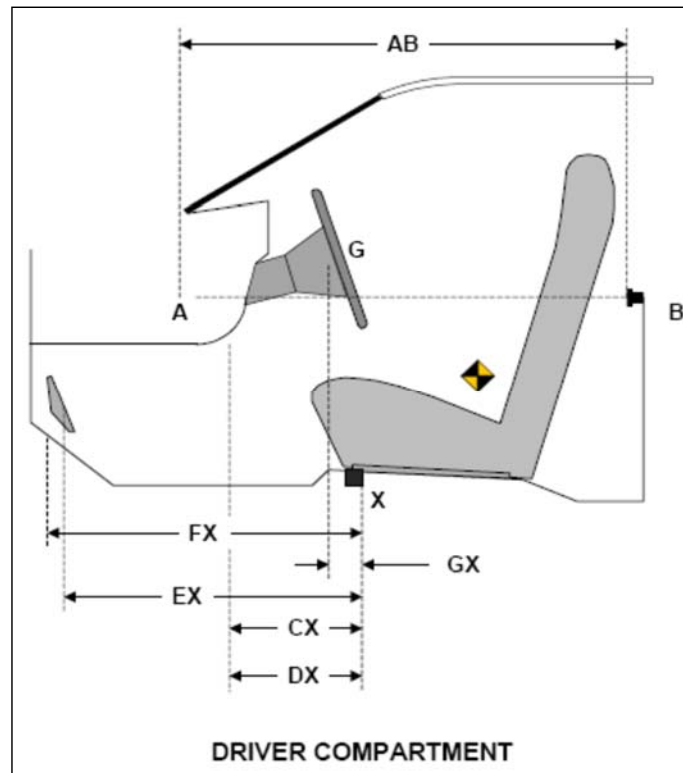


Figure 9 - Driver Compartment Measurements

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 = 12FDEWX,

where the value for **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 **X**. Typically it will be zone “2”, “3”, or “4” in a frontal NCAP test.

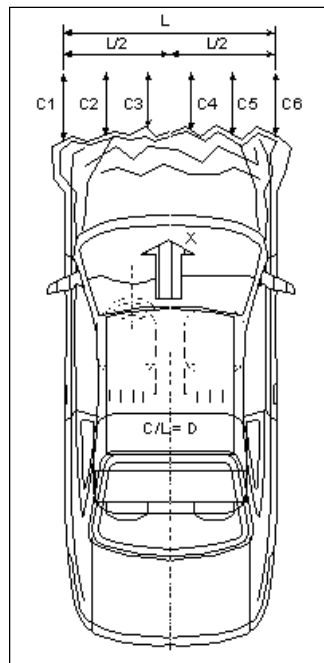


Figure 10 - Vehicle Crush Profile Measurements

D. FMVSS NOs. 212, 219 (PARTIAL), 301, and 305 INDICANT TESTING

Record the details from the FMVSS Nos. 212, 219 (Partial), 301, and 305 indicant tests according to the procedures in **Appendix J** and on the appropriate data sheets in **Appendix I**.

11.5 *ELECTROMAGNETIC INTERFERENCE AND STATIC CHARGE CONTROL*

The laboratory shall take all necessary precautions to avoid electromagnetic and/or static charge interference with the test data. 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.
- B. Use a static electricity elimination spray on the dummies and the interior of the vehicle.
- C. Ground and use static electricity elimination spray on pit covers.

12. **POST-TEST MEASUREMENTS AND OBSERVATIONS**

After the test, the information specified in the following sections shall be completed or recorded, typically on data sheets in **Appendix I**.

12.1 *TEST SPEED*

Record the test speed (km/h) recorded by the primary and redundant speed traps. Ensure a photo of the speed trap readouts is also taken.

12.2 *TEMPERATURE AND HUMIDITY STABILIZATION*

Record the dummy/vehicle temperature stabilization data for inclusion as Data Sheet No. 17 in **Appendix I**.

12.3 *DUMMY CONTACT POINTS*

Prior to removing the test dummy from the vehicle, observe where dummy body parts made contact with vehicle interior points, other body parts, air bags, or anything else, primarily as indicated by chalk markings transferred to the contacted surfaces. Where applicable, confirm contact locations by using high speed video analysis. Take photos as indicated in **Section 2.3** of **Appendix I**.

Record observations of contact on Data Sheet No. 11 from **Appendix I**. If no contact occurred for a particular body region, indicate “No contact”.

12.4 *VEHICLE DOOR OPENINGS, TRUNK OPENINGS, SEAT TRACK, AND SUPPLEMENTAL RESTRAINT INFORMATION*

A. DOORS

The Contractor shall indicate the post-test status of all doors post-test. It should be noted whether the doors remained in their pre-test locked or unlocked position or whether they were in an open condition post-test. In addition, an indication of whether the trunk, hatch, or tail gate opened should be noted. All applicable conditions should be noted on Data Sheet No. 11.

B. SEAT BACK AND SEAT TRACK MOVEMENT

In addition, any notable movement of the seat back from its initial test position should be described on Data Sheet No. 11. Measurements of seat track movement should also be included.

C. WINDOW, WINDSHIELD, AND OTHER POST-TEST OBSERVATIONS

Describe any damage to windows or the windshield that does not relate to the information conveyed in Data Sheet No. 15. Use the "Other" line to describe anything else of note.

D. SUPPLEMENTAL RESTRAINT INFORMATION

Note whether the vehicle was equipped with the supplemental restraint systems listed in Data Sheet No. 11. Also indicate the deployment status of each restraint system. The Contractor should provide descriptive comments for any air bag that should have deployed and failed to, deployed late, or appeared not to have inflated to full volume during impact.

E. POST-TEST VEHICLE INTERIOR AND EXTERIOR CRUSH MEASUREMENTS

Crush measurements should be taken and recorded as suggested in Section 11.4 of this document. This information should be entered on Data Sheet Nos. 12, 13, and 14.

12.5 *REMOVAL OF ANTHROPOMORPHIC TESTING DEVICES*

Once all post-test vehicle measurements have been taken, remove the anthropomorphic testing devices from the vehicle and take any remaining post-test photographs of the vehicle interior as indicated in Section 2.3 of **Appendix I**. The test dummies should incur no additional damage during removal from the test vehicle, and care should be taken to avoid introducing new contact chalk marks to the vehicle interior. Record any additional post-test observations related to dummy contact during this time.

12.6 *FMVSS NO. 301/305 STATIC ROLLOVER*

The Contractor shall perform the FMVSS No. 301 or 305 rollover as needed per **Appendix J**.

To avoid damage to the underbody of the test vehicle when moving the vehicle to the rollover device, ensure that the forklift is only permitted to make contact with the body sills of the vehicle. Accordingly, it may be necessary to place a stabilizer block made of rubber, wood, or polypropylene between the body sills and the forks of the forklift. This is particularly important for electric vehicles to reduce the risks of electric shock.

12.7 REMOVAL OF TEST INSTRUMENTATION AND PREPARATION FOR STORAGE

After the test, the Contractor shall remove all test-related instrumentation from the test vehicle. After removal of all test instrumentation, the test vehicle should be prepared for storage. Raise all windows on the test vehicle, if possible, close any hatches, if applicable, and close and latch all doors to the extent permitted by the vehicle crush. Exposed window openings should be covered with a covering that will protect the test vehicle from the elements.

13. 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 COR.

13.1 TESTING ISSUES AND TEST DATA LOSS

A. TEST FAILURE DESCRIPTION

A test which fails to meet an NCAP, applicable FMVSS, or SAB-OOP vehicle performance requirement. See **Section 2, GENERAL REQUIREMENTS**.

B. TEST FAILURE NOTIFICATION

Any potential test failure shall be communicated by telephone to the COR within 24 hours with written notification emailed within 48 hours (Saturdays and Sundays excluded). A **Laboratory Notice of Invalid Test or Apparent Test Failure** form (**Form 3 of Appendix I**) with copies of the related test data sheet(s) and preliminary data plot(s) (if applicable) shall be included. In the event of a test failure, post-test calibration and/or qualification checks of some critically sensitive test equipment and instrumentation may be required. The necessity for these verifications shall be at the COR's discretion and shall be performed without additional cost to the OCWS.

C. INVALID TEST DESCRIPTION

A test which does not conform precisely to all requirements and/or specifications of its respective NCAP test procedure and applicable contract and Statement of Work.

D. INVALID TEST NOTIFICATION

Any potentially invalid test shall be communicated by telephone to the COR within 24 hours with written notification emailed within 48 hours (Saturdays and Sundays excluded). A **Laboratory Notice of Invalid Test or Apparent Test Failure** form (**Form 3 of Appendix I**) with copies of the related test data sheet(s) and preliminary data plot(s) (if applicable) shall be included. In the event of an invalid test, post-test calibration and/or qualification checks of some critically sensitive test equipment and instrumentation may be required. The necessity for these verifications shall be at the COR's discretion and shall be performed without additional cost to the OCWS.

E. RETEST NOTIFICATION

The Contracting Office of NHTSA is the only NHTSA official authorized to notify the Contractor whether a retest of an invalid test or test failure is required. In the event a retest due to an invalid test is required, it shall be performed at the Contractor's expense. The retest shall be completed no more than **two (2) weeks after receipt of notification** by the Contracting Officer unless an alternative timeframe is approved or directed by NHTSA.

F. 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.

G. 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 NHTSA, and the retest vehicle shall remain the property of the Contractor. If a retest vehicle experiences a test anomaly or fails to meet any of the requirements of this test procedure, the Contractor shall retain the retest vehicle for a period not expected to exceed 180 days. If the retest is deemed valid, the Contractor may dispose of the vehicle upon notification from the COR that the final test report has been accepted.

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 AND PROCESSING.

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

THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR OBTAINING 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 COR.

H. 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 COR. The report and other required deliverables for the retest vehicle are required to be submitted to the COR within 3 weeks after completion of the retest.

I. DEFAULT

The Contractor is subject to the default and subsequent re-procurement costs for non-delivery of valid or conforming tests (pursuant to the Default clause in the contract).

J. CONDITIONS for PARTIAL PAYMENT

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

K. NHTSA'S RIGHTS

None of the requirements herein stated shall diminish or modify the rights of NHTSA to

determine that any test submitted by the Contractor does not conform precisely to all requirements/specifications in the Laboratory Test Procedure and Statement of Work applicable to the test.

13.2 DATA PROCESSING

NOTE: Parts of the following may not apply to onboard 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	Gs	0.045	2.202	0.045	2.203
Head y							

- B. It is suggested that just prior to vehicle testing, as a secondary check, ATD instrumentation, vehicle accelerometers, and onboard signal conditioning equipment are lightly tapped with a rubber mallet to ensure that (1) sensors are recording data, (2) sensors are recording data with the correct polarity, and (3) instrumentation connections are secure.
- C. Prior to initiation of the testing program and periodically thereafter, any equipment used onboard test vehicles should be sufficiently ruggedized to function in the test environment. The data recording equipment shall have a sufficient number of channels available for recording the necessary time histories of all instrumentation used on the test vehicle and with each test dummy.
- 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.
- 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 begin at a maximum of -50 ms and be truncated at 300 ms. The data should be placed onto permanent storage media after the application of appropriate calibration scale factors.
- F. As the data is recalled for integration or graphical reporting purposes, 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” for all data, 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 from all signals prior to submission of the data tape to NHTSA.
- I. FILTERING REQUIREMENTS:

	Filter Class	Cut-off Frequency
Head Acceleration	1000	1650
Head Angular Rate	60	100
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

- J. The Contractor must format all frontal NCAP test data using NHTSA’s Entree software along with the latest version of the NHTSA Test Reference Guide: Volume 1, Vehicle Tests. It is recommended that the Contractor regularly visit NHTSA’s website for the most updated version of both the software and the guide. **Appendix I** contains instructions for locating and downloading these items.
- K. When reporting injury measures that have redundant channel capability, the following process is used when a primary channel contains questionable data or fails completely:
 - All channels should be labeled and submitted *as they are recorded in the crash*, ordered according to the channel list in **Section 13.3**. Primary channels should **never** be switched with (or labeled as) redundant channels for any reason, even if the primary channel fails and the redundant is required for a resultant injury value calculation.

- Resultant injury values should be calculated using *as many primary channels as possible*. If a required primary channel fails, its corresponding redundant should be used in the resultant calculation *along with the remaining (preserved) primary channels*. In the case of a failed primary head Z acceleration, for example, HIC should be calculated using the primary X and Y along with the redundant Z.
 - In these cases, the instrumentation comment fields in the Entree header file may be used to clarify which channels were used for a resultant injury calculation. In the case of a failed head Z acceleration, for example, the Contractor should indicate in the INSCOM field that the redundant Z channel was used to calculate the HIC reported for that occupant.
- L. If a test signal contains intermittent noise, the original data channel (as recorded) should still be added to the appropriate slot in the data tape. NCAP staff may edit the signal as necessary and provide a copy to the Contractor if it is to be included in the test report or other final deliverables.

NOTE: It is extremely rare that a data channel would require editing of this nature. The Contractor should not edit test data unless instructed to do so in a dialogue with the COR or other NCAP staff.

- M. For Quicklook and test report purposes, injury measures shall be presented in accordance with standard rounding conventions and by rounding all values to three decimal places. For data tape (Entree) reporting purposes, the Contractor should follow the conventions specified in the latest version of the NHTSA Test Reference Guide, Volume 1: Vehicle Tests.
- N. Software programs that can calculate various NCAP-related injury measures and digitally filter the data collected from NCAP tests are also available on the NHTSA web site at: <https://www.nhtsa.gov/databases-and-software/signal-analysis-software-windows>

Any questions pertaining to this software should be directed to NCAP COR or to the following technical support department:

U.S. Dept. of Transportation
NHTSA/NVS-300
W46-318
1200 New Jersey Ave SE
Washington, DC 20590
ATTN: Signal Analysis Software Tools

All inquiries sent to NHTSA's technical support department should receive a response within two (2) business days. The COR should be contacted if a timely response is not received.

13.3 RECOMMENDED DATA TRACE ORDER

To ensure uniformity in data tape formatting, the following Entree curve order (CURNO) is required. The exact wording in the provided Instrumentation Comments (INSCOM) is optional; however, the sentiment implied should be reflected in data tapes submitted.

DRIVER DATA TRACES	
<i>CURNO</i>	<i>INSCOM</i>
1	DRIVER HEAD X - PRIMARY
2	DRIVER HEAD Y - PRIMARY
3	DRIVER HEAD Z - PRIMARY
4	DRIVER HEAD X - REDUNDANT
5	DRIVER HEAD Y - REDUNDANT
6	DRIVER HEAD Z - REDUNDANT
7	DRIVER NECK X - FORCE
8	DRIVER NECK Y - FORCE
9	DRIVER NECK Z - FORCE
10	DRIVER NECK X - MOMENT
11	DRIVER NECK Y - MOMENT
12	DRIVER NECK Z - MOMENT
13	DRIVER CHEST X - PRIMARY
14	DRIVER CHEST Y - PRIMARY
15	DRIVER CHEST Z - PRIMARY
16	DRIVER CHEST X - REDUNDANT
17	DRIVER CHEST Y - REDUNDANT
18	DRIVER CHEST Z - REDUNDANT
19	DRIVER CHEST DISPLACEMENT
20	DRIVER PELVIS X
21	DRIVER PELVIS Y
22	DRIVER PELVIS Z
23	DRIVER LEFT FEMUR
24	DRIVER RIGHT FEMUR
25	DRIVER LEFT FEMUR REDUNDANT
26	DRIVER RIGHT FEMUR REDUNDANT
27	DRIVER LEFT UPPER TIBIA X MOMENT
28	DRIVER LEFT UPPER TIBIA Y MOMENT
29	DRIVER LEFT UPPER TIBIA Z FORCE
30	DRIVER LEFT LOWER TIBIA X MOMENT
31	DRIVER LEFT LOWER TIBIA Y MOMENT
32	DRIVER LEFT LOWER TIBIA Z FORCE

33	DRIVER RIGHT UPPER TIBIA X MOMENT
34	DRIVER RIGHT UPPER TIBIA Y MOMENT
35	DRIVER RIGHT UPPER TIBIA Z FORCE
36	DRIVER RIGHT LOWER TIBIA X MOMENT
37	DRIVER RIGHT LOWER TIBIA Y MOMENT
38	DRIVER RIGHT LOWER TIBIA Z FORCE
39	DRIVER LEFT ANKLE X
40	DRIVER LEFT ANKLE Z
41	DRIVER LEFT FOOT Z - FRONT
42	DRIVER RIGHT ANKLE X
43	DRIVER RIGHT ANKLE Z
44	DRIVER RIGHT FOOT Z - FRONT
45	DRIVER SHOULDER BELT
46	DRIVER LAP BELT

PASSENGER DATA TRACES	
<i>CURNO</i>	<i>INSCOM</i>
47	PASSENGER HEAD X - PRIMARY
48	PASSENGER HEAD Y - PRIMARY
49	PASSENGER HEAD Z - PRIMARY
50	PASSENGER HEAD X - REDUNDANT
51	PASSENGER HEAD Y - REDUNDANT
52	PASSENGER HEAD Z - REDUNDANT
53	PASSENGER NECK X -- FORCE
54	PASSENGER NECK Y --
55	PASSENGER NECK Z --
56	PASSENGER NECK X - MOMENT
57	PASSENGER NECK Y - MOMENT
58	PASSENGER NECK Z - MOMENT
59	PASSENGER CHEST X - PRIMARY
60	PASSENGER CHEST Y - PRIMARY
61	PASSENGER CHEST Z - PRIMARY
62	PASSENGER CHEST X - REDUNDANT
63	PASSENGER CHEST Y - REDUNDANT
64	PASSENGER CHEST Z - REDUNDANT
65	PASSENGER CHEST DISPLACEMENT
66	PASSENGER PELVIS X
67	PASSENGER PELVIS Y
68	PASSENGER PELVIS Z
69	PASSENGER LEFT FEMUR

70	PASSENGER RIGHT FEMUR
71	PASSENGER LEFT FEMUR REDUNDANT
72	PASSENGER RIGHT FEMUR REDUNDANT
73	PASSENGER LEFT UPPER TIBIA X MOMENT
74	PASSENGER LEFT UPPER TIBIA Y MOMENT
75	PASSENGER LEFT UPPER TIBIA Z FORCE
76	PASSENGER LEFT LOWER TIBIA X MOMENT
77	PASSENGER LEFT LOWER TIBIA Y MOMENT
78	PASSENGER LEFT LOWER TIBIA Z FORCE
79	PASSENGER RIGHT UPPER TIBIA X MOMENT
80	PASSENGER RIGHT UPPER TIBIA Y MOMENT
81	PASSENGER RIGHT UPPER TIBIA Z FORCE
82	PASSENGER RIGHT LOWER TIBIA X MOMENT
83	PASSENGER RIGHT LOWER TIBIA Y MOMENT
84	PASSENGER RIGHT LOWER TIBIA Z FORCE
85	PASSENGER LEFT ANKLE X
86	PASSENGER LEFT ANKLE Z
87	PASSENGER LEFT FOOT Z - FRONT
88	PASSENGER RIGHT ANKLE X
89	PASSENGER RIGHT ANKLE Z
90	PASSENGER RIGHT FOOT Z - FRONT
91	PASSENGER SHOULDER BELT
92	PASSENGER LAP BELT

VEHICLE DATA TRACES	
<i>CURNO</i>	<i>INSCOM</i>
93	LEFT REAR SEAT CROSSMEMBER X
94	RIGHT REAR SEAT CROSSMEMBER X
95	TOP OF ENGINE X
96	BOTTOM OF ENGINE X
97	LEFT REAR SEAT CROSSMEMBER Z
98	RIGHT REAR SEAT CROSSMEMBER Z
99	LEFT REAR SEAT CROSSMEMBER X REDUNDANT
100	RIGHT REAR SEAT CROSSMEMBER X REDUNDANT

RESEARCH DATA TRACES	
<i>CURNO</i>	<i>INSCOM</i>
101	DRIVER HEAD X ANGULAR VELOCITY
102	DRIVER HEAD Y ANGULAR VELOCITY
103	DRIVER HEAD Z ANGULAR VELOCITY

104	PASSENGER HEAD X ANGULAR VELOCITY
105	PASSENGER HEAD Y ANGULAR VELOCITY
106	PASSENGER HEAD Z ANGULAR VELOCITY

LOAD CELL BARRIER DATA TRACES	
<i>CURNO</i>	<i>INSCOM</i>
107-???	Depends on load cell barrier size - See Appendix H

13.4 PERFORMANCE REQUIREMENTS – NOTIFICATION OF TEST RESULTS

The performance requirements are found in **Section 2** of this test procedure. If the test results indicate that the test vehicle has exceeded any of the injury criteria or has not met another requirement, the Contractor shall notify the COR in accordance with **Appendix I, Test Deliverables and Report Guidelines**.

13.5 NCAP TEST DELIVERABLES

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

13.6 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 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 may be given an inspection opportunity if needed.

13.7 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 NHTSA.

APPENDIX A
PART 572E (50th MALE) DUMMY PERFORMANCE
QUALIFICATION TEST PROCEDURE

APPENDIX A
PART 572 SUBPART E DUMMY PERFORMANCE QUALIFICATION 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 qualification 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 qualification 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 qualification 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

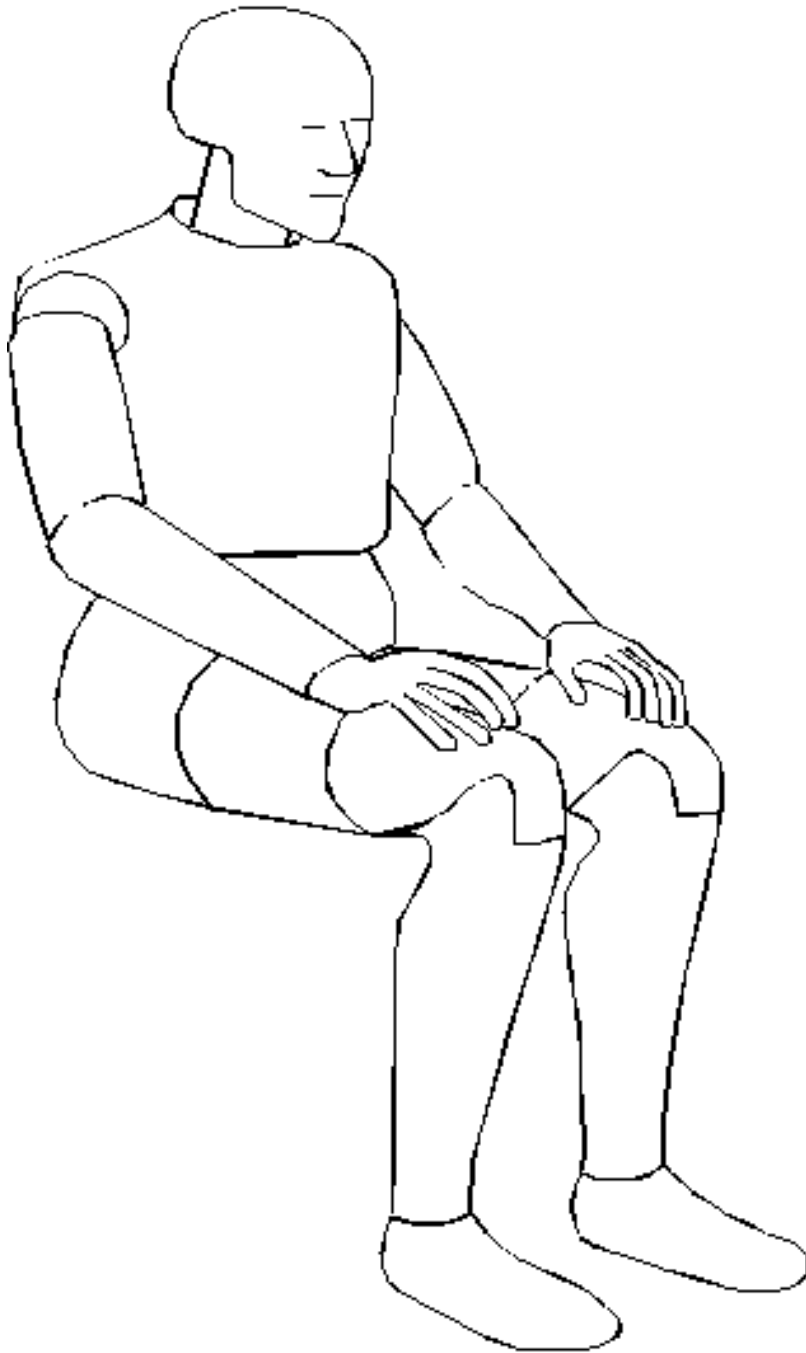


FIGURE 1A

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 qualification 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 COR) 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 qualification tests before and after each vehicle crash usage.

No information concerning the Part 572E dummy qualification data shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Branch or Division Chief.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire dummy qualification 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 qualified as test tools to be used in a vehicle test to determine compliance with the requirements of NCAP. The schedule for these performance qualification tests must be correlated with that of the vehicle tests. All testing shall be coordinated to allow monitoring by the COR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy qualification data available to the COR for review and analysis as required. All qualification test data for each particular Part 572, Subpart E dummy will be sent to the COR with each test report.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc. shall be either sent to the COR 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**, of this appendix) that will be included with the post-test dummy qualification. The COR will be kept informed of the dummies' conditions in order for replacement parts to be provided. The contractor shall qualify the dummies before and verify the qualification after every crash test.

8. CALIBRATION AND TEST INSTRUMENTATION

Before the contractor initiates the dummy performance qualification 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 COR. The calibration system will need the written acceptance of the COR 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 qualified before and after each test. These qualifications 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. PRE-TEST 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 (A_x , A_y , A_z) 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 qualification 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 (A_x , A_y , A_z) 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 qualification 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))

SIGN CONVENTIONS FOR PART 572 SUBPART E TEST DUMMIES

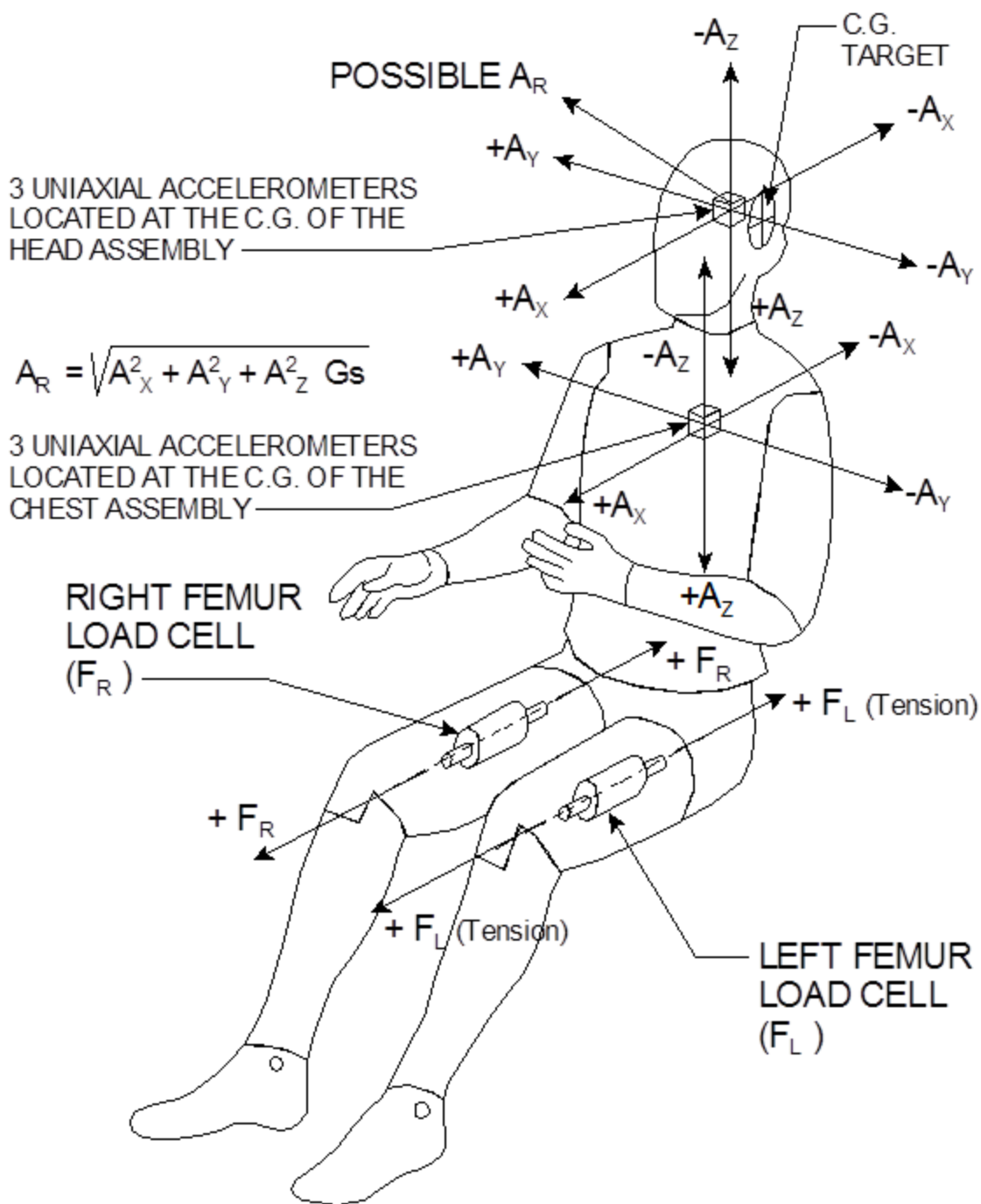


FIGURE 2A

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

TABLE 1A**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 qualification tests with the exception of the shoes being removed.

12. QUALIFICATION 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 qualification test data sheet.

14. REPORTS

14.1 APPARENT NONCONFORMANCE

During a post-test qualification, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COR 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 COR's discretion and shall be performed without additional costs to the OCWS.

14.2 QUALIFICATION DOCUMENTATION

14.2.1 DATA SHEETS

Copies of the data sheets (see **Section 15**) containing pre-test qualification and post-test qualification verification data for each Part 572, Subpart E dummy used in the crash test shall be submitted with the final NCAP test report for the vehicle.

Contractors are required to **PROOF READ** all test reports before submittal to the COR. 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 A1
DUMMY DAMAGE CHECKLIST (50th Male)

Dummy Serial Number _____

Test Date _____

Technician _____

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

__ Perform general cleaning.

Dummy Item	Inspect for	Comments	Damaged	OK
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 (50th Male)
 (Procedures for Disassembly, Inspection and Assembly of the Hybrid III Dummy)

Dummy Serial Number _____ Test Date _____
 Technician _____

Pre-test qualification
 Post-test qualification 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 qualification if required (pre-test qualification 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 ± 0.1 in above the horizontal seating surface and 5.4 ± 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 ± 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**.

Signature

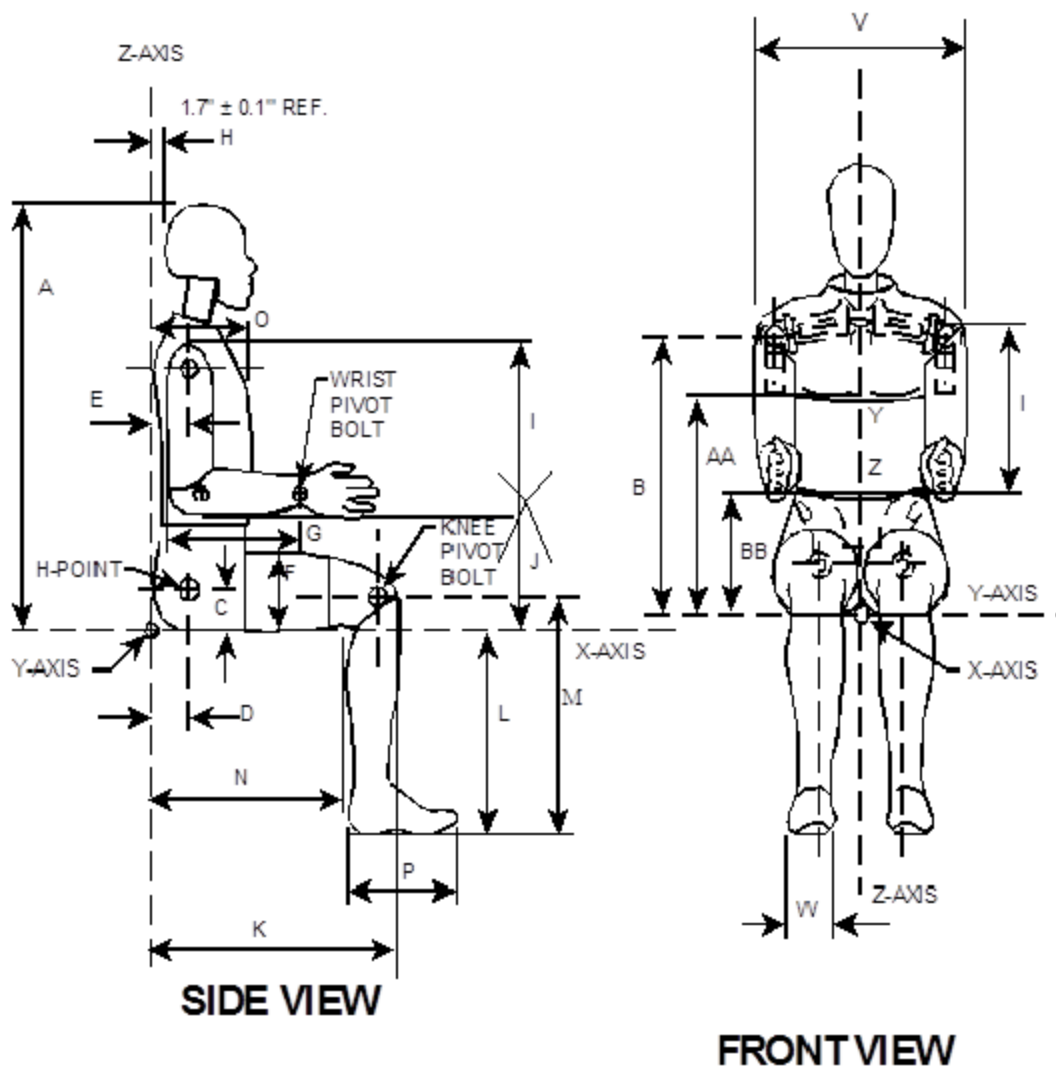
Date

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

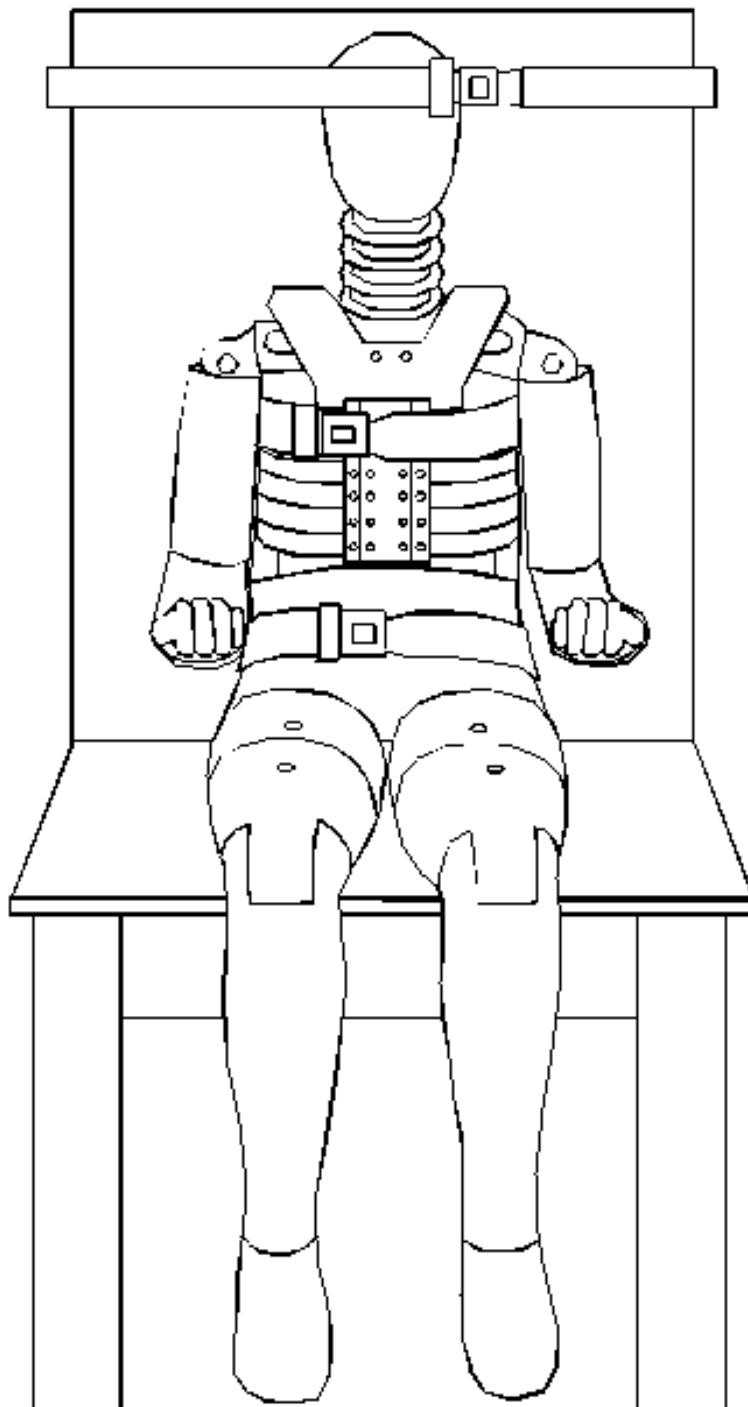


FIGURE 4A

EXTERNAL DIMENSIONS TEST SETUP

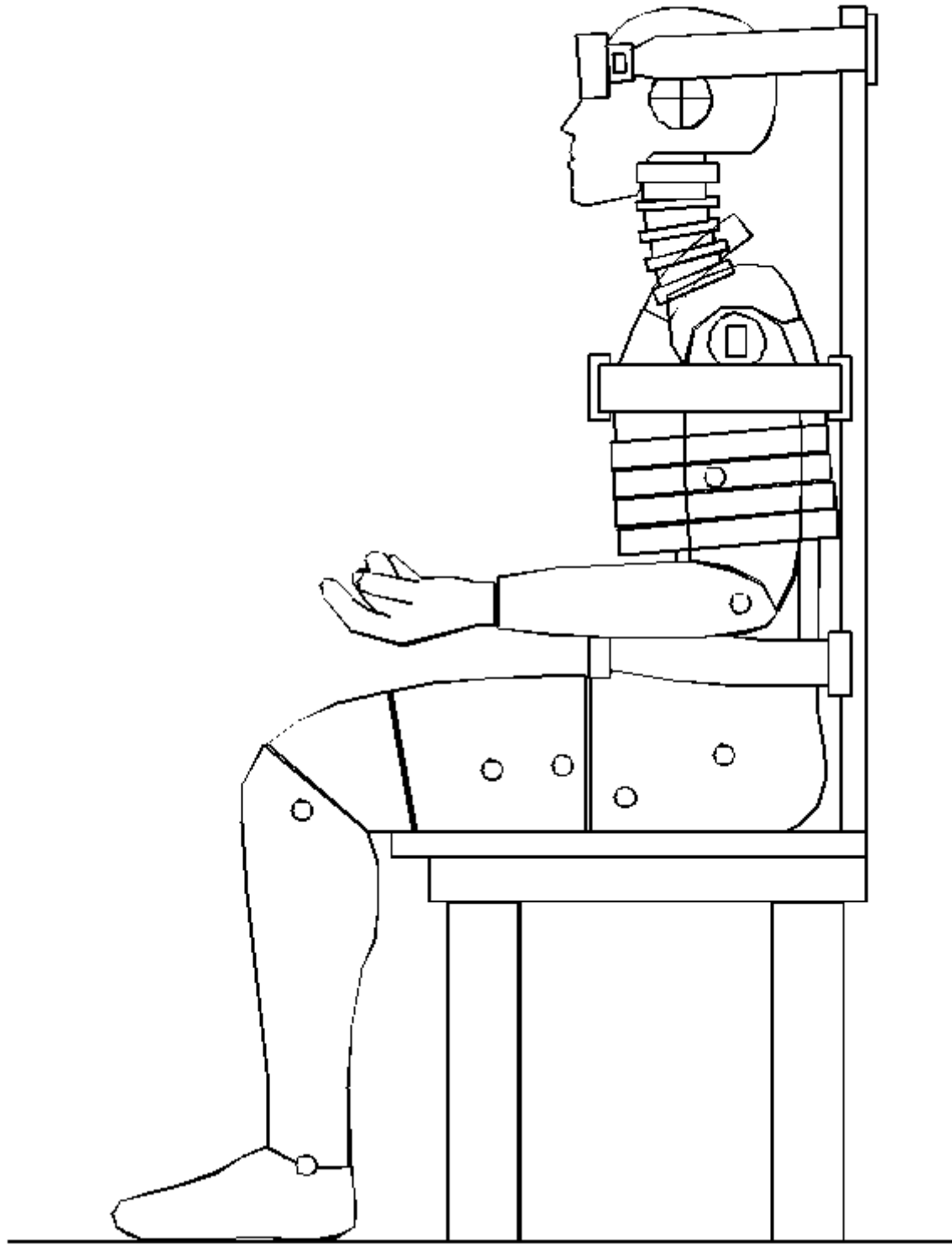


FIGURE 5A

DATA SHEET A3
HEAD DROP TEST (572.32) (50th Male)

Dummy Serial Number _____ Test Date _____
 Technician _____

Pre-test qualification
 Post-test qualification 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 qualification 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 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-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 ± 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)):

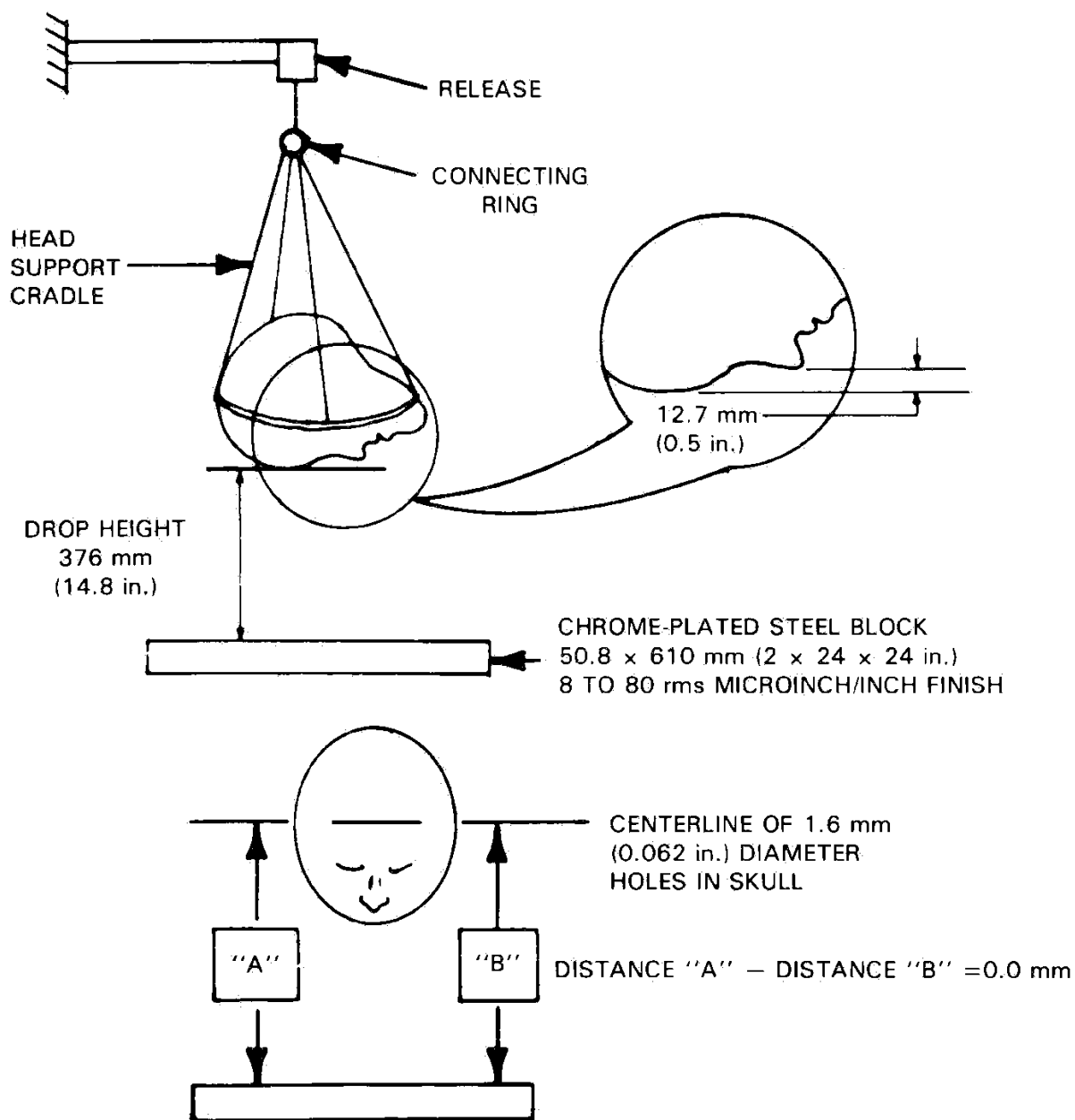
Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	
Resultant versus time history curve	Unimodal	
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	

- __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 ± 1 mm (0.04 in.)

FIGURE 6A

HEAD DROP TEST SETUP

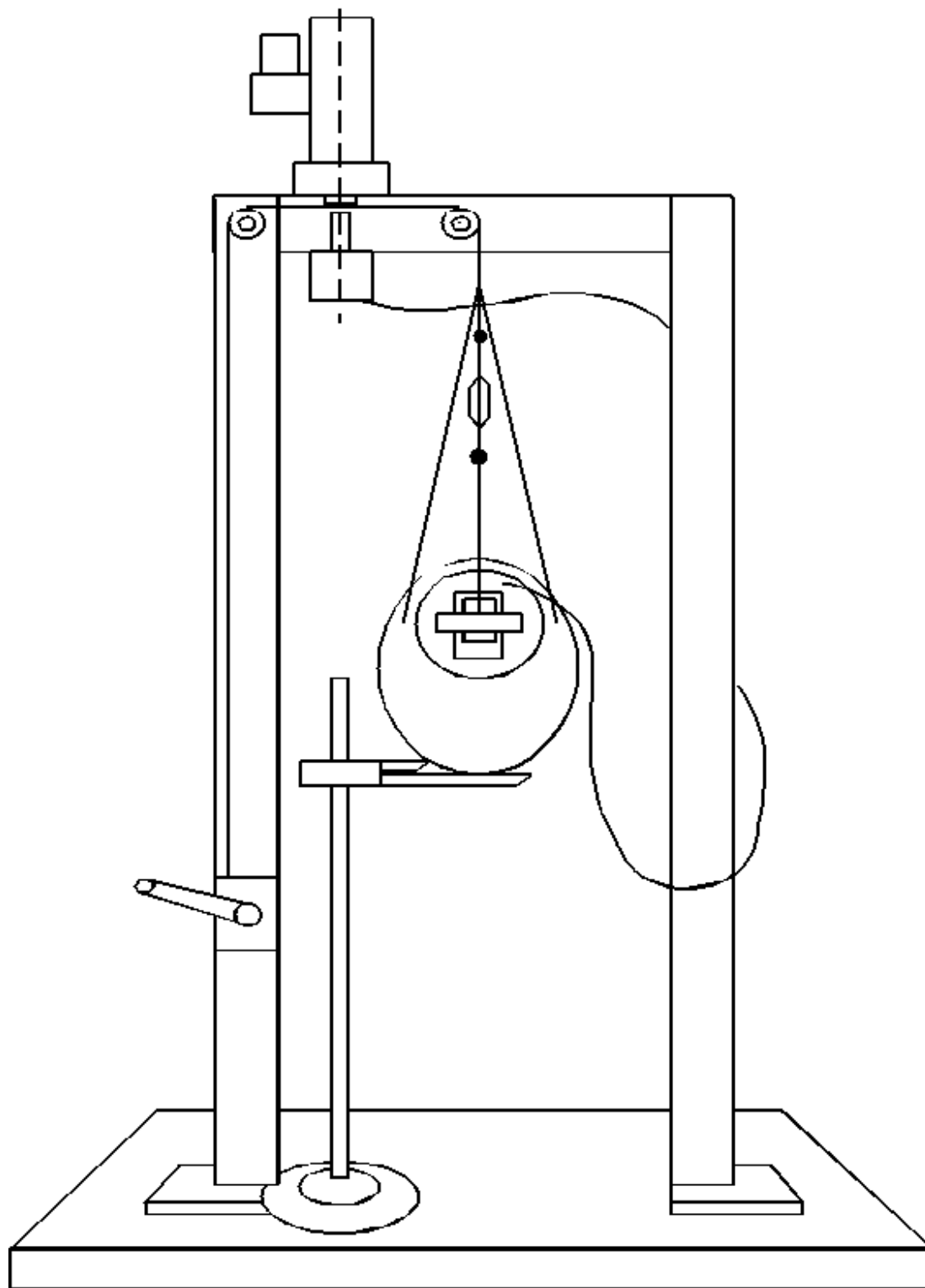


FIGURE 7A

DATA SHEET A4
NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number _____ Test Date _____
Technician _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification. 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 qualification neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to 1.0 ± 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 ± 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 Deceleration Versus Time 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 Cross 0° 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 Positive Moment Decay** (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) (50th Male)

Dummy Serial Number _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification. 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 qualification Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to 1.0 ± 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 ± 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) & (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

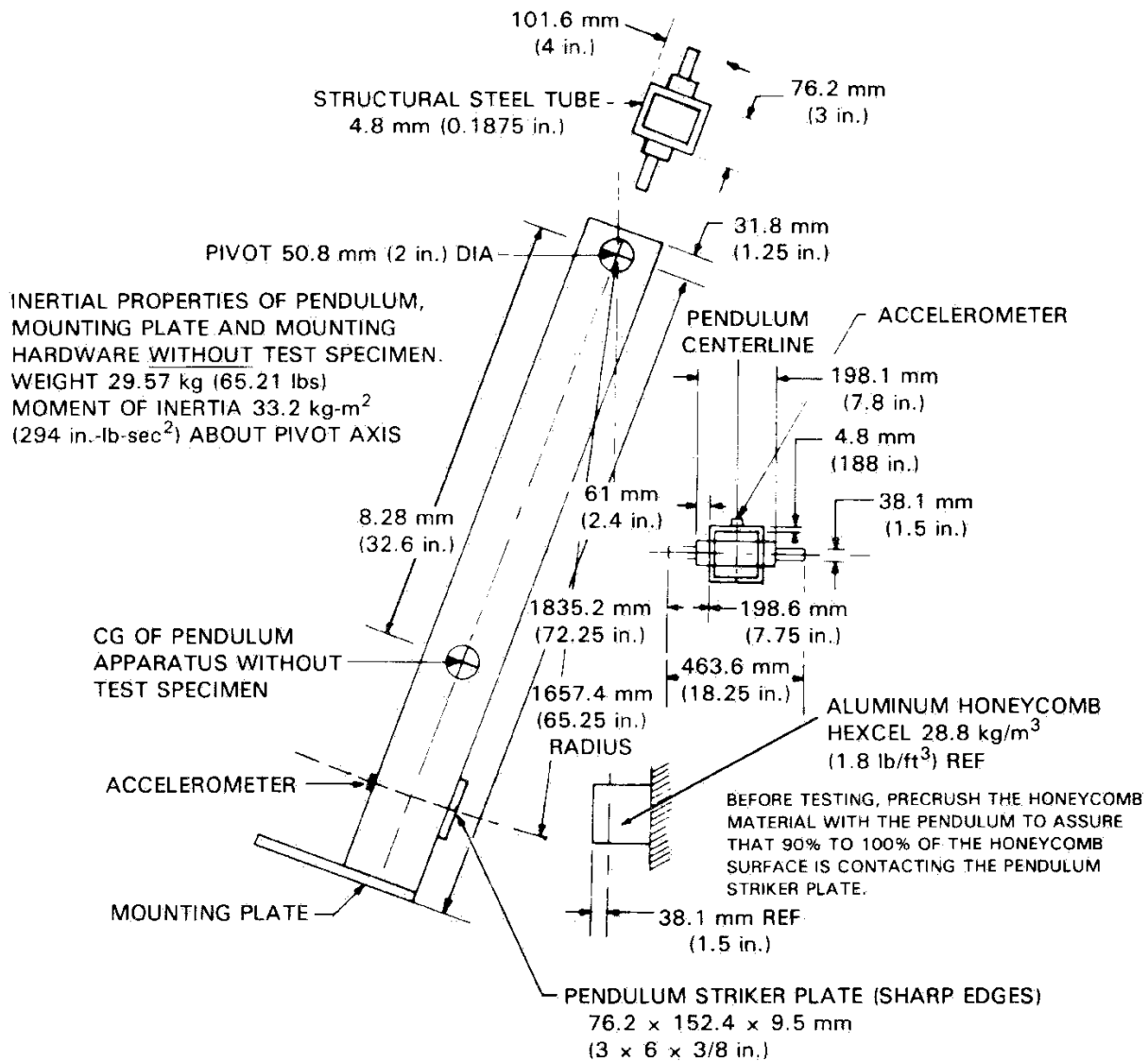
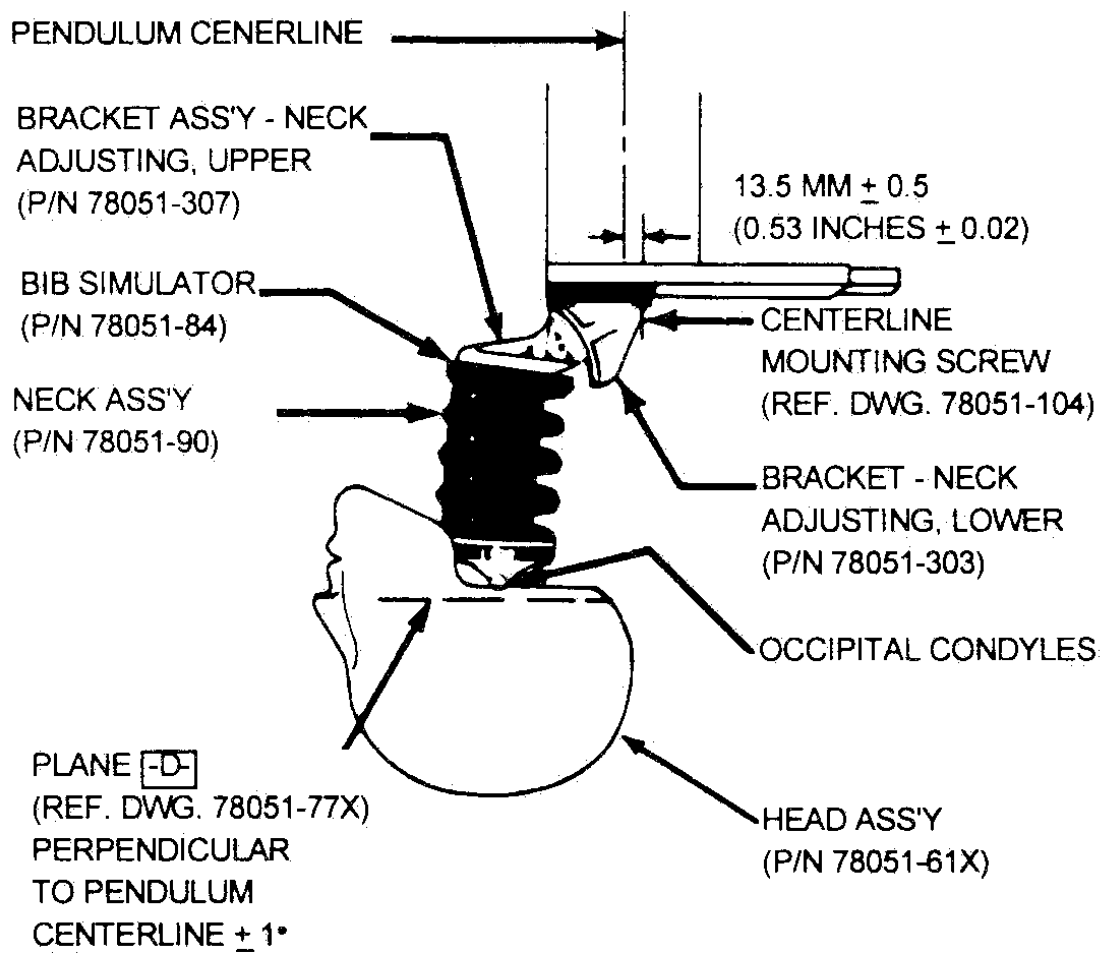


FIGURE 8A

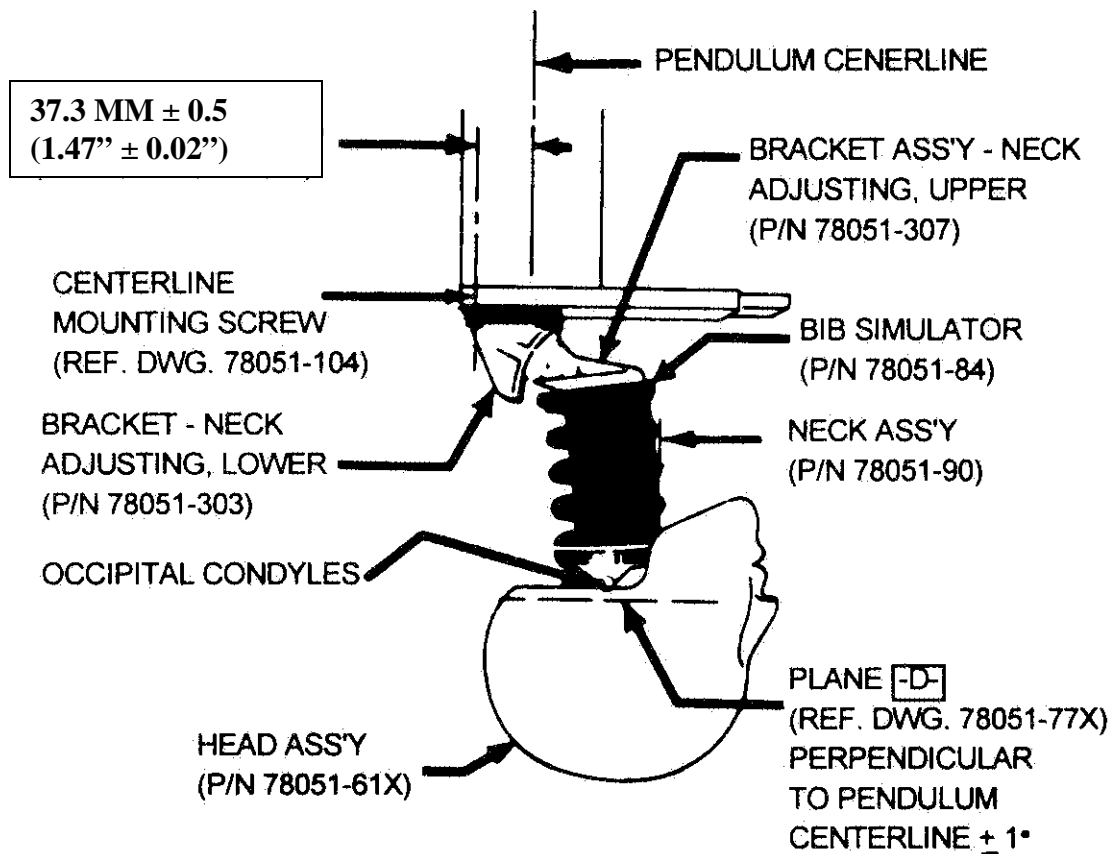
FLEXION - TEST SET-UP SPECIFICATIONS



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

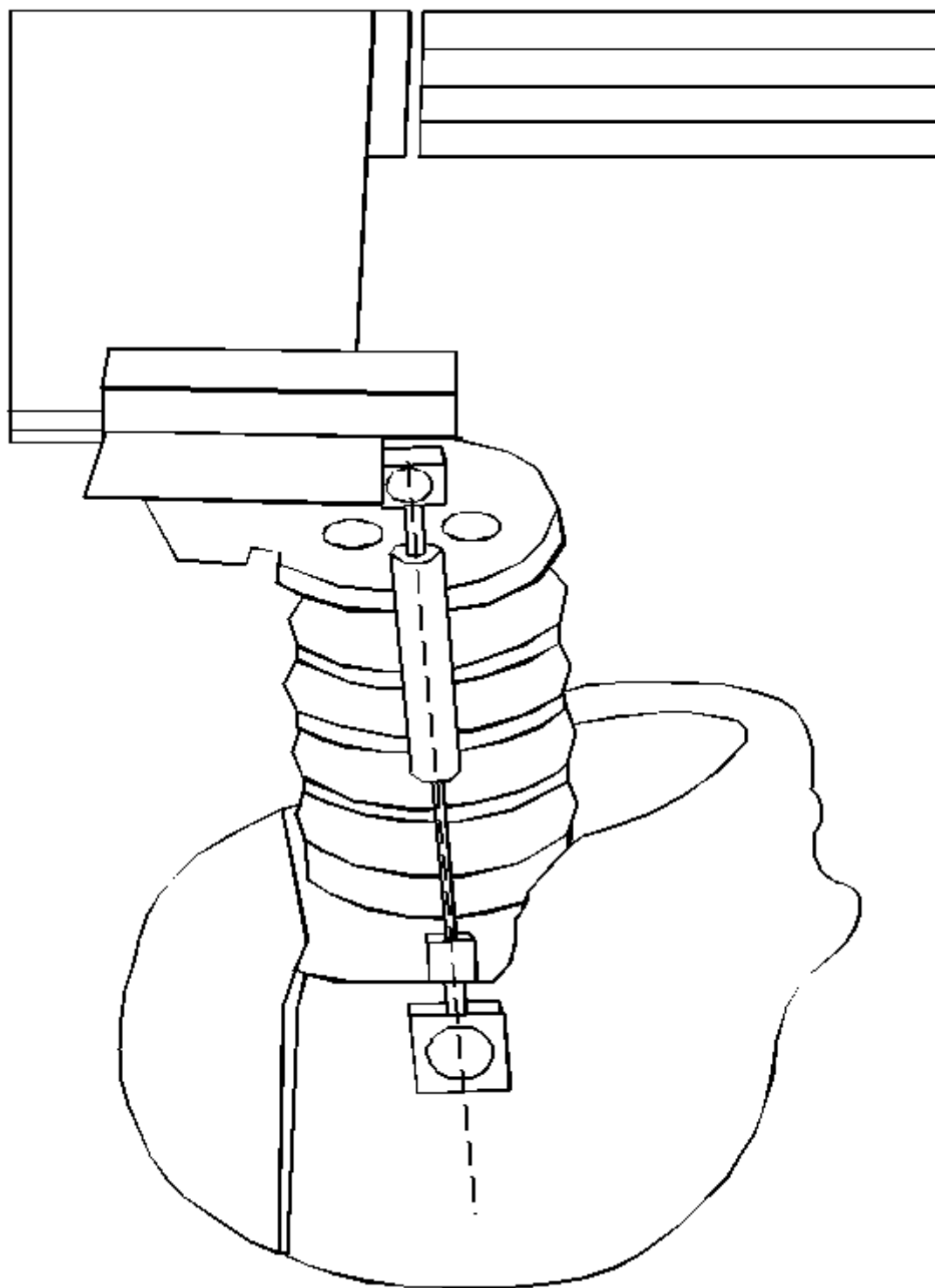


FIGURE 11A

DATA SHEET A6
THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number _____ Test Date _____
 Technician _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification 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 ± 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° 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° 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.

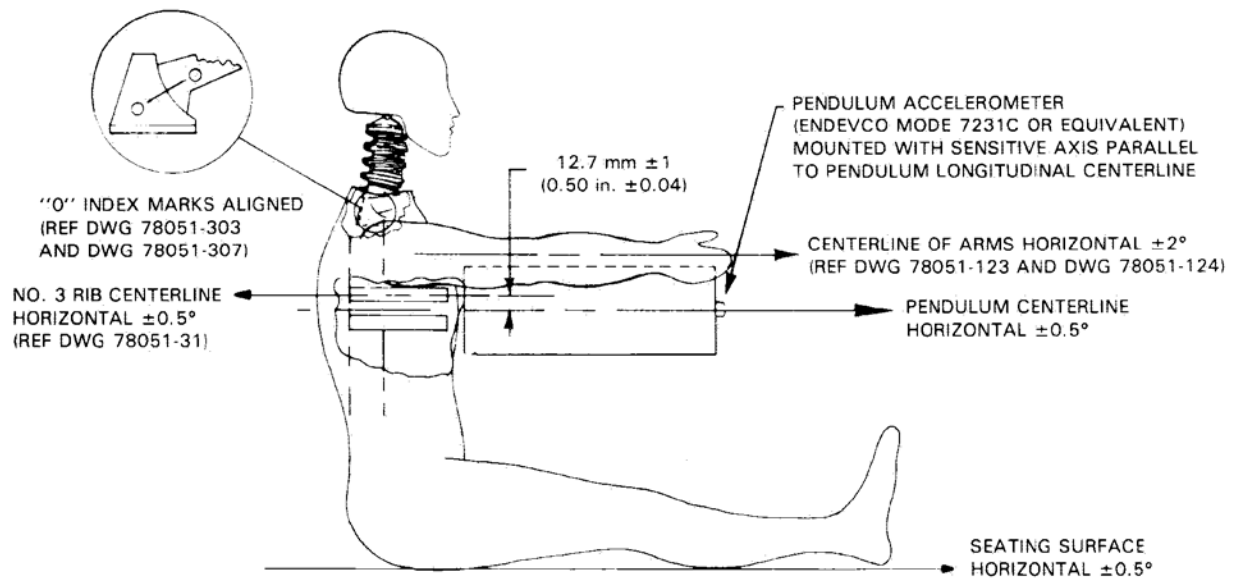
**Force = impactor mass x acceleration (572.34(b))

***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 pendulum force versus chest compression, 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° 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 QUALIFICATION - HYSTERESIS

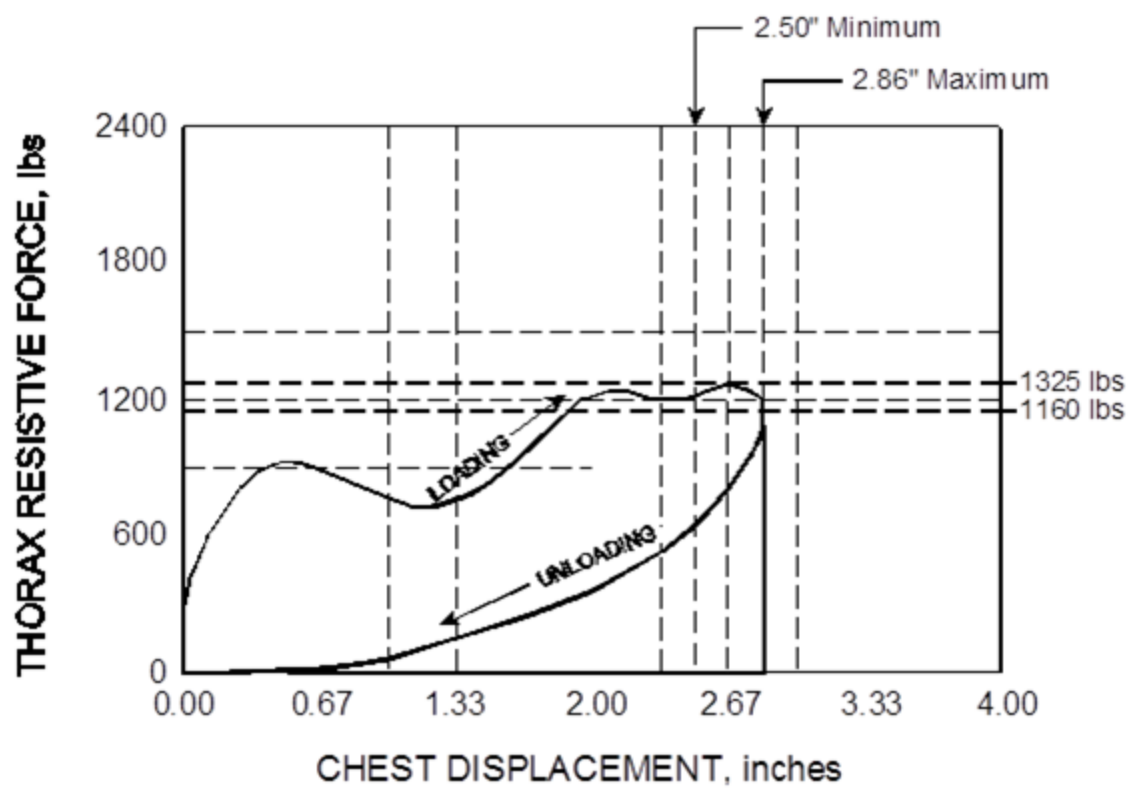


FIGURE 13A

DATA SHEET A7
LEFT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number _____ Test Date _____
 Technician _____

Pre-test qualification
 Post-test qualification 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) (50th Male)

Dummy Serial Number _____ Test Date _____
 Technician _____

Pre-test qualification
 Post-test qualification 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

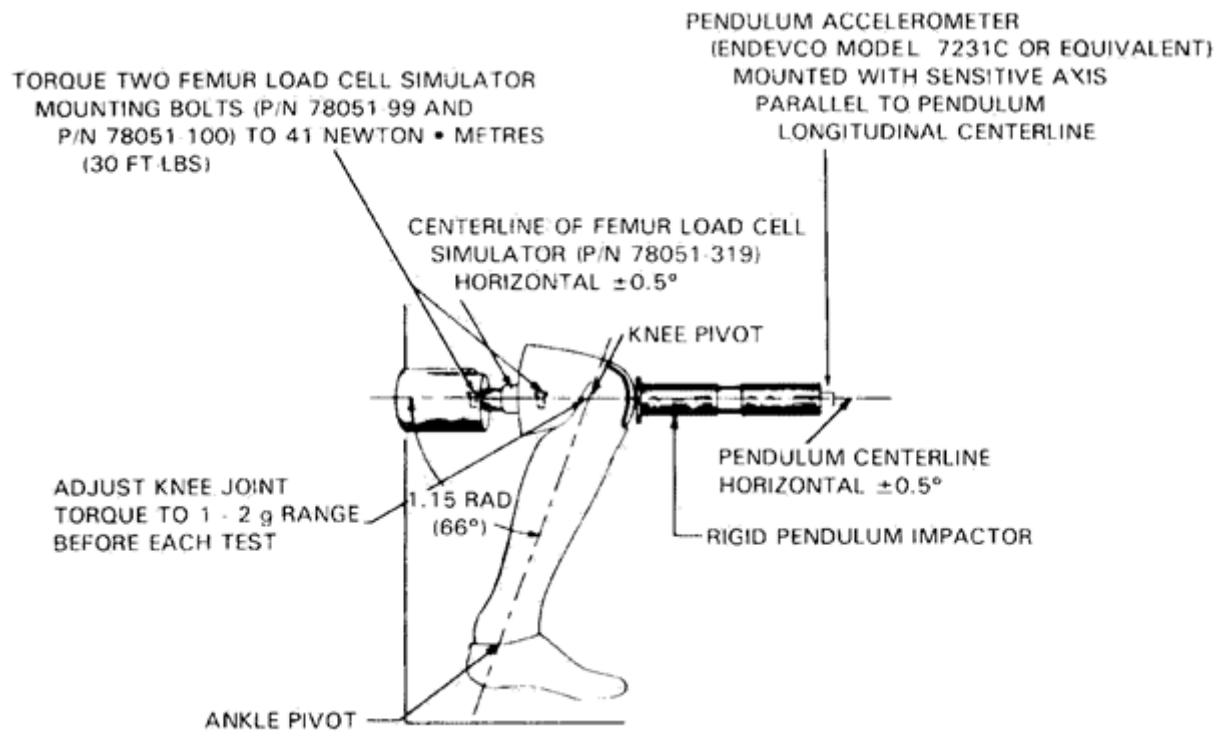


FIGURE 14A

DATA SHEET A9
HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number _____ Test Date _____
 Technician _____

__ Pre-test qualification
 __ Post-test qualification 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°	torque ≤ 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 ½ 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°	torque ≤ 70 ft-lbf	
Rotation at 150 lbf-ft	$40^\circ \leq \text{rotation} \leq 50^\circ$	

Signature

Date

PELVIC BONE STABILIZER INSERT

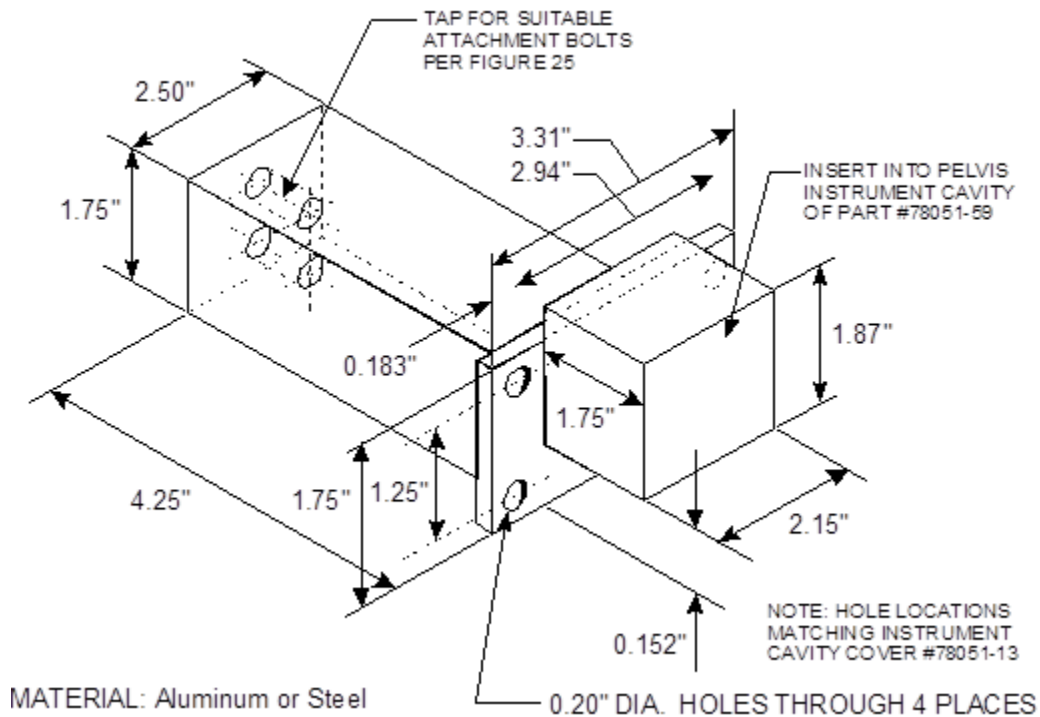


FIGURE 15A

PELVIS UPPER SUPPORT DEVICE

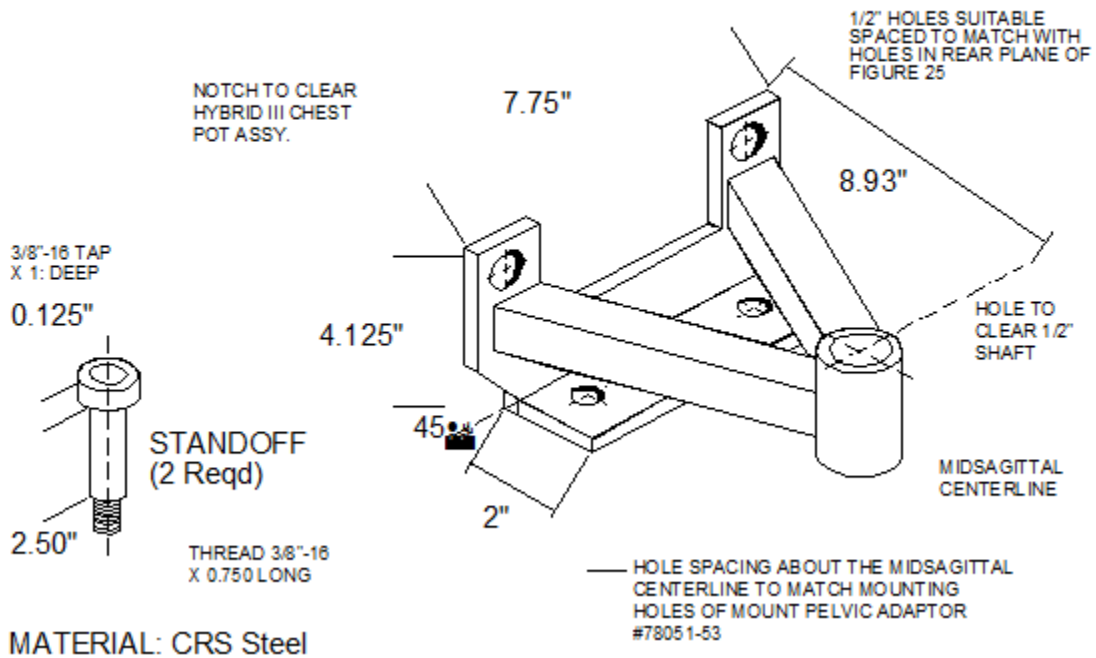


FIGURE 16A

HIP-JOINT TEST FIXTURE ASSEMBLY

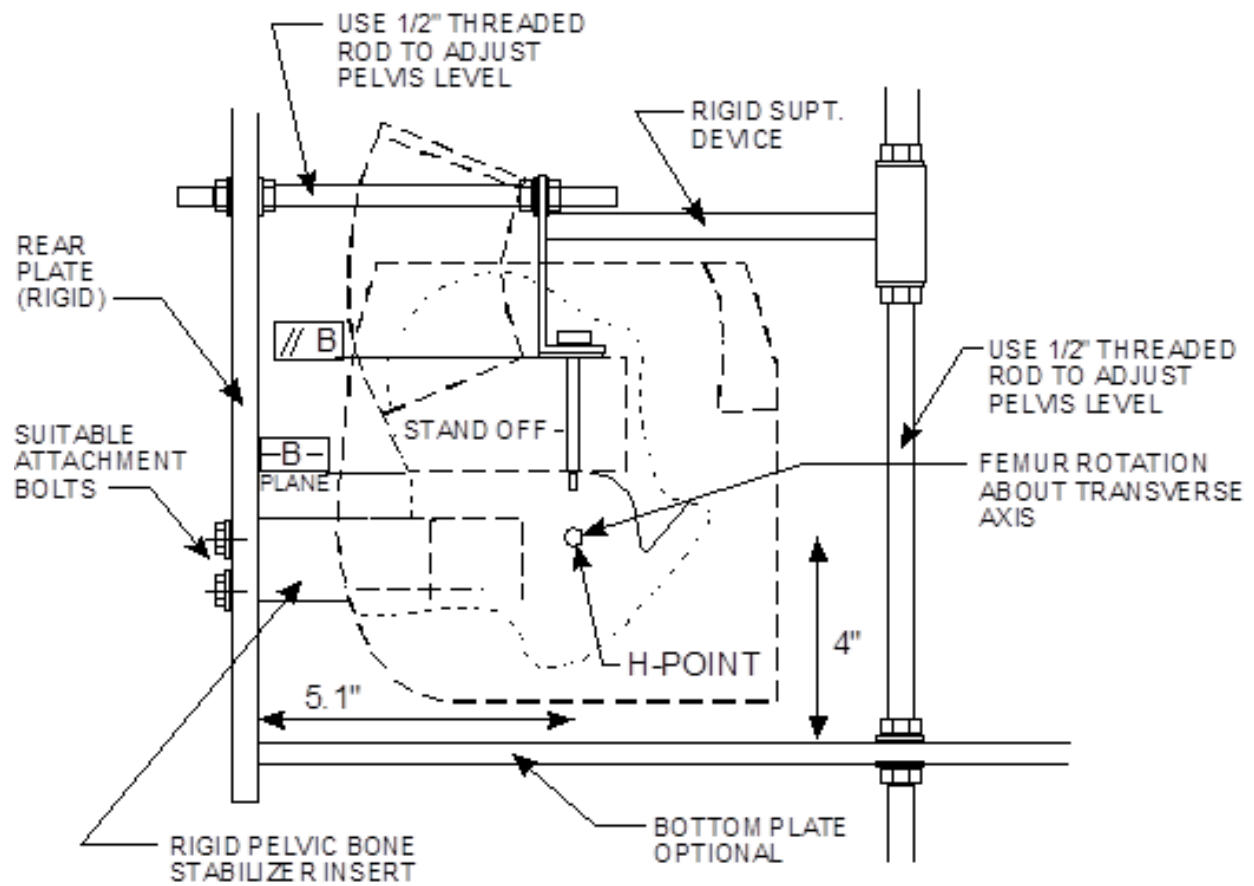


FIGURE 17A

HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY

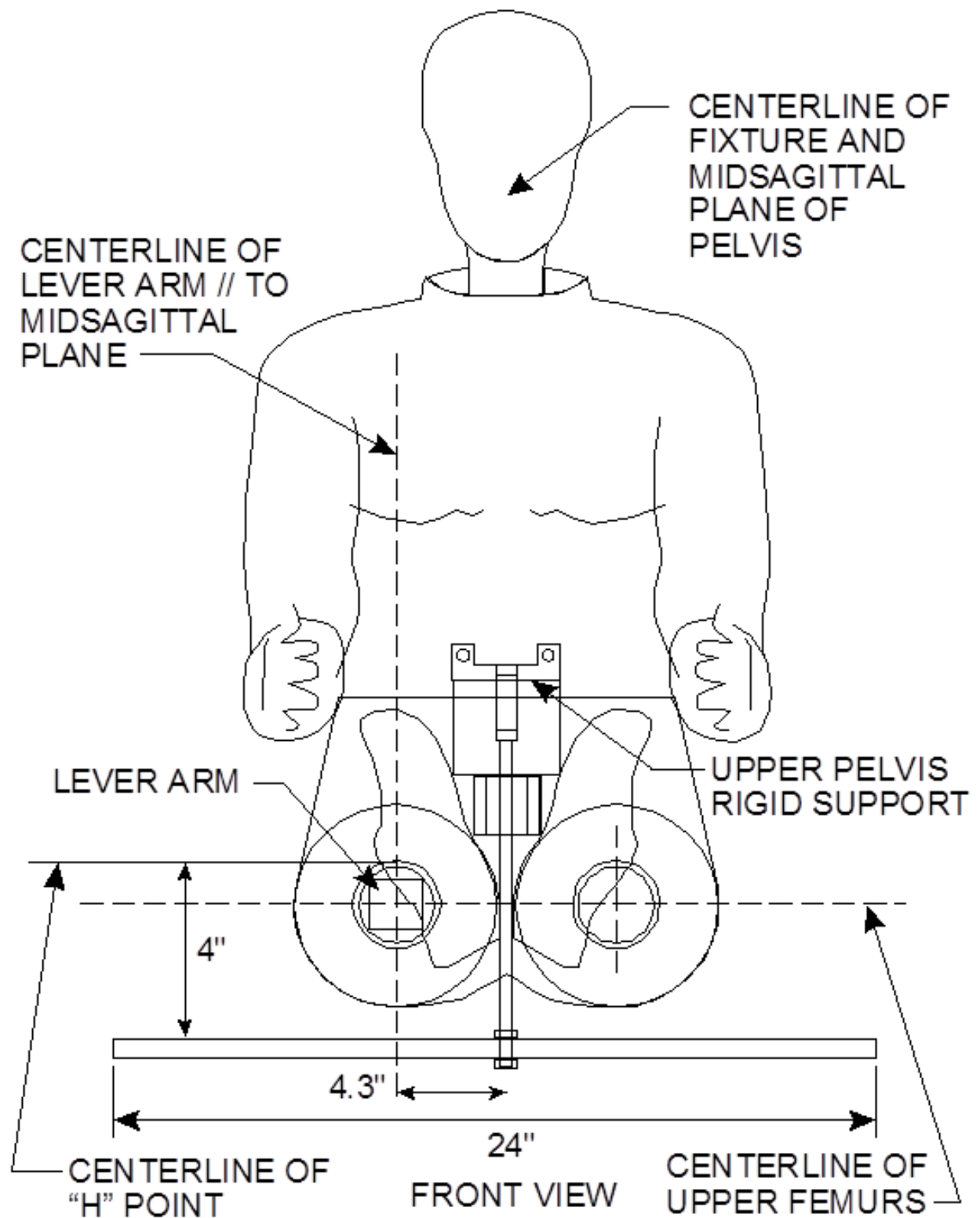


FIGURE 18A

HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY

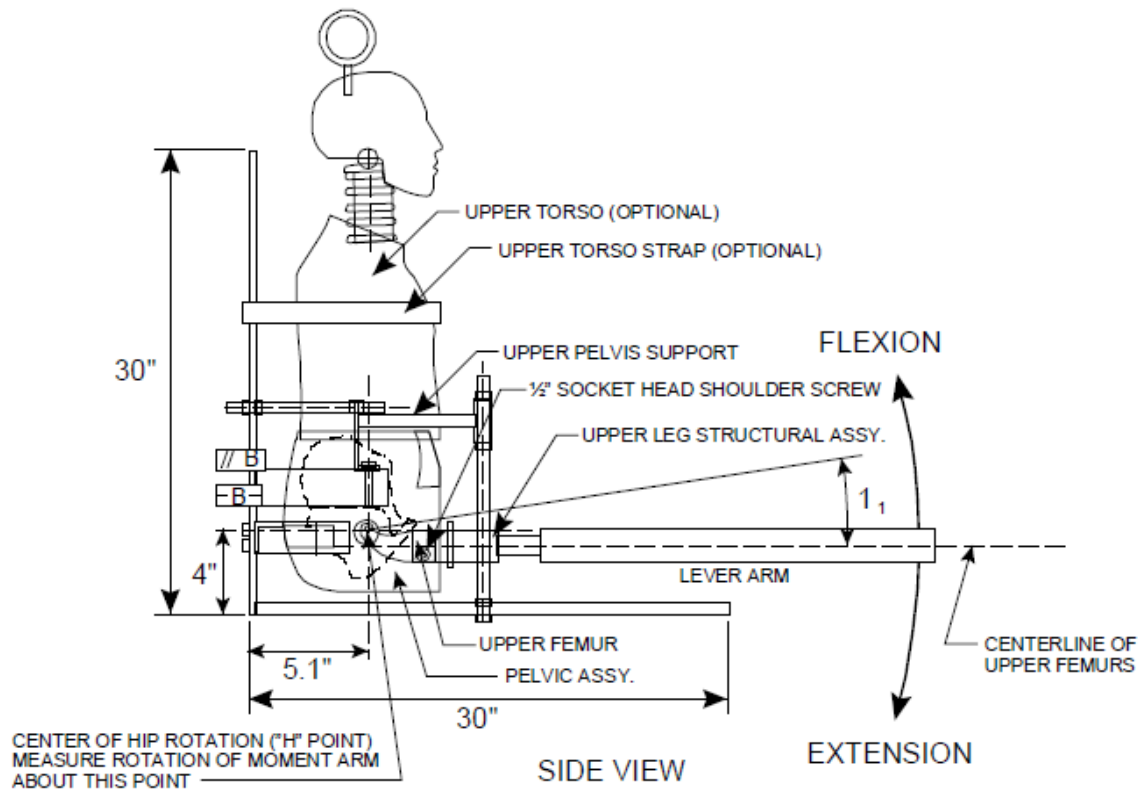


FIGURE 19A

DATA SHEET A10
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
<i>DUMMY INSTRUMENTATION</i>					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
NECK TRANSDUCER					
CHEST ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
CHEST POTENTIOMETER					
FEMUR LOAD CELLS					
(1) RIGHT FEMUR					
(2) LEFT FEMUR					
LABORATORY INSTRUMENTATION					
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 (5th FEMALE) DUMMY PERFORMANCE
QUALIFICATION TEST PROCEDURE

APPENDIX B
PART 572 O (5th FEMALE) DUMMY PERFORMANCE QUALIFICATION 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 qualification 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 qualification 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 qualification 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 qualification 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 COR) 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 qualification tests before and after each vehicle test usage.

No information concerning the Part 572, Subpart O dummy qualification data shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Branch or Division Chief.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire dummy qualification 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 qualified as test tools to be used in NCAP vehicle crash tests. The schedule for these performance qualification tests must be correlated with that of the vehicle tests. In addition, all testing shall be coordinated to allow monitoring by the COR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy qualification data available to the COR for review and analysis as required. All qualification test data for each particular Part 572, Subpart O dummy will be sent to the COR with each test report.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc. shall be either sent to the COR 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 qualification, if requested. The COR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be qualified 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 qualification 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 COR. The calibration system will need the written acceptance of the COR 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 qualified as indicated in NCAP test procedure. These qualifications 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. PRE-TEST 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 triaxial configuration within the spine box instrumentation cavity as shown drawing 880105-000 sheet 3 of 6. The chest accelerometers are not required for dummy qualification 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 qualification 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 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 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 ± 0.023 kg (30.8 ± 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-cm² (3.22 lbs-in-sec²) 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 ± 0.25 mm (6.00 ± 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 ± 0.01 kg (6.6 ± 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-cm² (0.177 lbs-in-sec²) 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 ± 0.2 mm (3.00 ± 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 O TEST DUMMIES

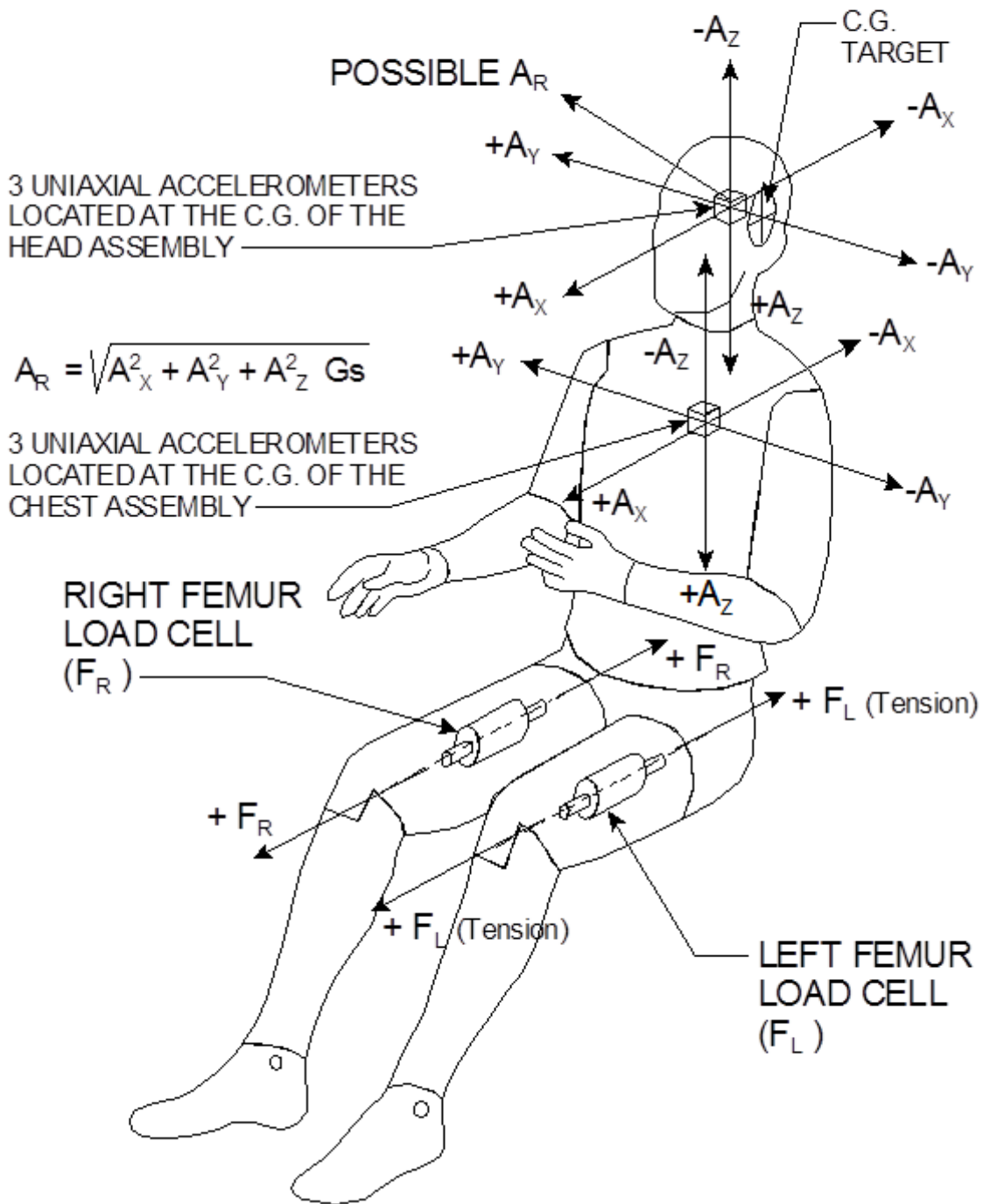


FIGURE 1B

TABLE 1

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

Complete the data sheets in **Section 15** of this appendix.

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 qualification test data sheet.

14. REPORTS

14.1 APPARENT NONCONFORMANCE

During qualification verification, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COR 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 COR's discretion and shall be performed without additional costs to the OCWS.

14.2 QUALIFICATION DOCUMENTATION

14.2.1 DATA SHEETS

Copies of the data sheets (see **Section 15** of this appendix) containing the pre-test qualification and post-test qualification verification data for each Part 572, Subpart O dummy used in the crash test shall be submitted with the final NCAP test report for the vehicle.

Contractors are required to **PROOF READ** all test reports before submittal to the COR. 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 _____
 Technician _____

Test Date _____

This check sheet is completed as part of the qualification 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 (5th Female)
 (See the PADI)

Dummy Serial Number _____
 Technician _____

Test Date _____

Pre-test qualification

Post-test qualification 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 **Figures 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 qualification if required (pre-test qualification 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 ± 2.5 mm (3.3 ± 0.1 in) above the horizontal seating surface and 147.3 ± 2.5 mm (5.8 ± 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 ± 2.5 mm (1.8 ± 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

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 ± 5.1 mm above seat surface	175.3-190.5	
P	FOOT LENGTH	Tip of toe to rear of heel	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 ± 12.7 mm above seat surface	850.9-881.3	
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 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

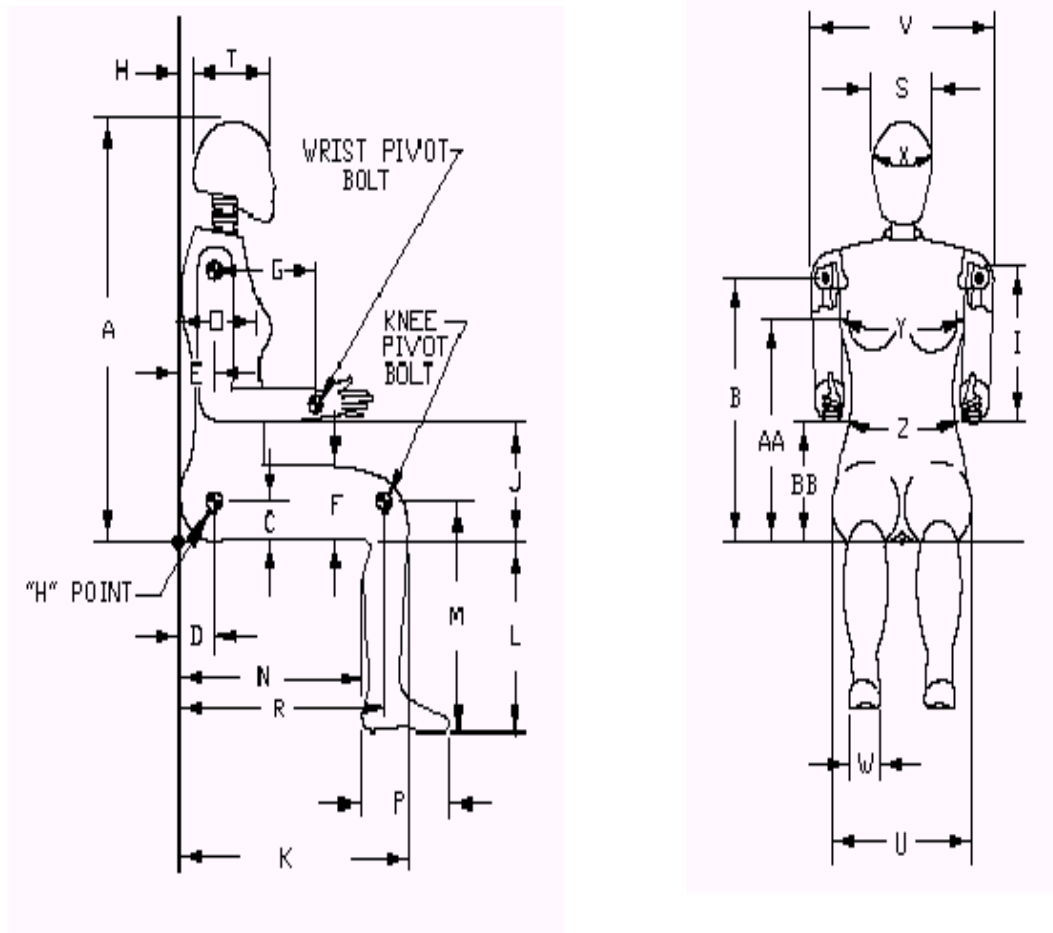


FIGURE 2B

EXTERNAL DIMENSIONS TEST SETUP

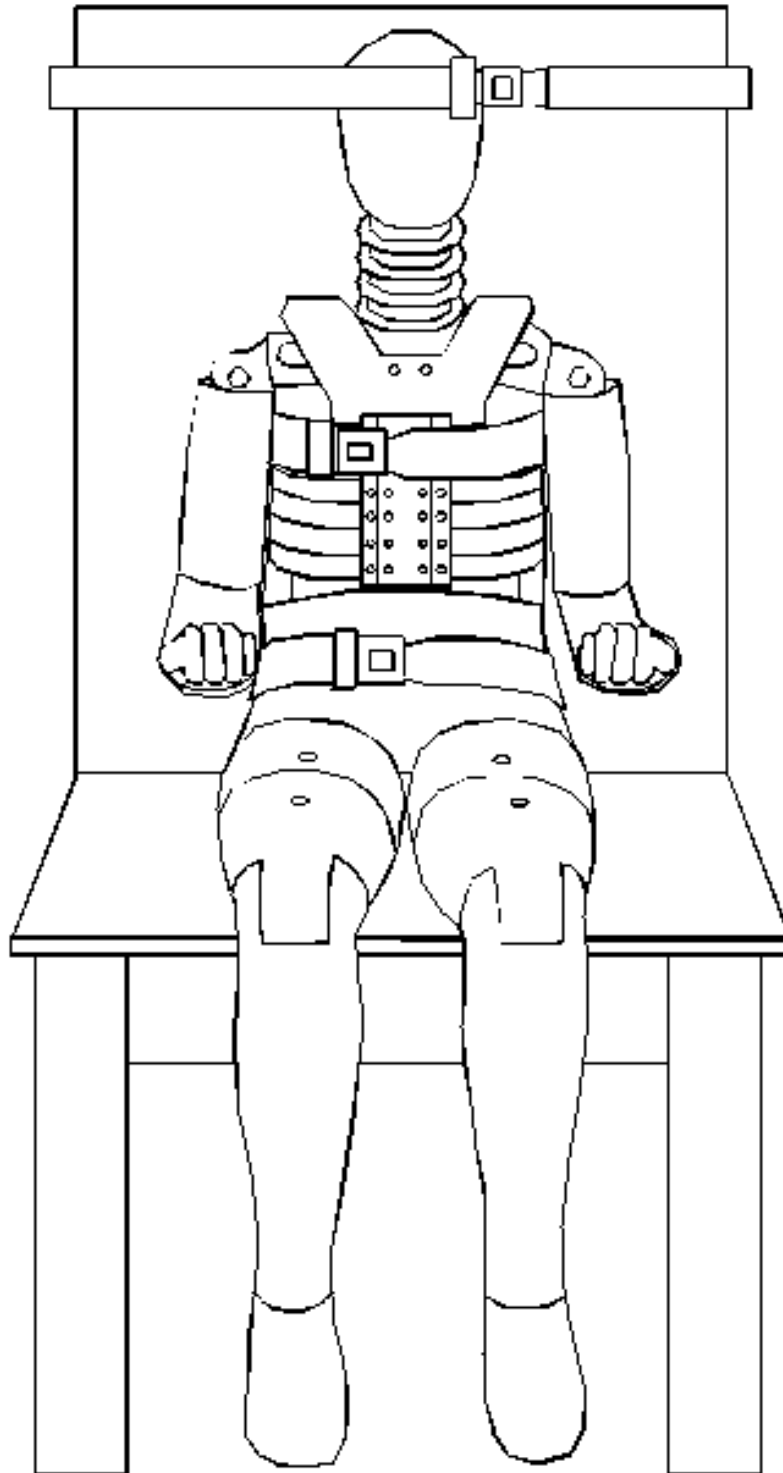


FIGURE 3B

EXTERNAL DIMENSIONS TEST SETUP

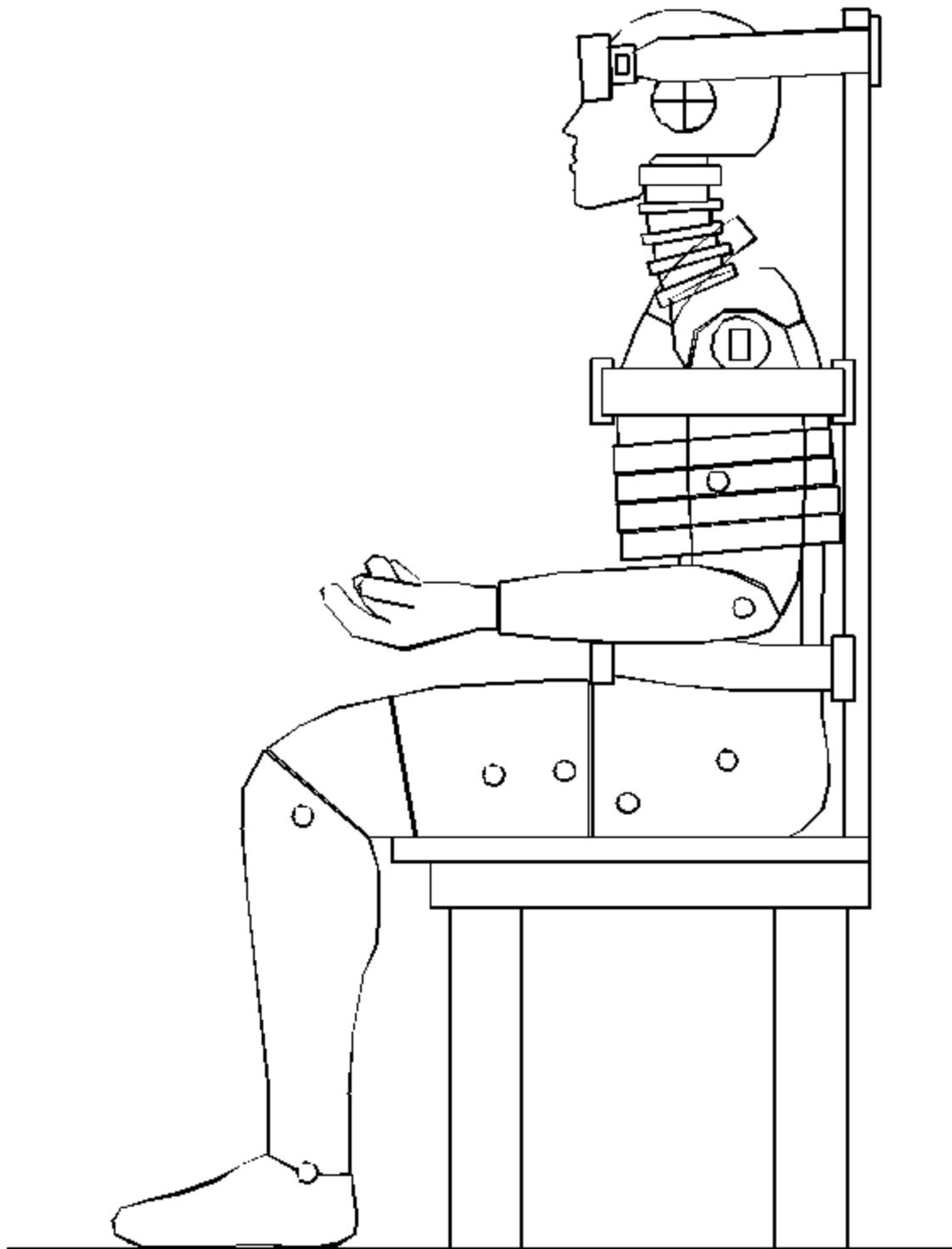


FIGURE 4B

DATA SHEET B3
HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number _____
 Technician _____

Test Date _____

__ Pre-test qualification
 __ Post-test qualification 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 qualification 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 ± 1.0 mm (14.8 ± 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 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-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 ± 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

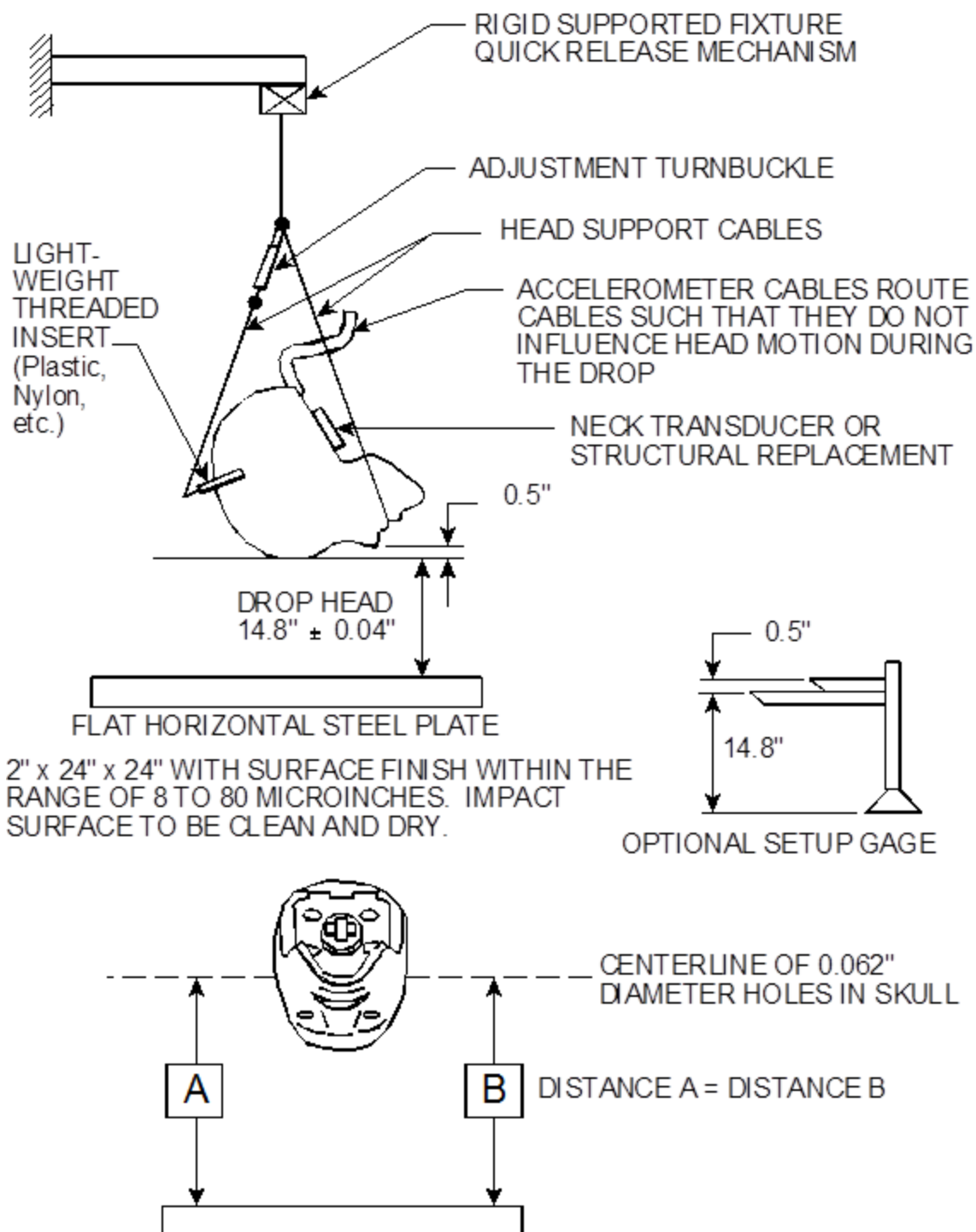


FIGURE 5B

HEAD DROP TEST SETUP

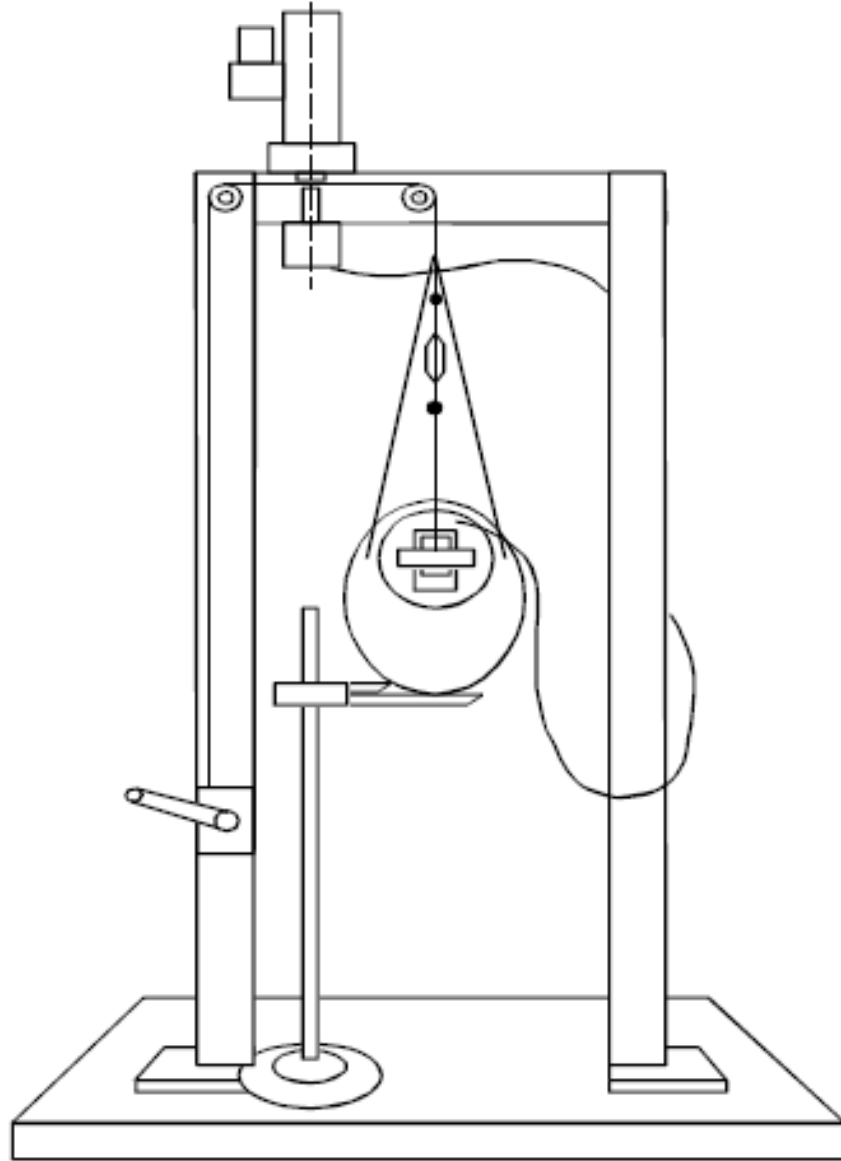


FIGURE 6B

DATA SHEET B4
NECK FLEXION TEST (572.133) (5th Female)

Dummy Serial Number _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification. 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 ± 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 ± 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) & (572.133(c)(4)(I & ii))

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

*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) (5th Female)

Dummy Serial Number _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification. 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 ± 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 ± 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) & (572.133(c)(4)(I & ii))

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

*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

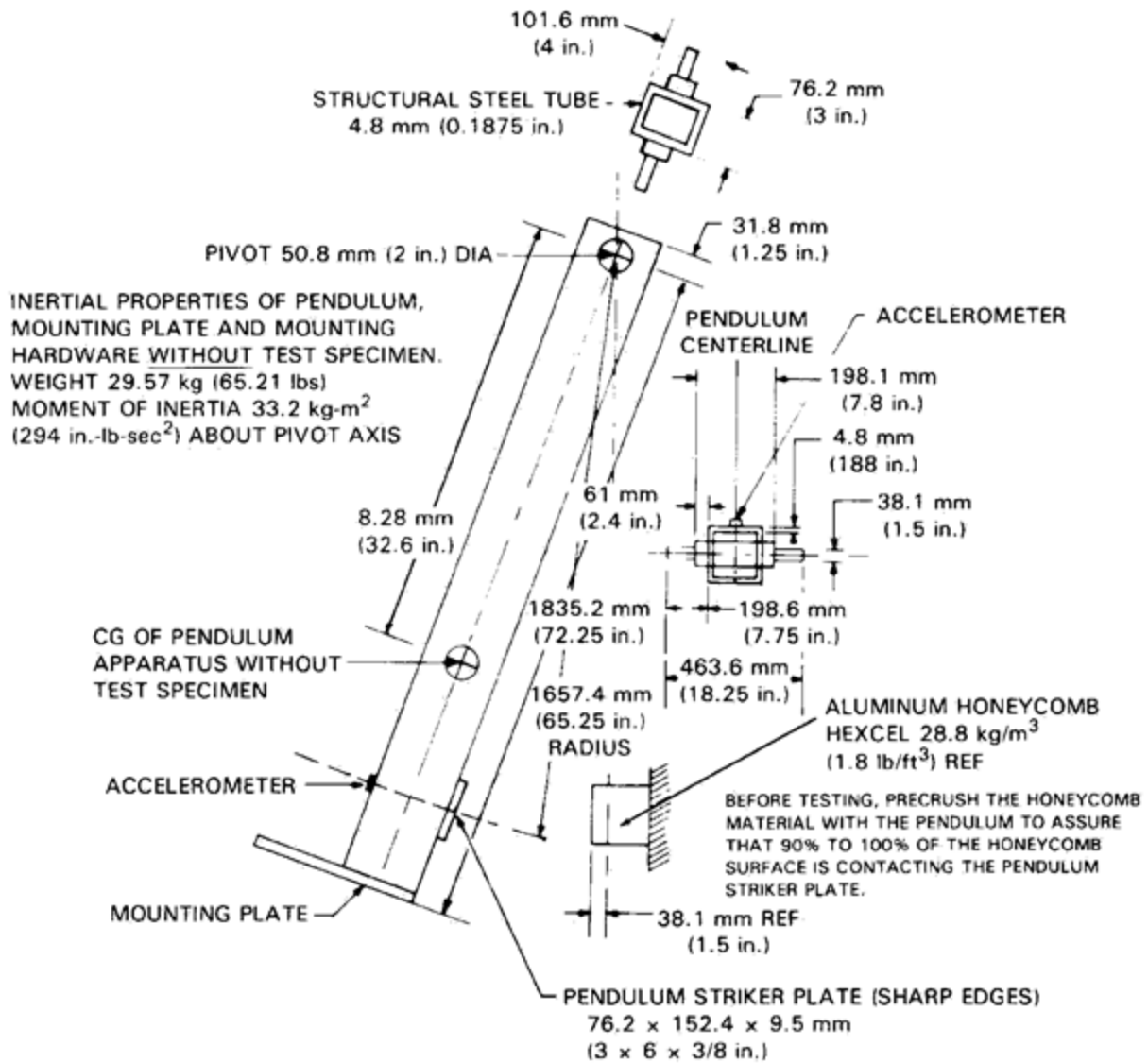


FIGURE 7B

NECK FLEXION TEST SETUP SPECIFICATIONS

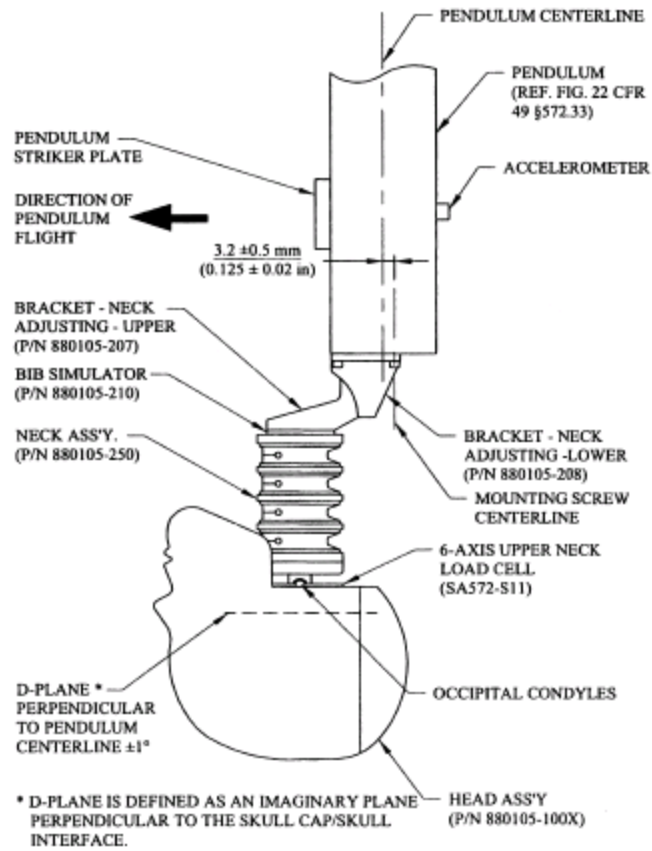


FIGURE 8B

NECK EXTENSION TEST SETUP SPECIFICATIONS

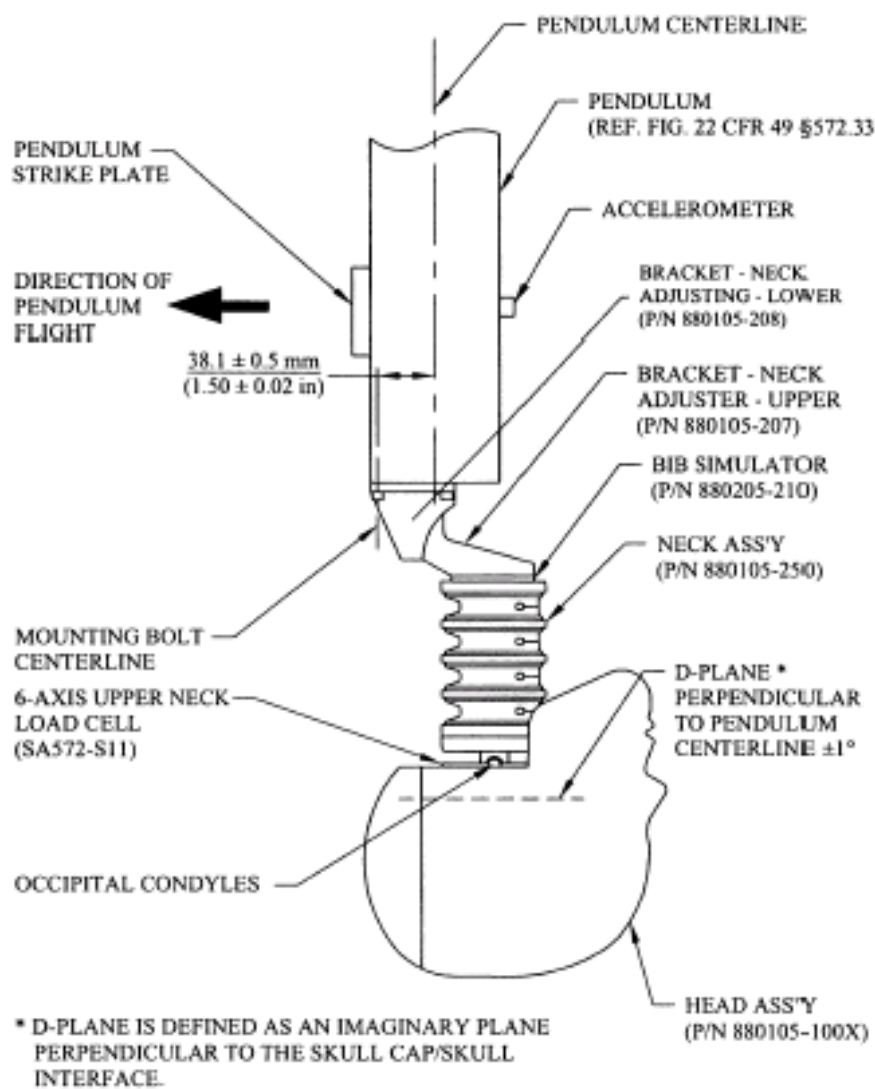


FIGURE 9B

ROTATION TRANSDUCER ASSEMBLY

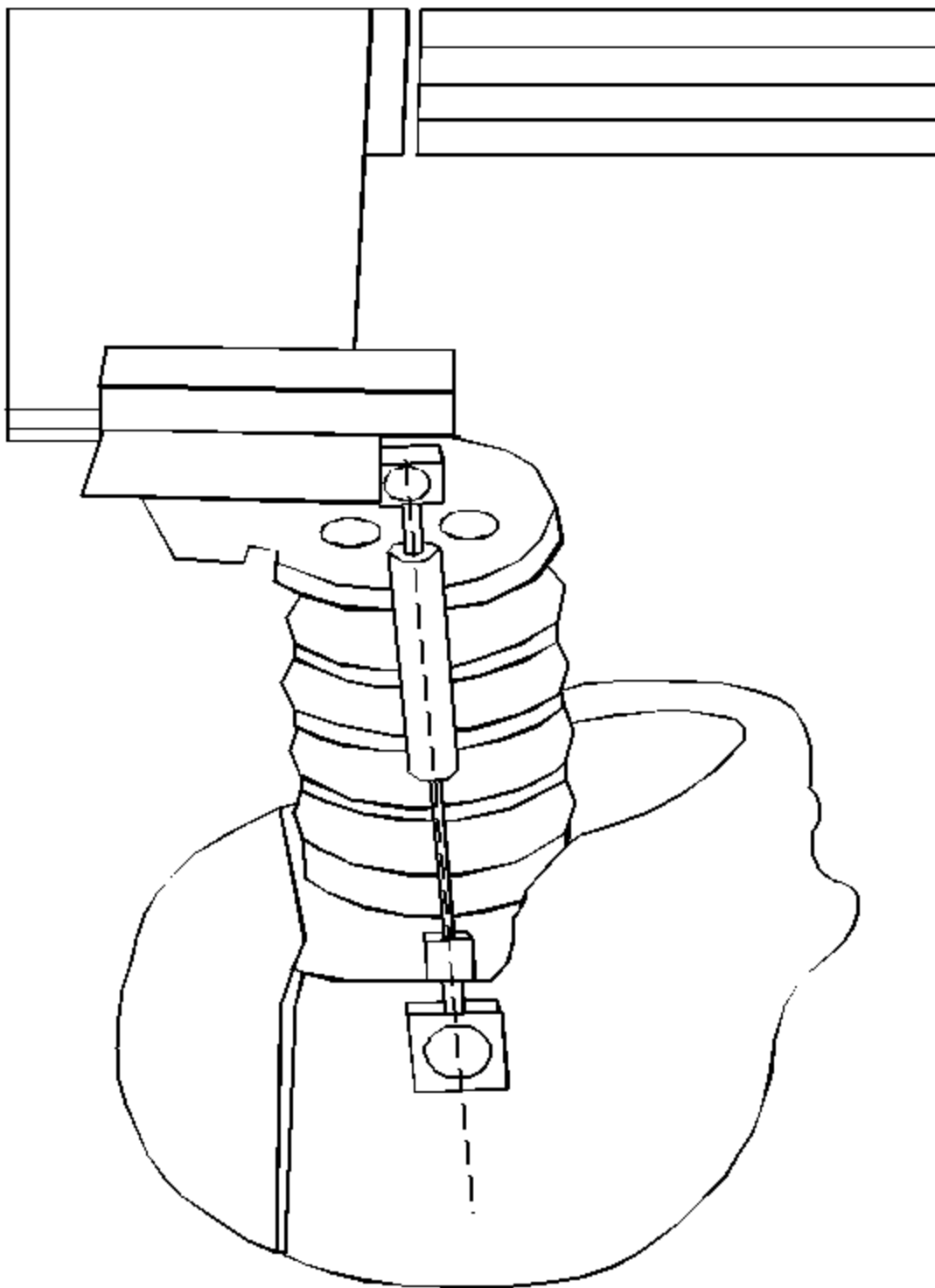


FIGURE 10B

DATA SHEET B6
THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number _____
 Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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 qualification 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 qualification 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 ± 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° 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° 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, should 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, pendulum acceleration, pendulum force, and pendulum force versus chest compression follow this sheet.

Signature

Date

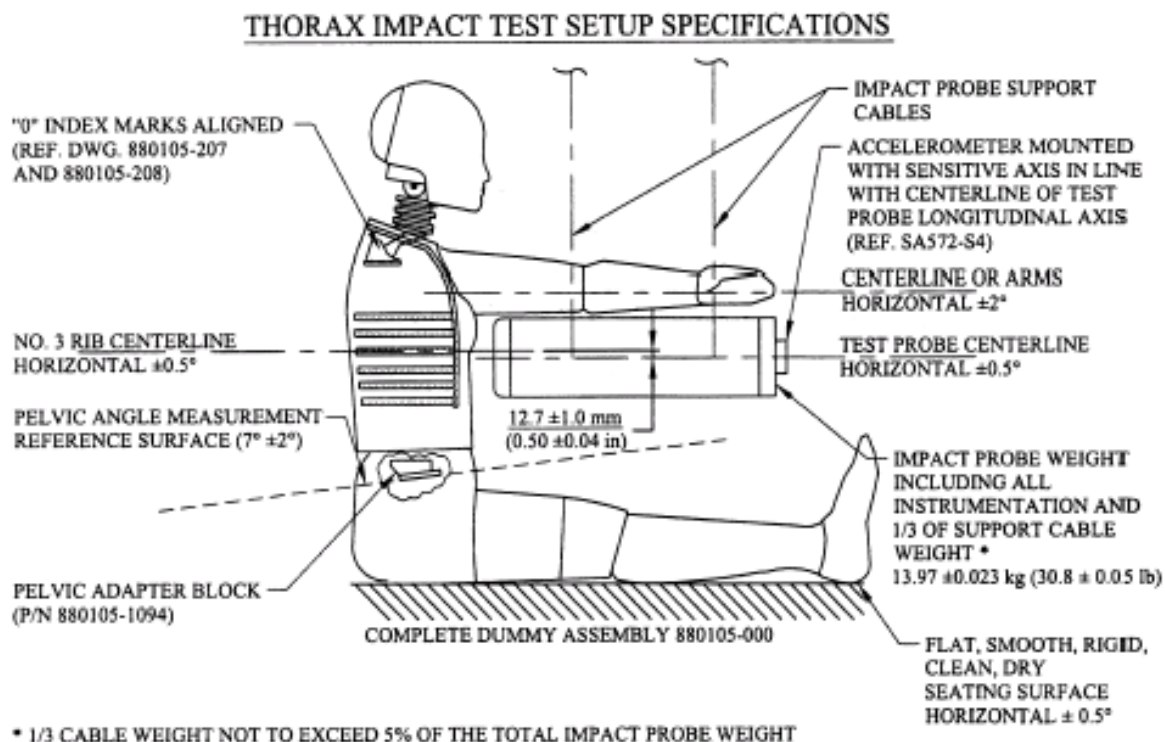


FIGURE 11B

Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of 13.97 ± 0.023 kg (30.8 ± 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-cm² (3.22 lbs-in-sec²) 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 ± 0.25 mm (6.00 ± 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.

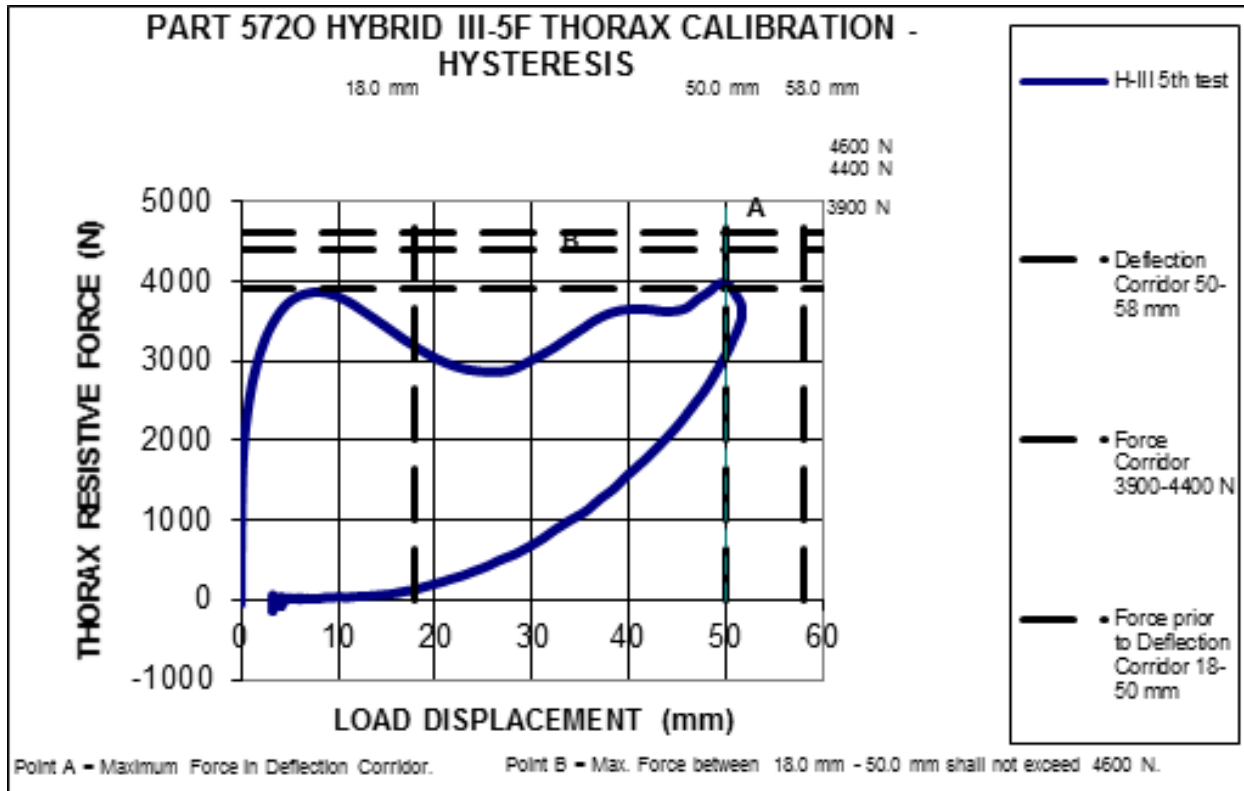


FIGURE 12B

DATA SHEET B7
TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number _____
 Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° 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	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	
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 $\pm 8^\circ$	

Signature

Date

TORSO FLEXION TEST SET UP SPECIFICATIONS

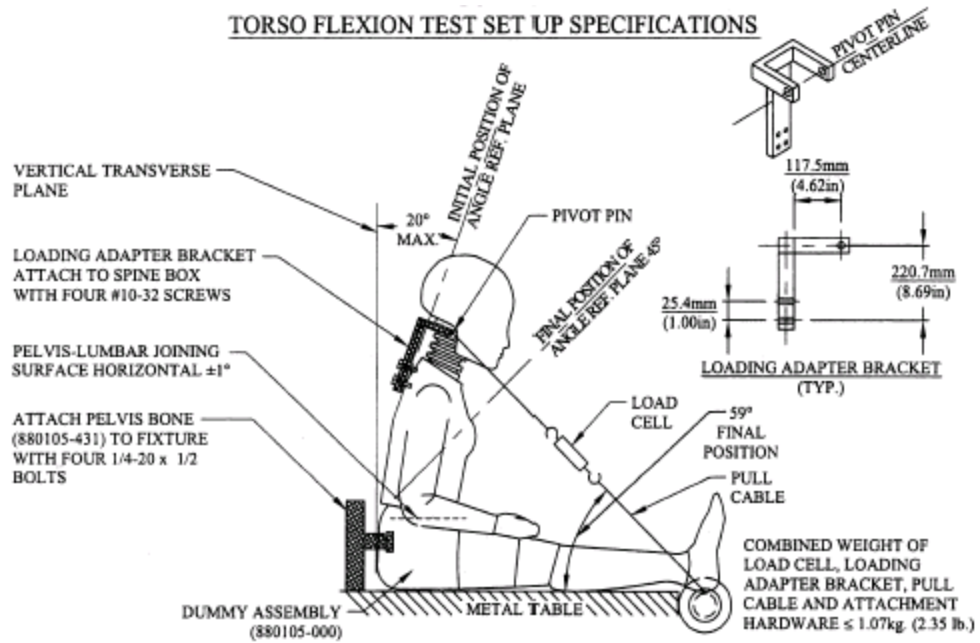


FIGURE 13B

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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, should 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) (5th Female)

Dummy Serial Number _____
 Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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, should 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

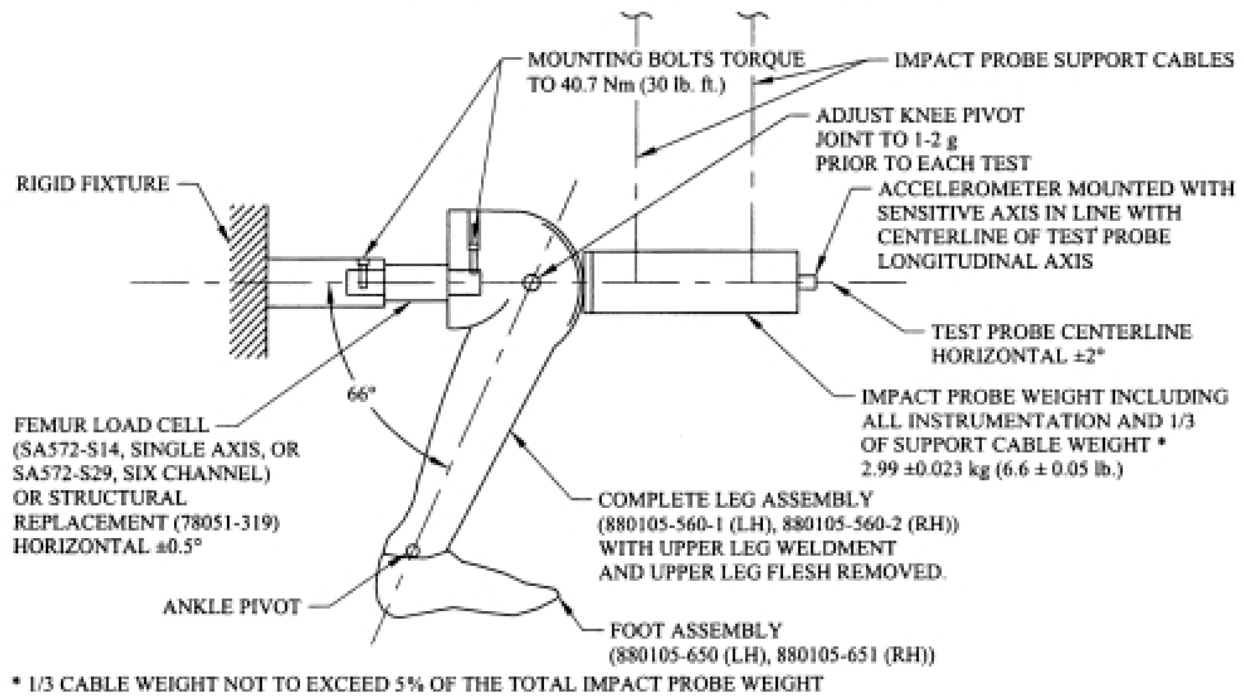


FIGURE 14B

Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of 2.99 ± 0.23 kg (6.6 ± 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-cm² (0.177 lbs-in-sec²) 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 ± 0.2 mm (3.0 ± 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.

DATA SHEET B10
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
NECK TRANSDUCER					
CHEST ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
CHEST POTENTIOMETER					
FEMUR LOAD CELLS					
(1) RIGHT FEMUR					
(2) LEFT FEMUR					
LABORATORY INSTRUMENTATION					
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 QUALIFICATION TEST
PROCEDURE

APPENDIX C
PART 572, SUBPART N DUMMY PERFORMANCE QUALIFICATION 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 qualification 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 qualification 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 qualification 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 www.regulations.gov under Docket No. NHTSA-2010-0147.

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 qualification 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 COR) 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 qualification tests before and after each vehicle crash usage.

No Information concerning the Part 572, Subpart N dummy qualification data shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Branch or Division Chief.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire dummy qualification 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 qualified as test tools to be used in NCAP vehicle crash tests. The schedule for these performance qualification tests must be correlated with that of the vehicle tests. In addition, all testing shall be coordinated to allow monitoring by the COR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy qualification data available to the COR for review and analysis as required. All qualification test data for each particular Part 572, Subpart N dummy will be sent to the COR with each test report.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc. shall be either sent to the COR 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 qualification, if requested. The COR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be qualified 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 qualification 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 COR. The calibration system will need the written acceptance of the COR 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 qualified as indicated in NCAP test procedure. These qualifications 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. PRE-TEST 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 qualification 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 qualification 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 ± 0.02 kg (6.3 ± 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 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 ± 0.25 mm (4.00 ± 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 ± 0.02 kg (1.8 ± 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-cm² (0.03 lbs-in-sec²) 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 ± 0.2 mm (3.00 ± 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. 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 CONVENTIONS FOR PART 572 TEST DUMMIES

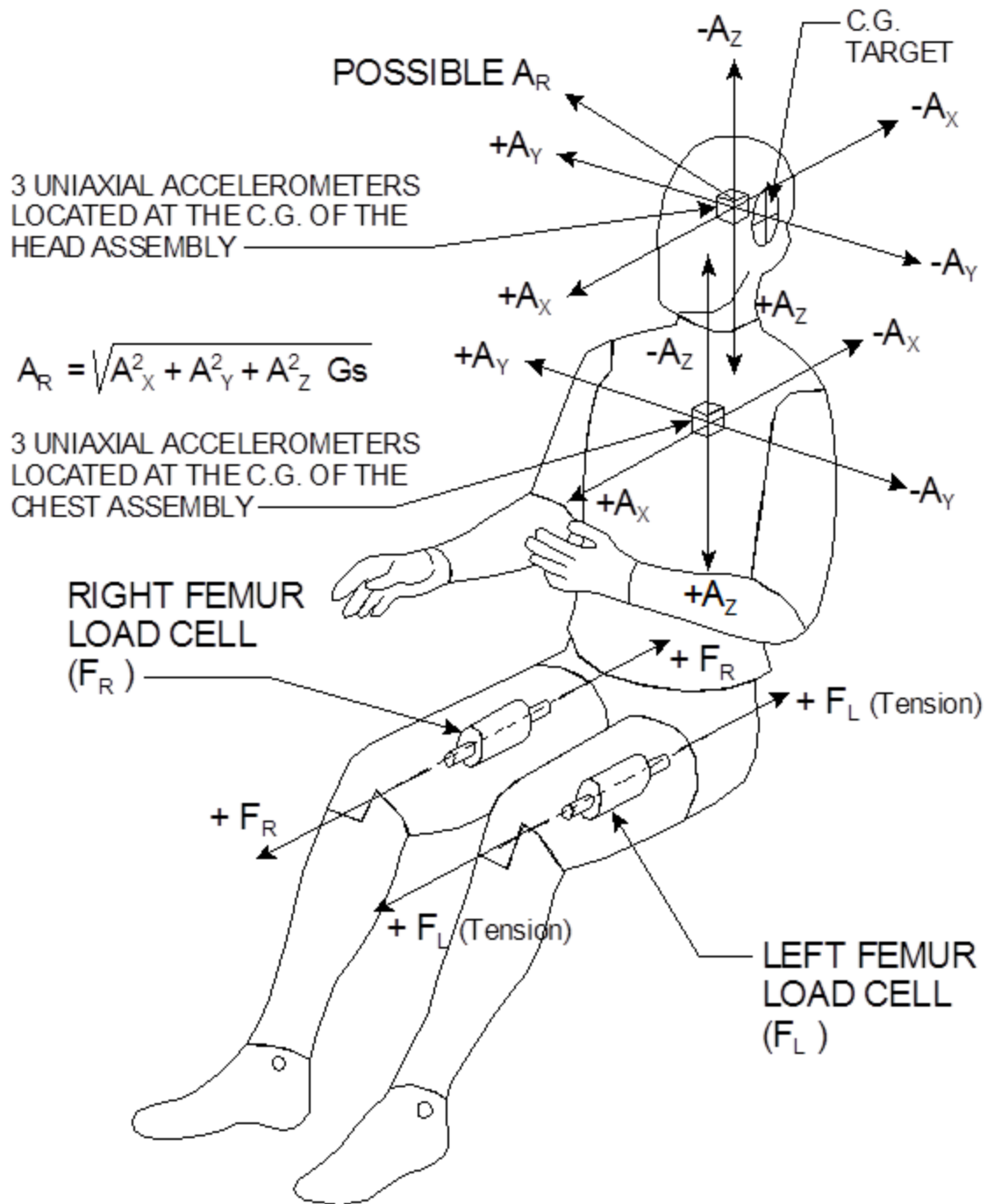


FIGURE 1C

TABLE 1C

SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS	
BODY SEGMENT — MEASURED FORCE	POSITIVE OUTPUT DIRECTION
NECK FX SHEAR FY SHEAR FZ AXIAL MX MOMENT (ROLL) MY MOMENT (PITCH) MZ MOMENT (YAW)	HEAD REARWARD OR CHEST FORWARD HEAD LEFTWARD, CHEST RIGHTWARD HEAD UPWARD, CHEST DOWNWARD LEFT EAR TOWARD LEFT SHOULDER CHIN TOWARD STERNUM CHIN TOWARD LEFT SHOULDER
FEMUR FX SHEAR FY SHEAR FZ AXIAL MX MOMENT (ROLL) MY MOMENT (PITCH) MZ MOMENT (YAW)	KNEE UPWARD, UPPER FEMUR DOWNWARD KNEE RIGHTWARD, UPPER FEMUR LEFTWARD KNEE FORWARD (TENSION), PELVIS REARWARD KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE KNEE UPWARD, HOLD UPPER FEMUR IN PLACE KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY
KNEE CLEVIS - FZ AXIAL	TIBIA DOWNWARD (TENSION), FEMUR UPWARD
UPPER TIBIA MX MOMENT MY MOMENT	ANKLE LEFTWARD, HOLD KNEE IN PLACE ANKLE FORWARD, BOTTOM OF KNEE CLEVIS REARWARD
LOWER TIBIA FX SHEAR FY SHEAR FZ AXIAL MX MOMENT MY MOMENT	ANKLE FORWARD, KNEE REARWARD ANKLE RIGHTWARD, KNEE LEFTWARD ANKLE DOWNWARD (TENSION), KNEE UPWARD ANKLE LEFTWARD, HOLD KNEE IN PLACE ANKLE FORWARD, BOTTOM OF KNEE CLEVIS 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 qualification tests with a cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. (572.124(c)(2))

12. QUALIFICATION 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 qualification test data sheet.

14. REPORTS

14.1 APPARENT NONCONFORMANCE

During a qualification verification, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COR 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 COR's discretion and shall be performed without additional costs to the OCWS.

14.2 QUALIFICATION DOCUMENTATION

14.2.1 COPIES

Copies of the data sheets containing the qualification 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 COR. 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 _____
 Technician _____

Test Date _____

This check sheet is completed as part of the qualification 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 _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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 **Figures 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 ± 0.2 in-lbs).

NOTE: At this point the thorax is to be inspected for damage. The thorax displacement transducer may be removed for qualification if required (pre-test qualification 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 ± 5.1 mm (2.7 ± 0.2 in) above the horizontal seating surface and 94.0 ± 5.1 mm (3.7 ± 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 ± 2.5 mm (0.8 ± 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° 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 the following table and **Figure 2C**.

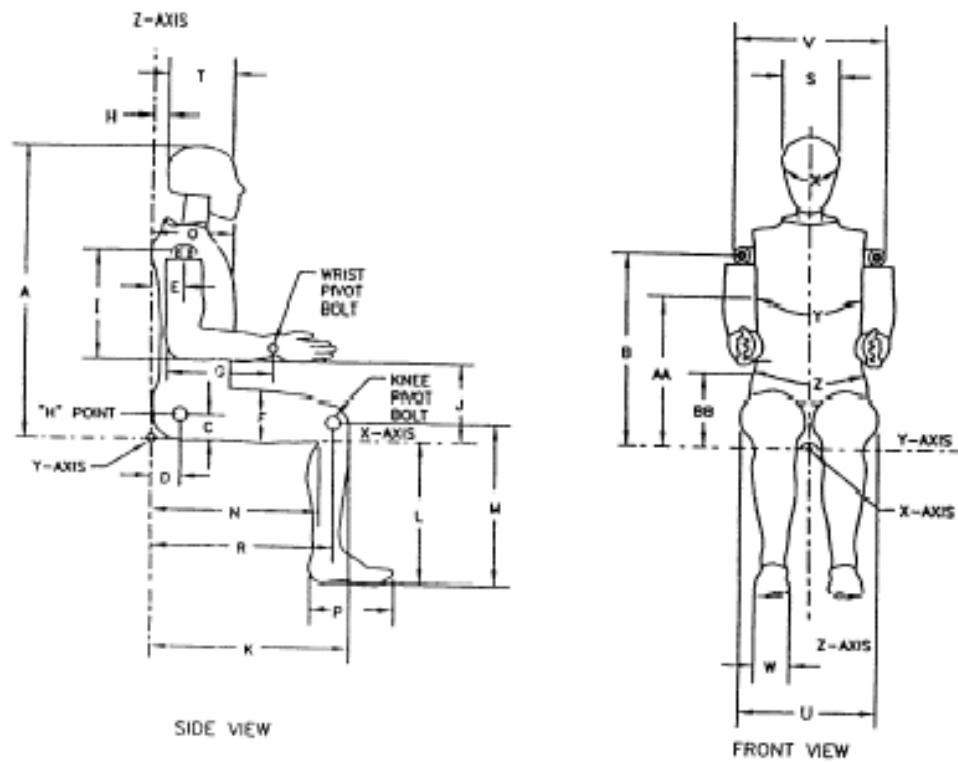
Signature

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 at 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 ± 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 ± 5.1 mm above seat surface	596.9 - 622.3	
Z	WAIST CIRCUMFERENCE (with chest jacket and abdominal insert)	Measured 158.8 ± 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



Notes:
 $Q = A - C - D + R + M$

FIGURE 2C

EXTERNAL DIMENSIONS TEST SETUP

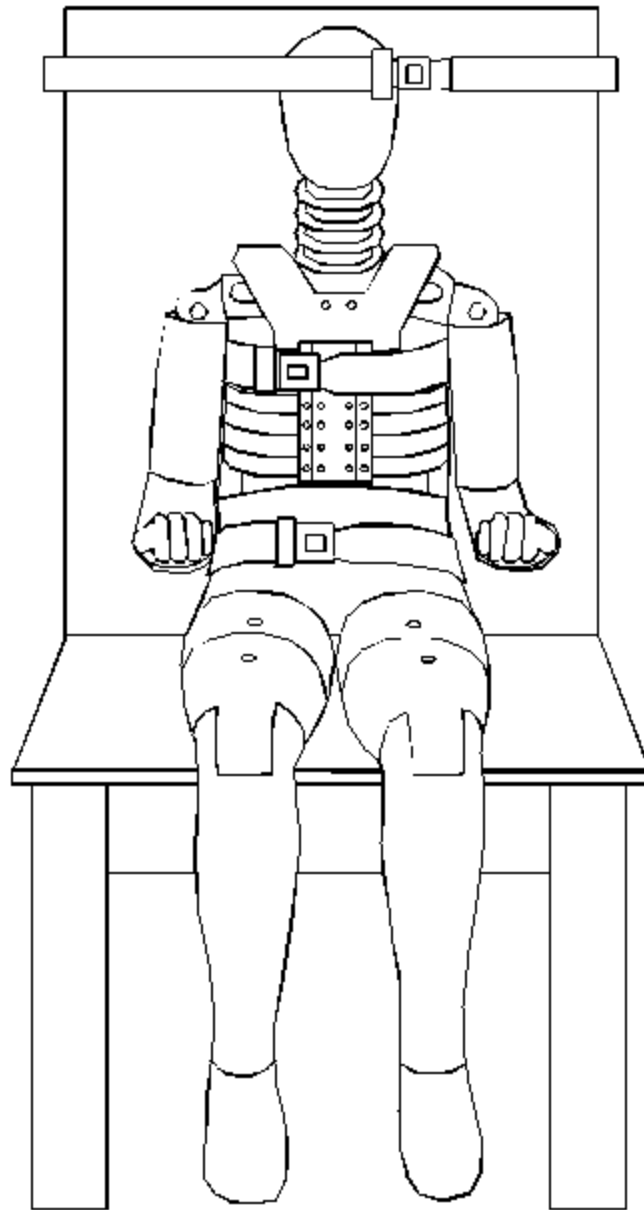


FIGURE 3C

EXTERNAL DIMENSIONS TEST SETUP

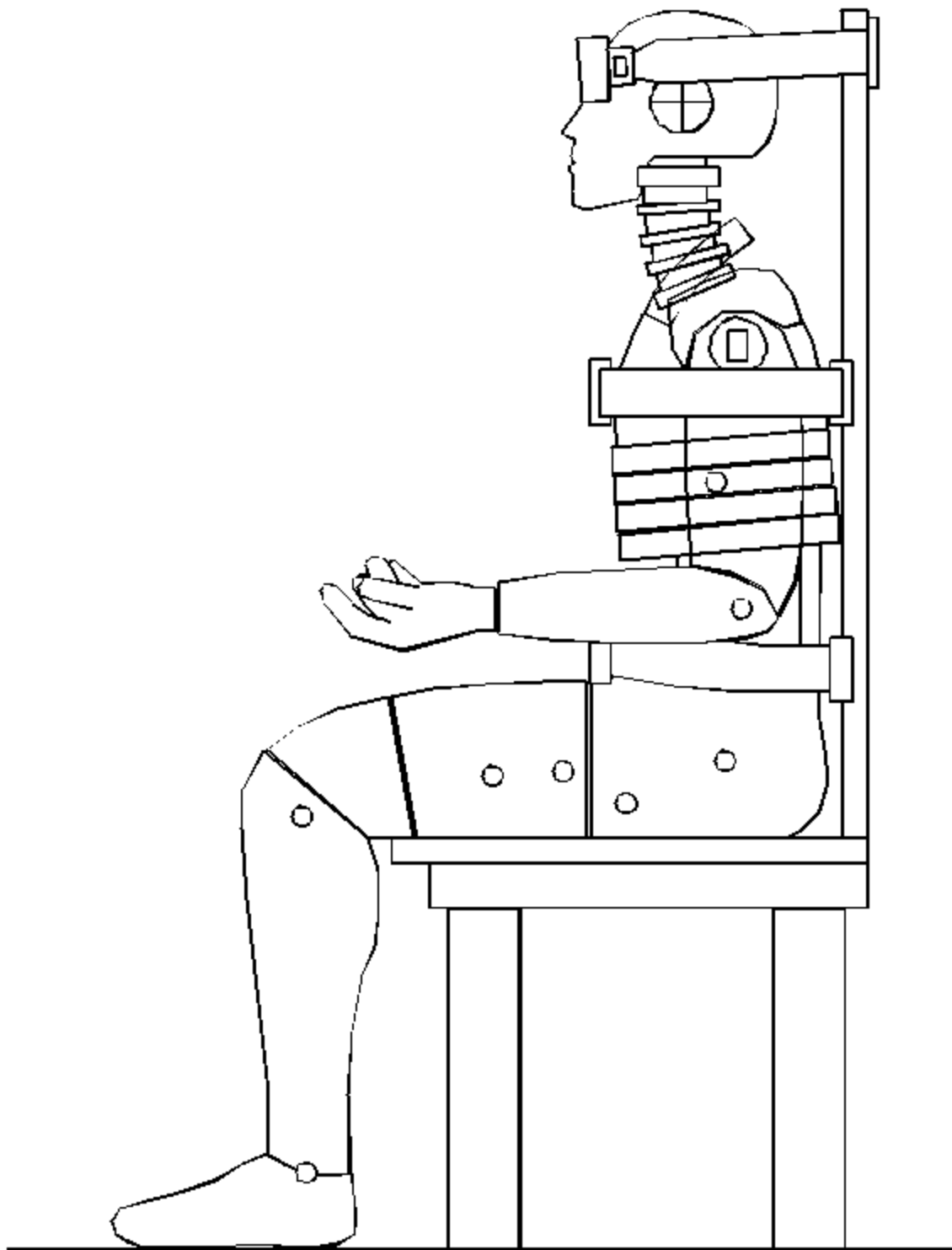


FIGURE 4C

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

Dummy Serial Number _____
 Technician _____

Test Date _____

__ Pre-test qualification
 __ Post-test qualification 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 qualification 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 ± 1.0 mm (14.8 ± 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 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-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 ± 1.0 mm (14.8 inches ± 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

Figure N 1
HEAD DROP TEST SET-UP SPECIFICATIONS

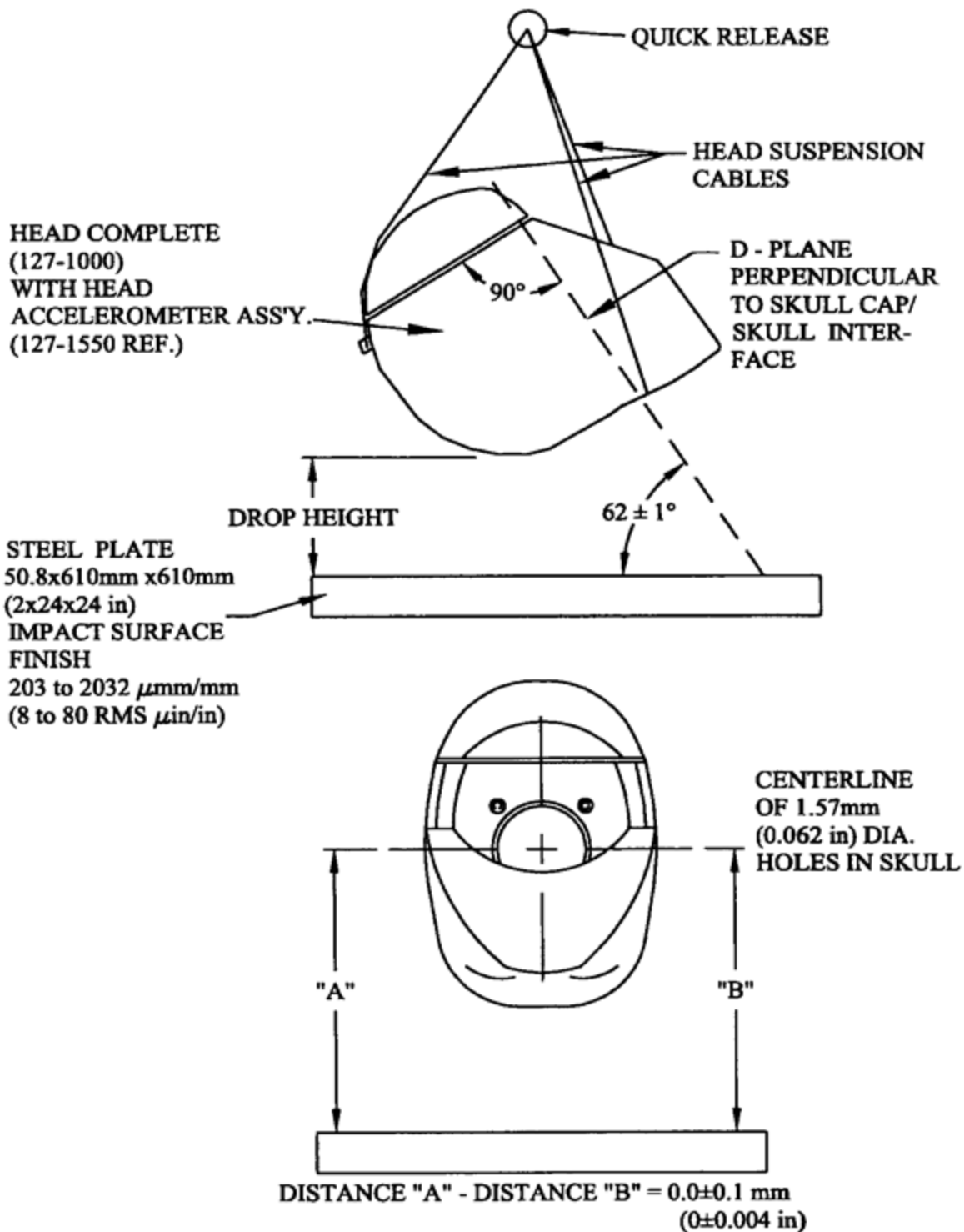


FIGURE 5C

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

Dummy Serial Number _____
Technician _____

Test Date _____

__ Pre-test qualification
__ Post-test qualification 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 qualification 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 qualification.
Record findings and actions: _____

- __6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 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 ± 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) & (572.123(c)(4)(i & ii))

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

*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 _____
Technician _____

Test Date _____

__ Pre-test qualification
__ Post-test qualification 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 qualification 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 qualification.
Record findings and actions: _____

- __6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 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 ± 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) & (572.123(c)(4)(i & ii))

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

*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

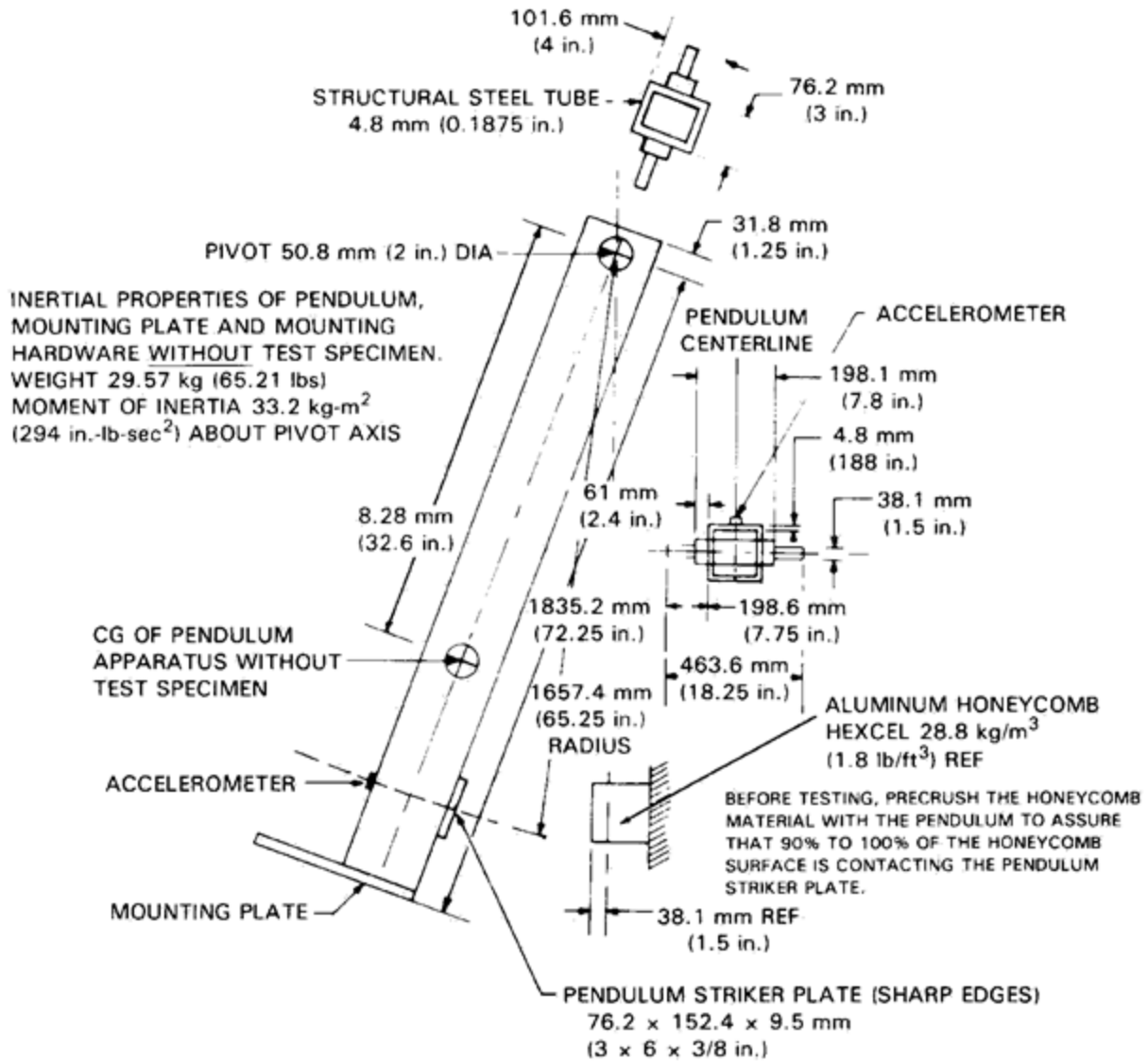


FIGURE 6C

NECK FLEXION TEST SET-UP SPECIFICATIONS

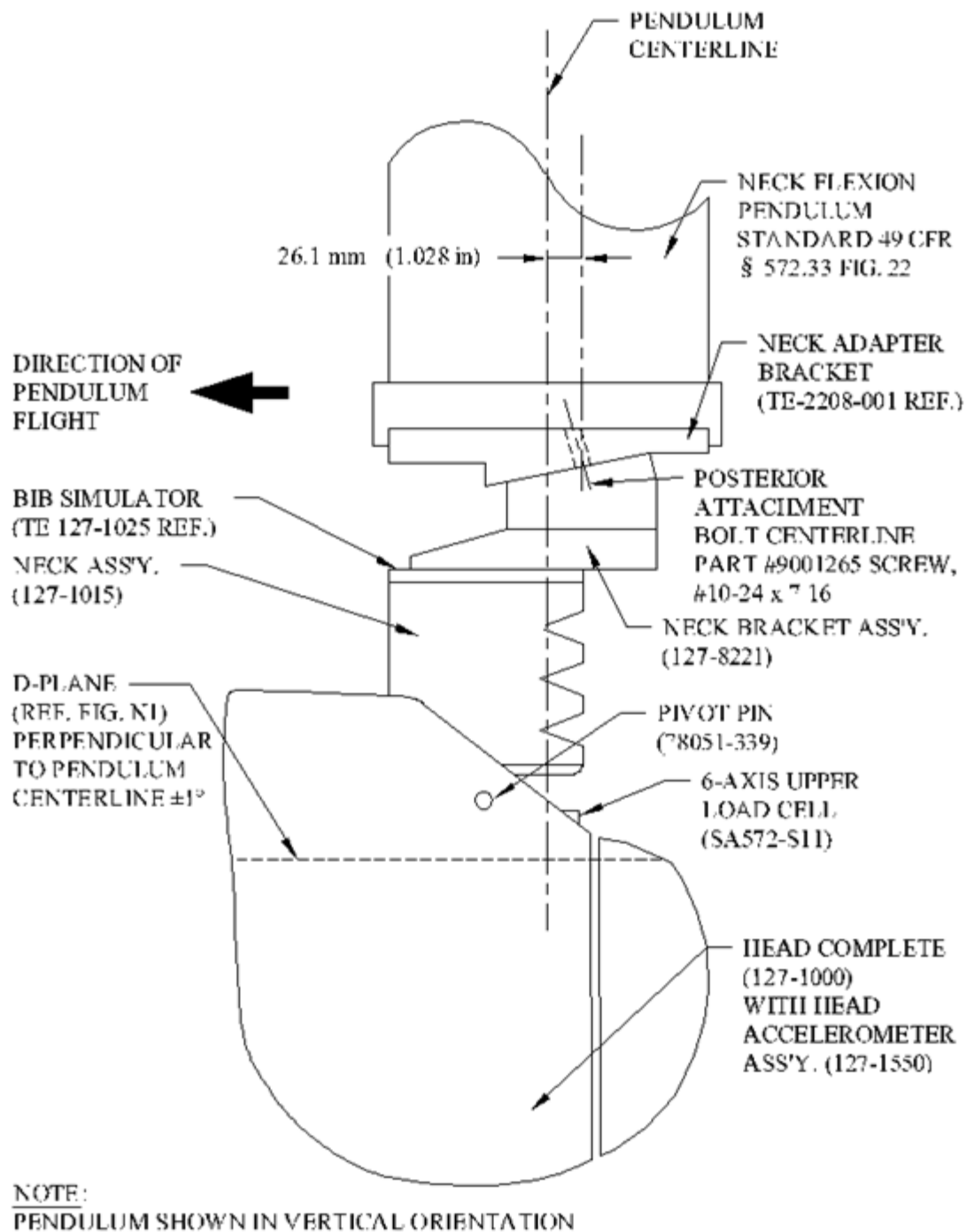


FIGURE 7C

NECK EXTENSION TEST SET-UP SPECIFICATIONS

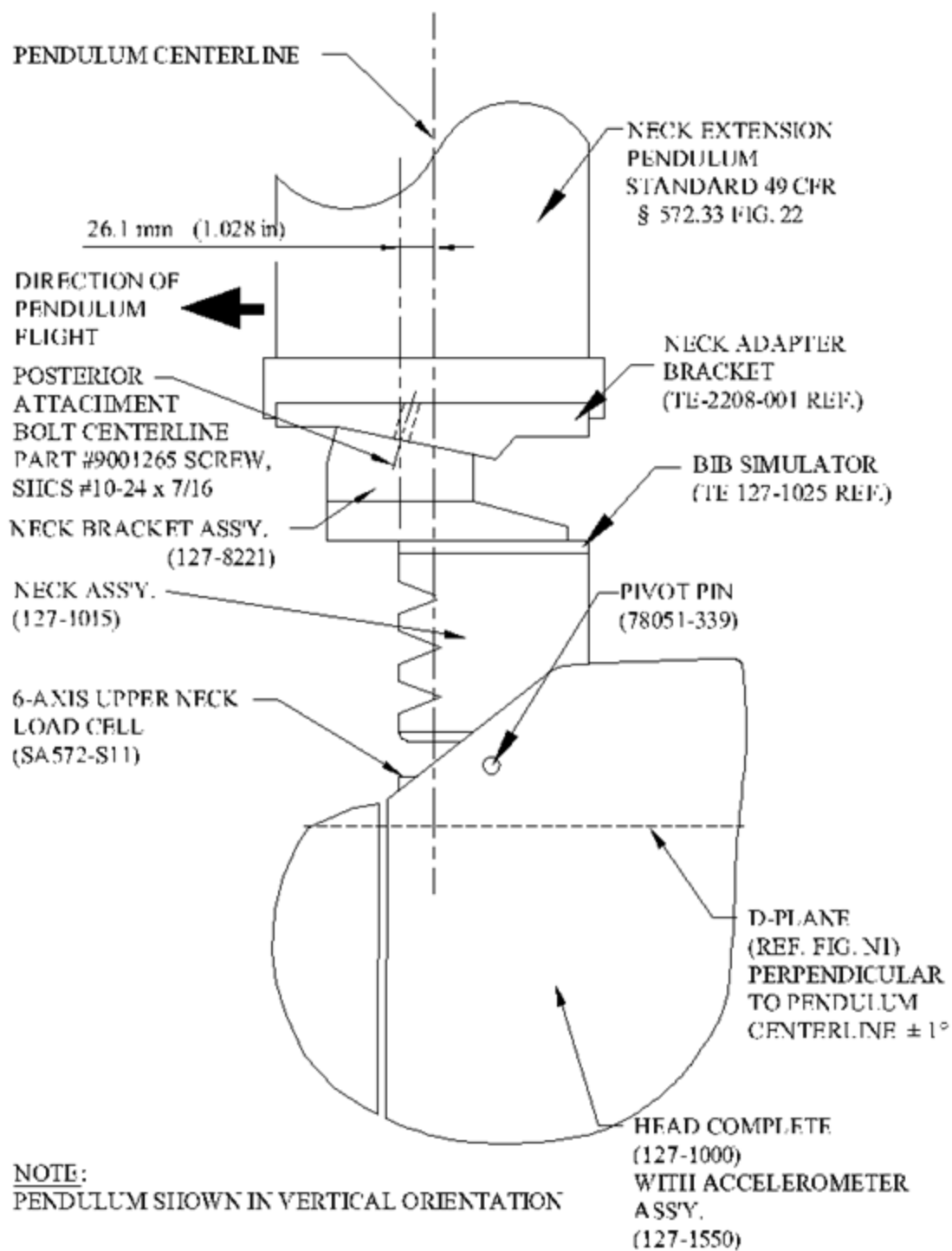


FIGURE 8C

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

Dummy Serial Number _____
 Technician _____

Test Date _____

__ Pre-test qualification
 __ Post-test qualification 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 qualification 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 qualification 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 ± 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° 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° 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, should 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

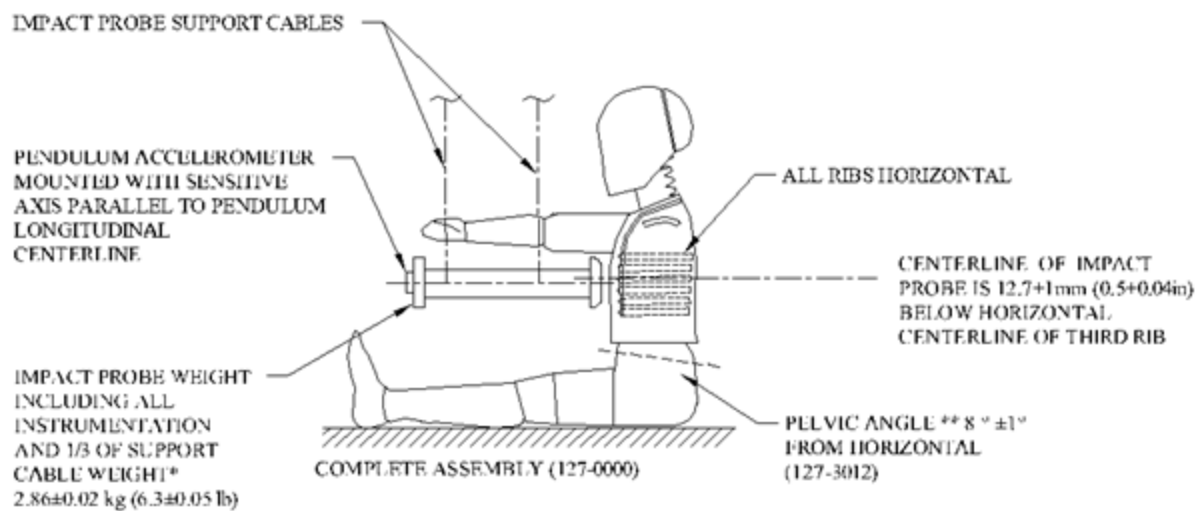
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (**Figure 10C**)

__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

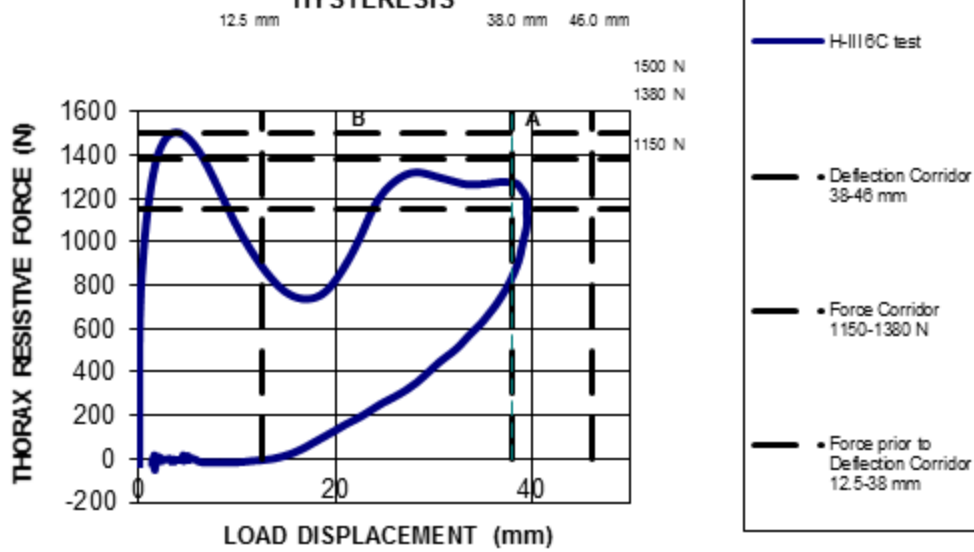
** PELVIS LUMBAR JOINING SURFACE

FIGURE 9C

Probe specifications:

1. Rigid metallic construction, concentric about its longitudinal axis.
2. A mass of 2.86 ± 0.02 kg (6.3 ± 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 kg-cm² (0.141 lbs-in-sec²) 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 ± 0.25 mm (4.00 ± 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 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.

**PART 572N HYBRID III-6C THORAX QUALIFICATION
HYSTERESIS**



Point A - Maximum Force in Deflection Corridor. Point B - Max. Force between 12.5 mm - 38.0 mm shall not exceed 1500 N.

FIGURE 10C

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

Dummy Serial Number _____

Test Date _____

Technician _____

Pre-test qualification

Post-test qualification 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))
9. Remove all external support that was implemented in 9 above. (572.125(c)(5))
10. 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°) _____
11. Attach the pull cable and the load cell. (572.125(c)(6))
12. 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))
13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
14. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))

__15. 3 minutes after the release of the force, measure the reference plane angle.
(572.125(c)(9))

__16. 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 $\pm 8^\circ$	

Signature

Date

TORSO FLEXION TEST SET-UP SPECIFICATIONS

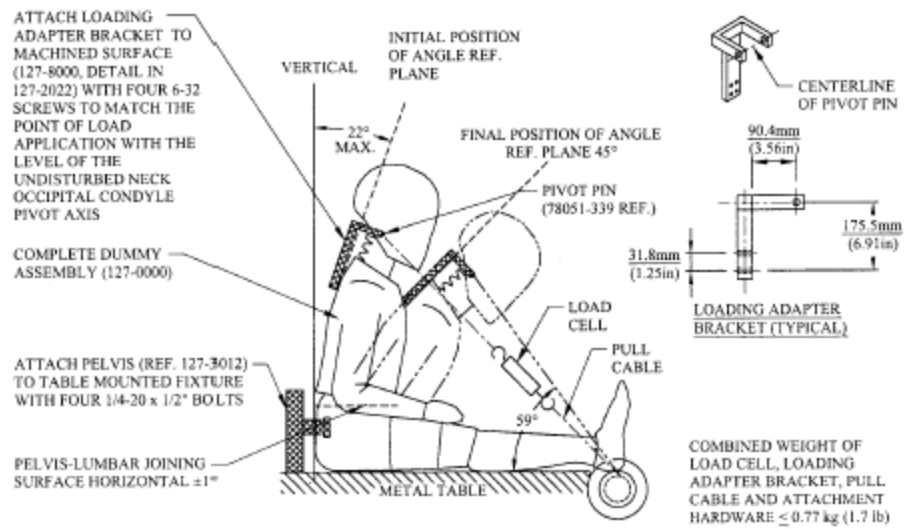


FIGURE 11C

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

Dummy Serial Number _____
Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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, should 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 _____
 Technician _____

Test Date _____

Pre-test qualification
 Post-test qualification 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, should 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

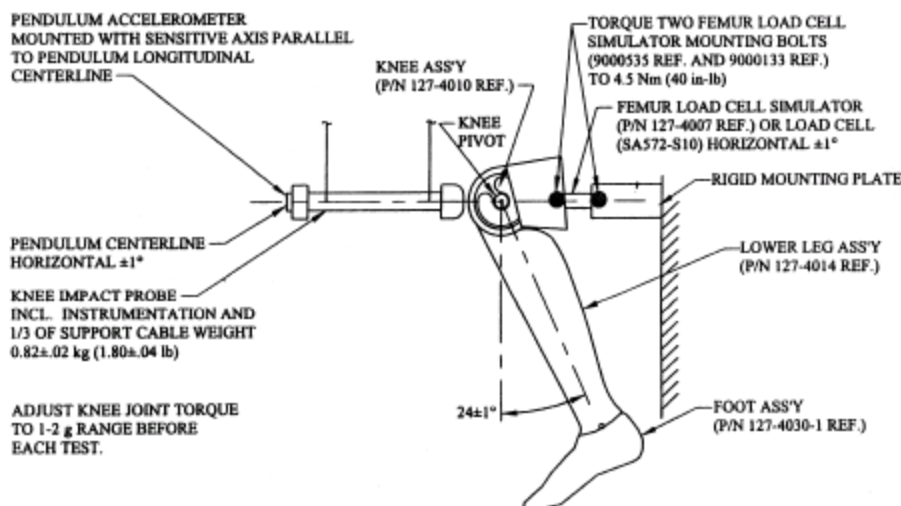


FIGURE 12C

Probe specifications (572.127(b)):

1. Rigid metallic construction, concentric in shape and symmetric about its longitudinal axis.
2. A mass of 0.82 ± 0.02 kg (1.8 ± 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-cm² (0.03 lbs-in-sec²) 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 ± 0.2 mm (3.00 ± 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.

DATA SHEET C10
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

LD. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
NECK TRANSDUCER					
CHEST ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
CHEST POTENTIOMETER					
FEMUR LOAD CELLS					
(1) RIGHT FEMUR					
(2) LEFT FEMUR					
LABORATORY INSTRUMENTATION					
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 QUALIFICATION TEST
PROCEDURE

APPENDIX D
PART 572, SUBPART P DUMMY PERFORMANCE QUALIFICATION 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 qualification 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 qualification 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 qualification 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 www.regulations.gov under Docket No. NHTSA-2000- 7051.

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 qualification 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 COR) 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 qualification tests before and after each vehicle crash test.

No Information concerning the Part 572, Subpart P dummy qualification data shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Branch or Division Chief.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire dummy qualification 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 qualified as test tools to be used in NCAP vehicle crash tests. The schedule for these performance qualification tests must be correlated with that of the vehicle tests. All testing shall be coordinated to allow monitoring by the COR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy qualification data available to the COR for review and analysis as required. All qualification test data for each particular Part 572, Subpart P dummy will be sent to the COR with each test report.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc. shall be either sent to the COR 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.

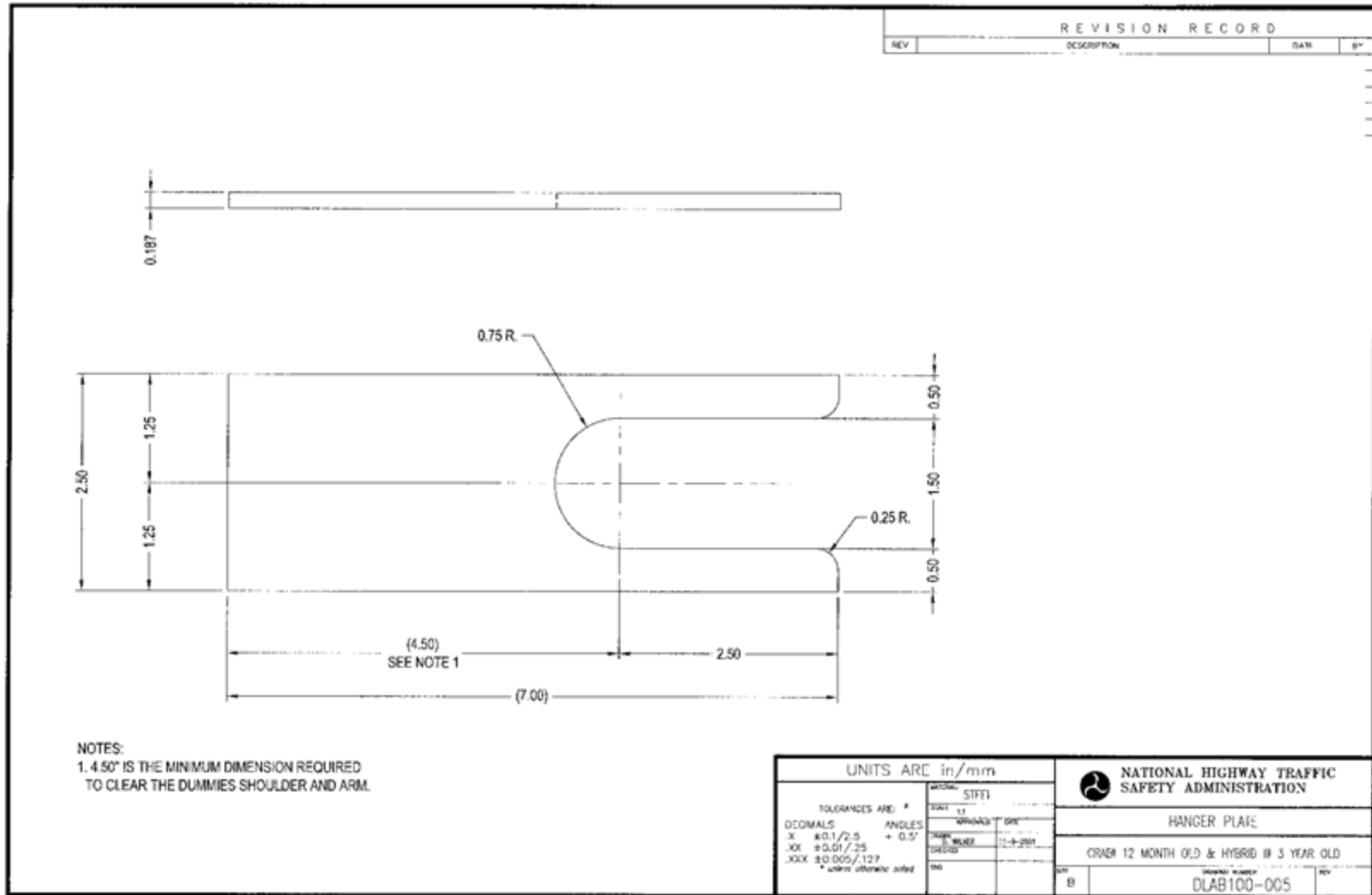


FIGURE 1D

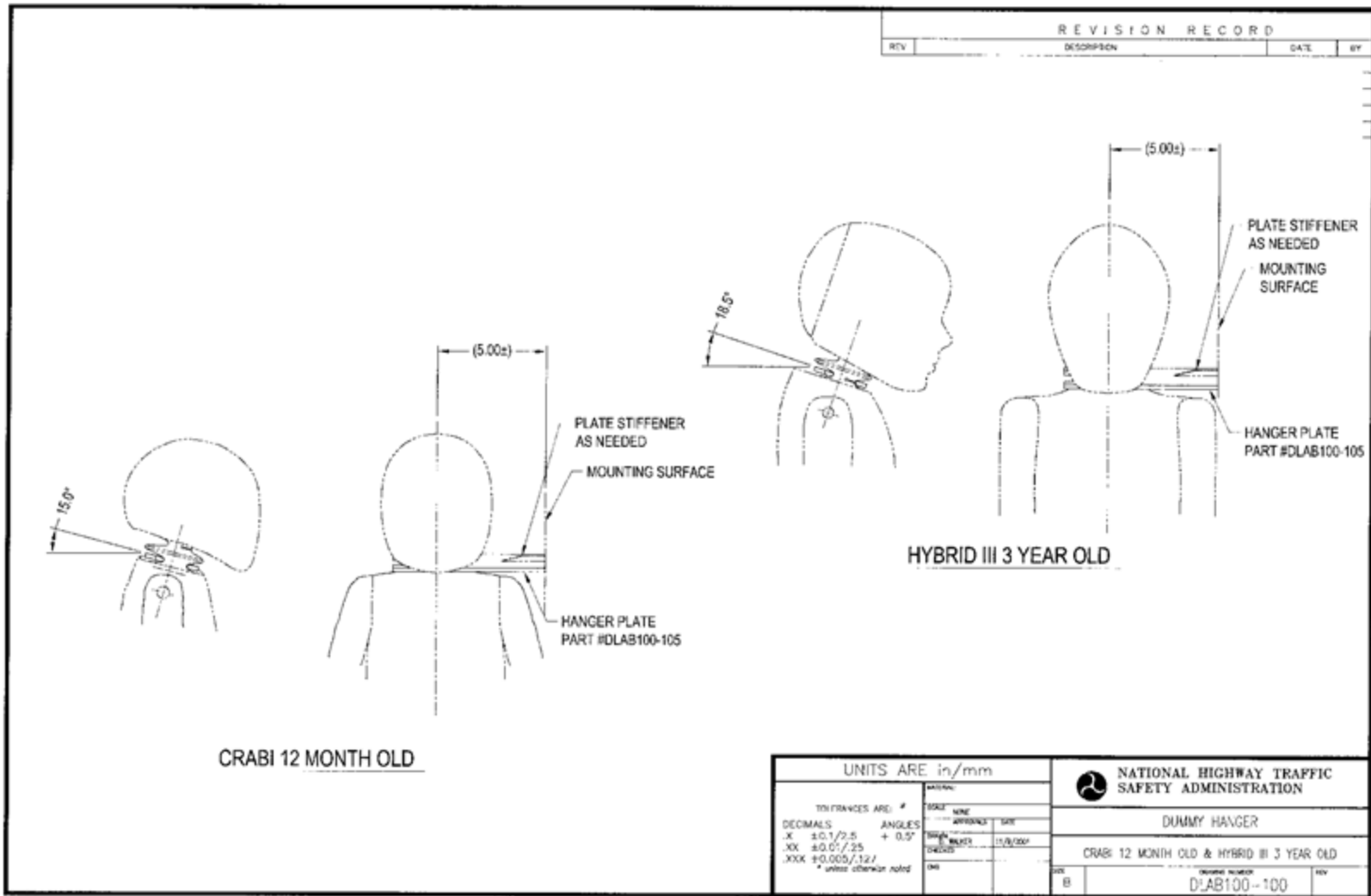


FIGURE 2D

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 qualification, if requested. The COR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be qualified 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 qualification 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 COR. The calibration system will need the written acceptance of the COR 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 qualified as indicated in NCAP test procedure. These qualifications 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. PRE-TEST 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 qualification 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 ± 0.01 kg (3.75 ± 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 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 ± 0.2 mm (2.00 ± 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 CONVENTIONS FOR PART 572 TEST DUMMIES

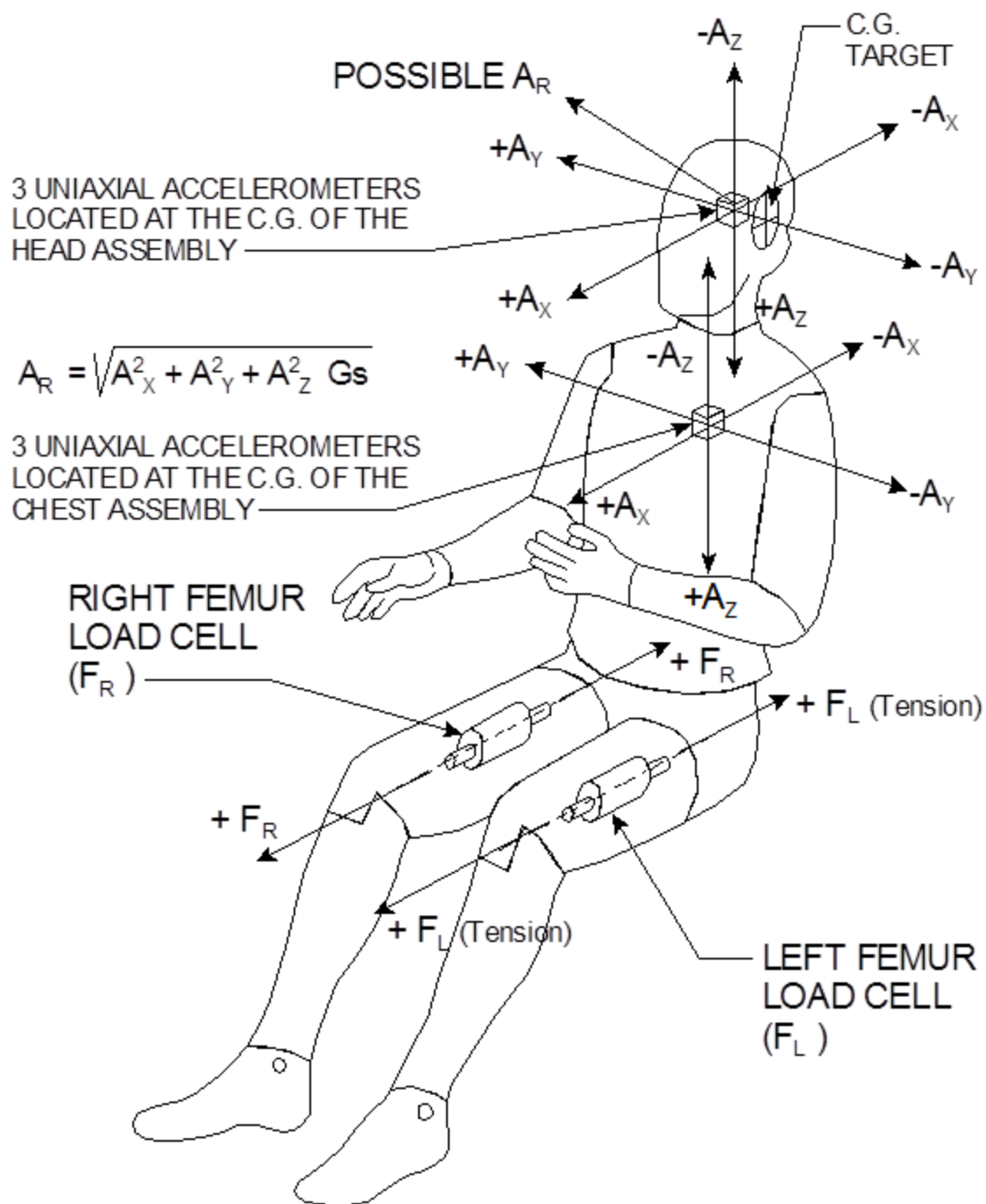


FIGURE 3D

TABLE 1D

SIGN CONVENTION FOR HYBRID III TRANSDUCER OUTPUTS	
BODY SEGMENT — MEASURED FORCE	POSITIVE OUTPUT DIRECTION
NECK FX SHEAR FY SHEAR FZ AXIAL MX MOMENT (ROLL) MY MOMENT (PITCH) MZ MOMENT (YAW)	HEAD REARWARD OR CHEST FORWARD HEAD LEFTWARD, CHEST RIGHTWARD HEAD UPWARD, CHEST DOWNWARD LEFT EAR TOWARD LEFT SHOULDER CHIN TOWARD STERNUM CHIN TOWARD LEFT SHOULDER
FEMUR FX SHEAR FY SHEAR FZ AXIAL MX MOMENT (ROLL) MY MOMENT (PITCH) MZ MOMENT (YAW)	KNEE UPWARD, UPPER FEMUR DOWNWARD KNEE RIGHTWARD, UPPER FEMUR LEFTWARD KNEE FORWARD (TENSION), PELVIS REARWARD KNEE LEFTWARD, HOLD UPPER FEMUR IN PLACE KNEE UPWARD, HOLD UPPER FEMUR IN PLACE KNEE ROTATED CCW WHEN FACING FRONT OF DUMMY
KNEE CLEVIS - FZ AXIAL	TIBIA DOWNWARD (TENSION), FEMUR UPWARD
UPPER TIBIA MX MOMENT MY MOMENT	ANKLE LEFTWARD, HOLD KNEE IN PLACE ANKLE FORWARD, BOTTOM OF KNEE CLEVIS REARWARD
LOWER TIBIA FX SHEAR FY SHEAR FZ AXIAL MX MOMENT MY MOMENT	ANKLE FORWARD, KNEE REARWARD ANKLE RIGHTWARD, KNEE LEFTWARD ANKLE DOWNWARD (TENSION), KNEE UPWARD ANKLE LEFTWARD, HOLD KNEE IN PLACE ANKLE FORWARD, BOTTOM OF KNEE CLEVIS 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 qualification 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. QUALIFICATION 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 qualification test data sheet.

14. REPORTS

14.1 APPARENT NONCONFORMANCE

During qualification verification, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COR 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 qualification check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy.

The necessity for the qualification shall be at the COR's discretion and shall be performed without additional costs to the OCWS.

14.2 FINAL PERFORMANCE QUALIFICATION REPORTS

14.2.1 COPIES

Copies of the data sheets containing the qualification 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 COR. 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 qualification 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 _____
 Technician _____

Test Date _____

__Pre-test qualification

__Post-test qualification verification

- __1. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in **Figures 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 ± 5.1 mm (1.55 ± 0.2 in) above the horizontal seating surface and 62.0 ± 5.1 mm (2.44 ± 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 ± 5.1 mm (2.1 ± 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 ± 5.1 mm above seat surface	138.5-153.7	
P	FOOT LENGTH	Tip of toe to rear of heel	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 midsagittal 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 ± 5.1 MM above the seat surface	248.9-259.1	
BB	REFERENCE LOCATION FOR DIMENSION Z	Reference: 165.1 ± 5.1 MM above seat surface	160.0-170.2	

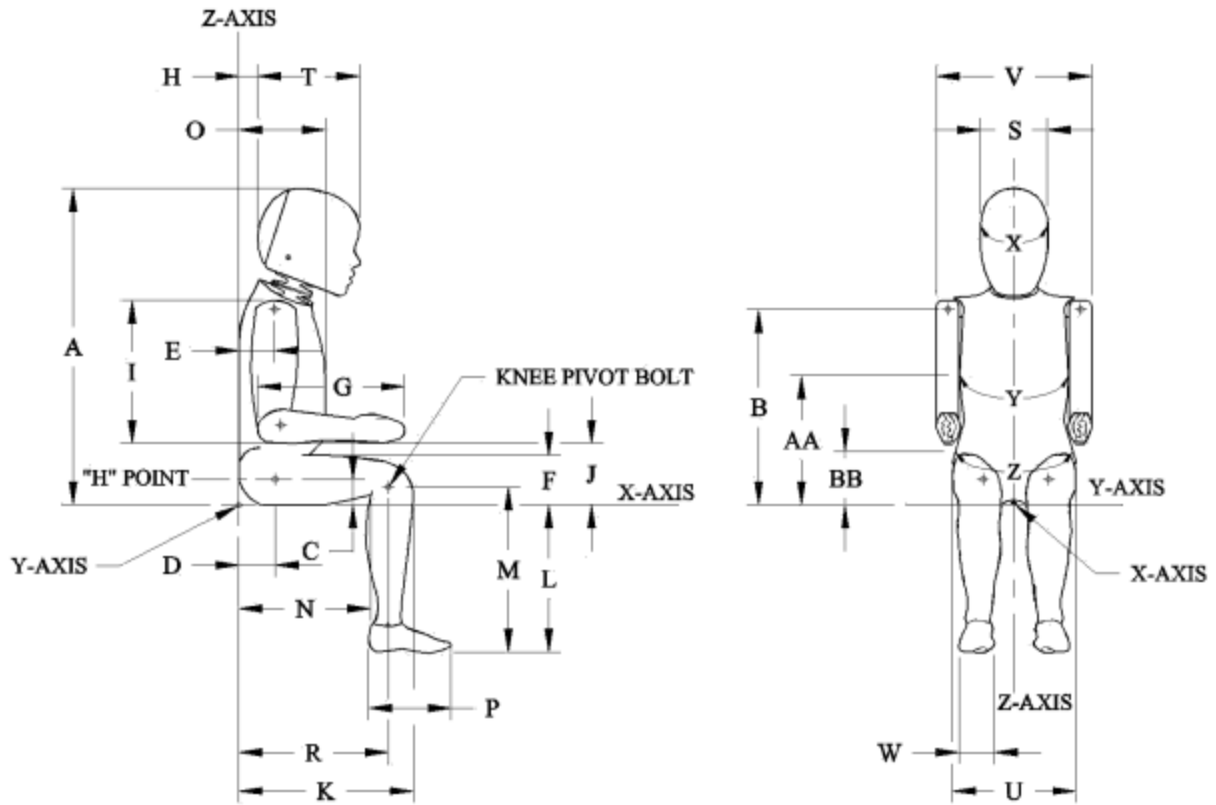


FIGURE 4D

EXTERNAL DIMENSIONS TEST SETUP

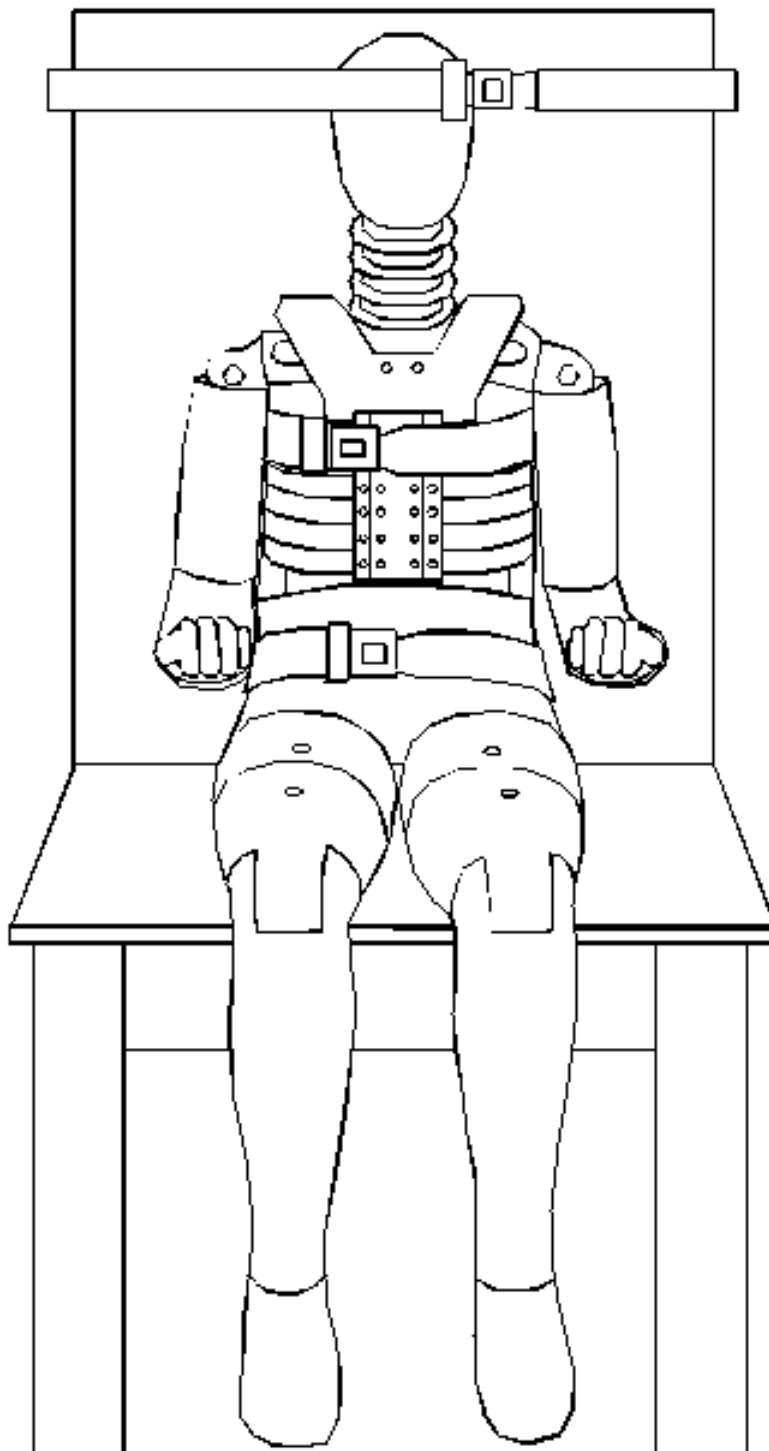


FIGURE 5D

EXTERNAL DIMENSIONS TEST SETUP

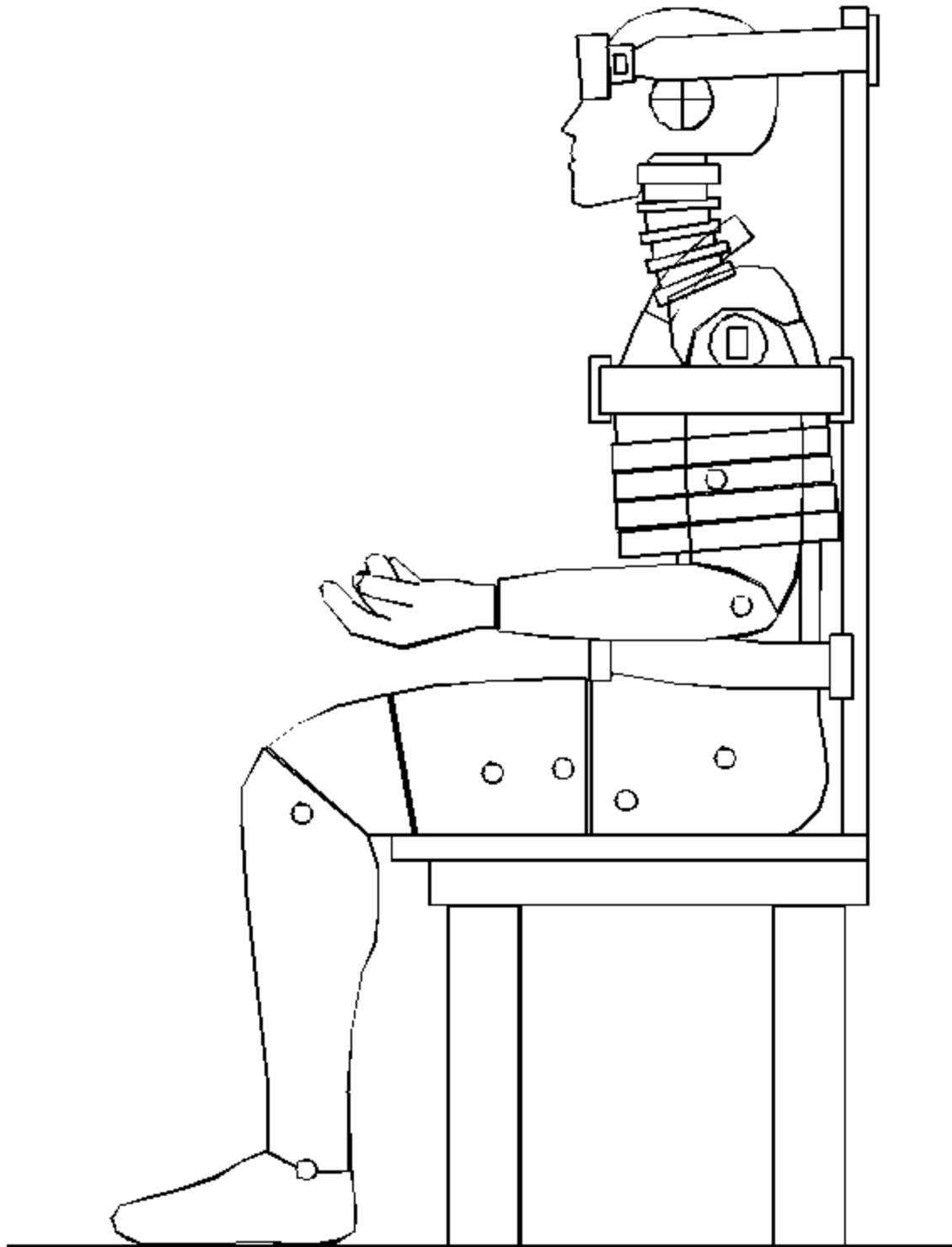


FIGURE 6D

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

Dummy Serial Number _____

Test Date _____

Technician _____

__ Pre-test qualification

__ Post-test qualification 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))
- __3. Accelerometers and their respective mounts are smooth and clean.
- __4. The head accelerometer mounting plate screws ((10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- __5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- __6. 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 _____
- __7. 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 qualification verification testing completed before any replacement or repairs are made.
 Record findings and actions: _____

- __8. 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))
- __9. Suspend and orient the head assembly as shown in **Figure 7D**. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 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.

- __10. 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 _____
- __11. The impact surface is clean and dry and has a microfinish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.142(c)(4))
 Record actual microfinish _____
- __12. 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 _____
- __13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b) & (572.142(c)(4))
- __14. 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 $\leq 15 \text{ g}$	

- __15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

 Signature

 Date

HEAD DROP TEST SET-UP SPECIFICATIONS

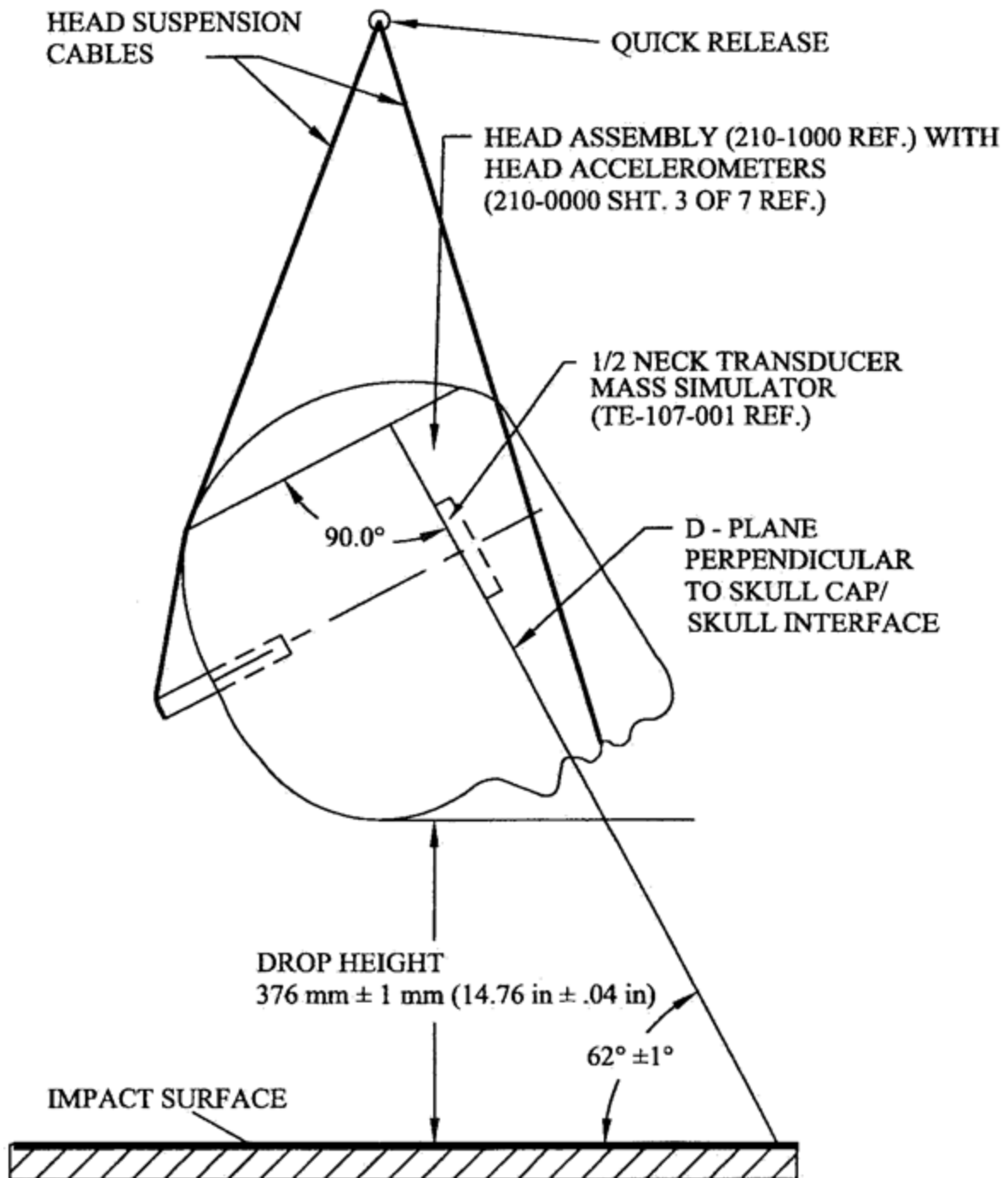


FIGURE 7D

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

Dummy Serial Number _____
Technician _____

Test Date _____

__Pre-test qualification

__Post-test qualification 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 qualification verification testing completed before any replacement or repairs are made.
Record findings and actions: _____

- __5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- __6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- __7. The test fixture pendulum conforms to the specifications in **Figure 8D**.
- __8. 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))
- __9. 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.

- __10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- __11. 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))
- __12. 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))
- __13. 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 ΔV with respect to impact speed	@ 10 ms	$2.0 \text{ m/s} \leq \Delta V \leq 2.7 \text{ m/s}$
	@ 15 ms	$3.0 \text{ m/s} \leq \Delta V \leq 4.0 \text{ m/s}$
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.1 \text{ m/s}$
Plane D Rotation	Peak moment* $42 \text{ Nm} \leq \text{moment} \leq 53 \text{ Nm}$ during the following rotation range $70^\circ \leq \text{angle} \leq 82^\circ$	___ Nm @ ___ degrees
Positive Moment Decay** (Flexion)	Time to decay to 10 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	

*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))

- __14. 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 _____
Technician _____

Test Date _____

__Pre-test qualification

__Post-test qualification 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 qualification verification testing completed before any replacement or repairs are made.
 Record findings and actions: _____

- __5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- __6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- __7. The test fixture pendulum conforms to the specifications in **Figure 8D**.
- __8. 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))
- __9. 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.

- __10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- __11. 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))
- __12. 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))
- __13. 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 ΔV 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* $-53.3 \text{ Nm} \leq \text{moment} \leq -43.7 \text{ Nm}$ during the following rotation range $83 \leq \text{angle} \leq 93$	___ Nm @ ___ degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	

*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))

- __14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

Signature

Date

PENDULUM SPECIFICATIONS

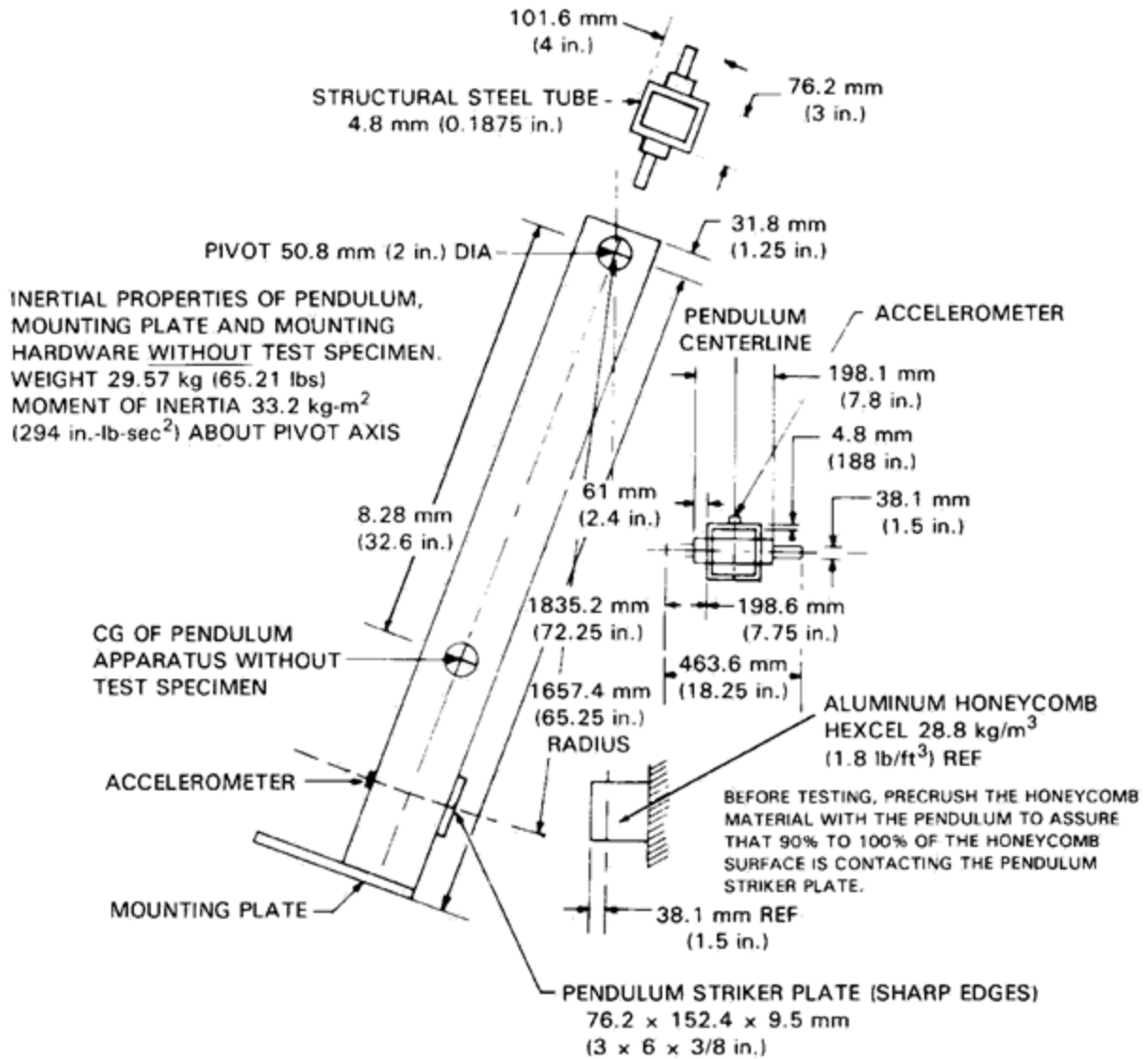
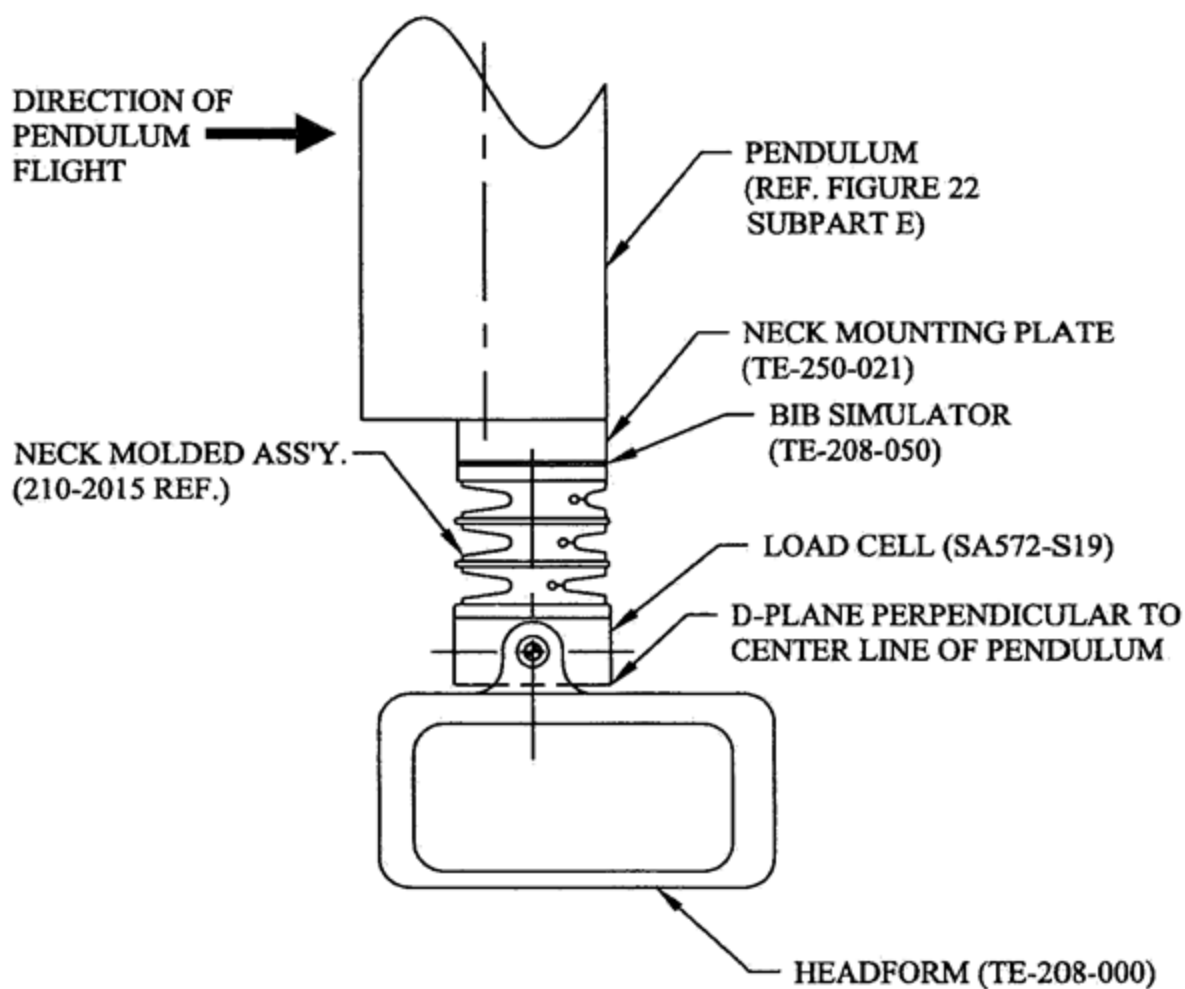


FIGURE 8D

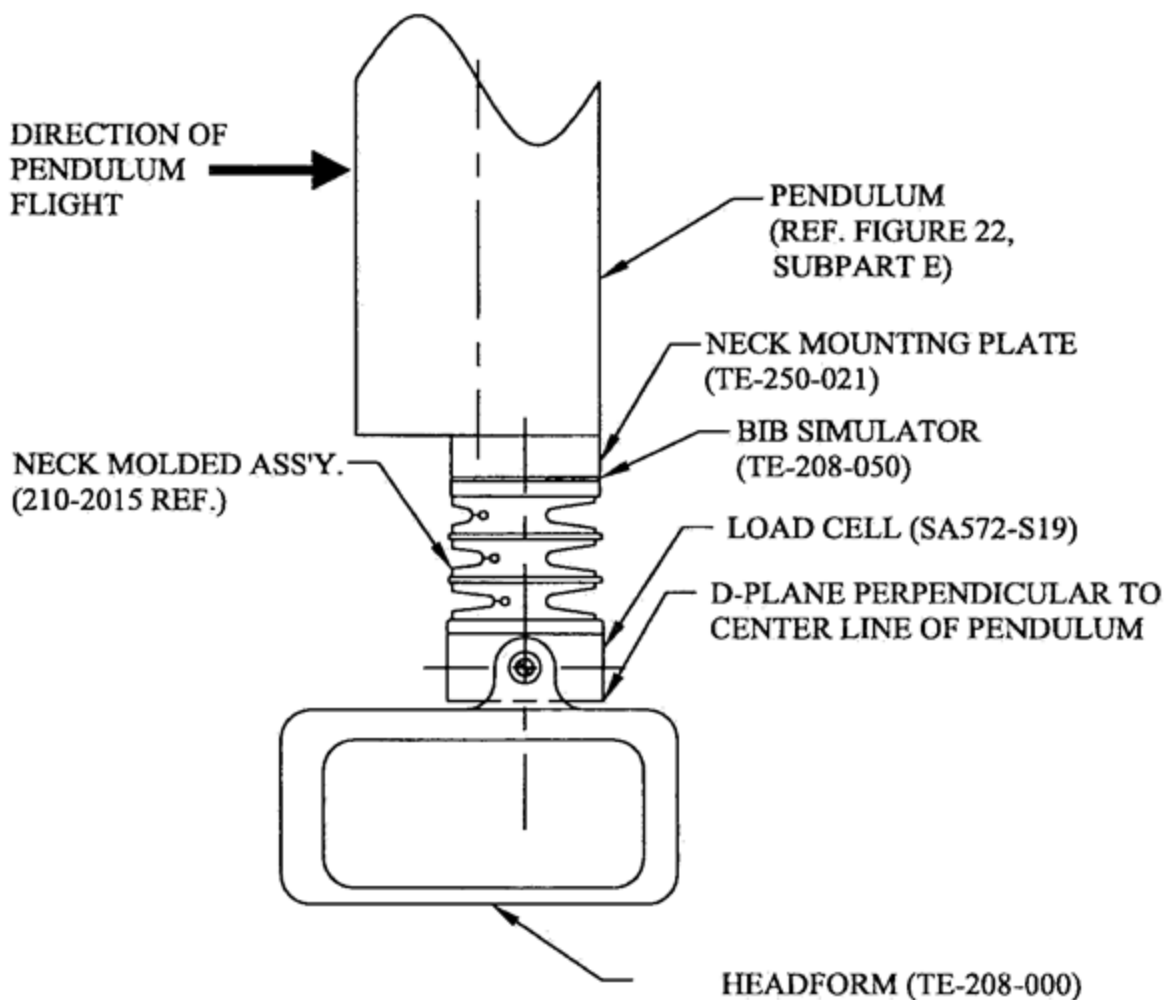
NECK FLEXION TEST SET-UP SPECIFICATIONS



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 _____
 Technician _____

Test Date _____

__ Pre-test qualification
 __ Post-test qualification 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 qualification 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 qualification 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 ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 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(l)).
- __15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° 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

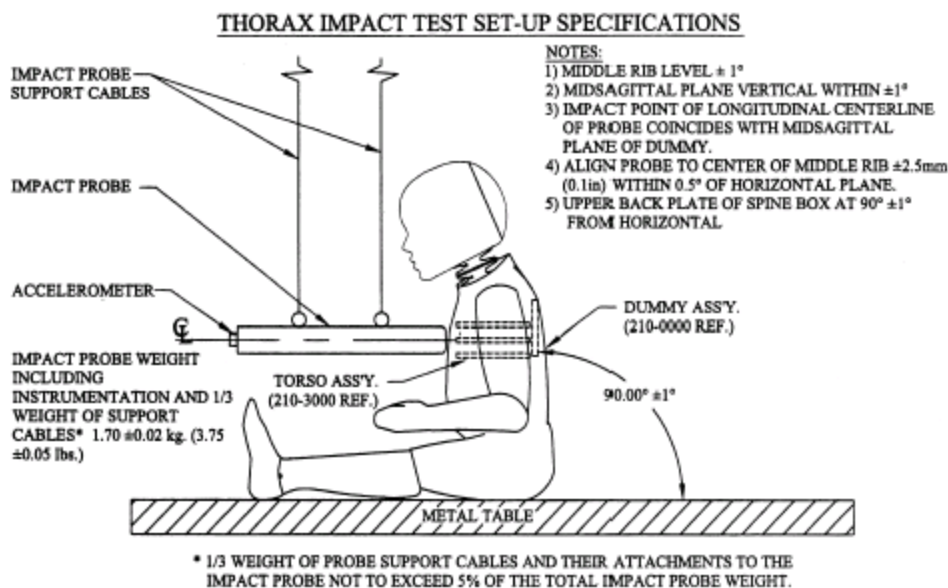


FIGURE 11D

Probe specifications:

1. Rigid metallic construction, concentric its longitudinal axis.
2. A mass of 1.7 ± 0.02 kg (3.75 ± 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-cm² (0.145 lbs-in-sec²) 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 ± 0.2 mm (2.00 ± 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.

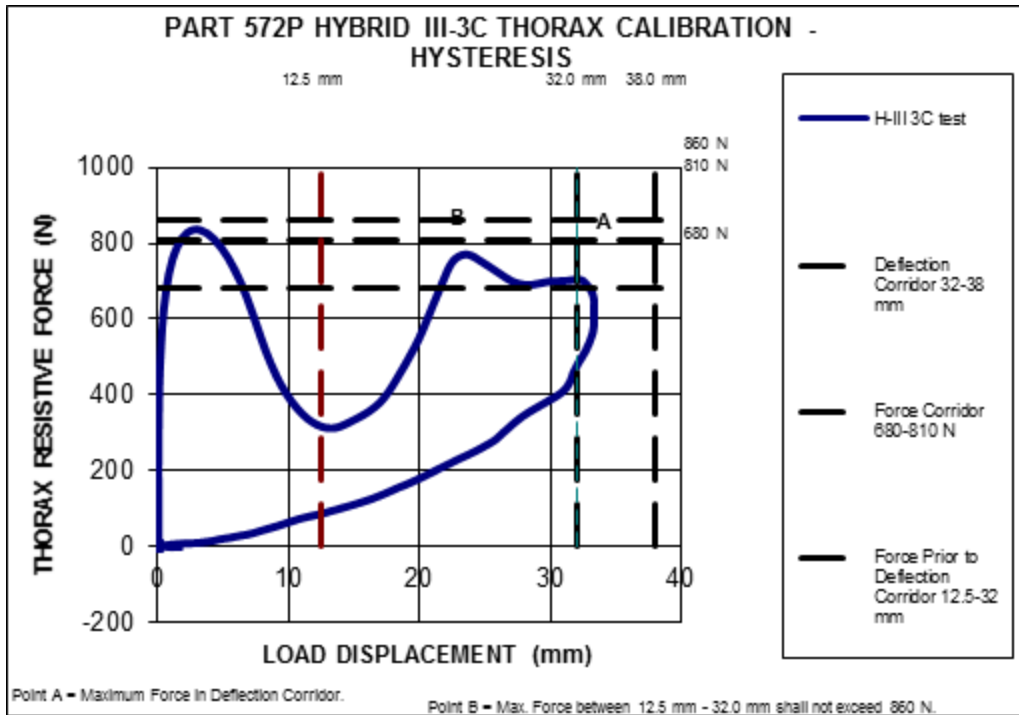


FIGURE 12D

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

Dummy Serial Number _____

Test Date _____

Technician _____

Pre-test qualification

Post-test qualification 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))
6. 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))
7. 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))
8. 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))
9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° 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))
10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0° . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
11. Remove all external support that was implemented in 9 above and wait 2 minutes. (572.145(c)(4))
12. 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°)_____
- __13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- __14. 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 torso reference plane reaches $45^\circ \pm 0.5^\circ$ of flexion relative to the vertical transverse plane. (572.145(c)(5))
- __15. 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))
- __16. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- __17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- __18. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 15^\circ$	
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	
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 $\pm 10^\circ$	

- __19. A plot of the force versus time follows this sheet.

Signature

Date

TORSO FLEXION TEST SET-UP SPECIFICATION

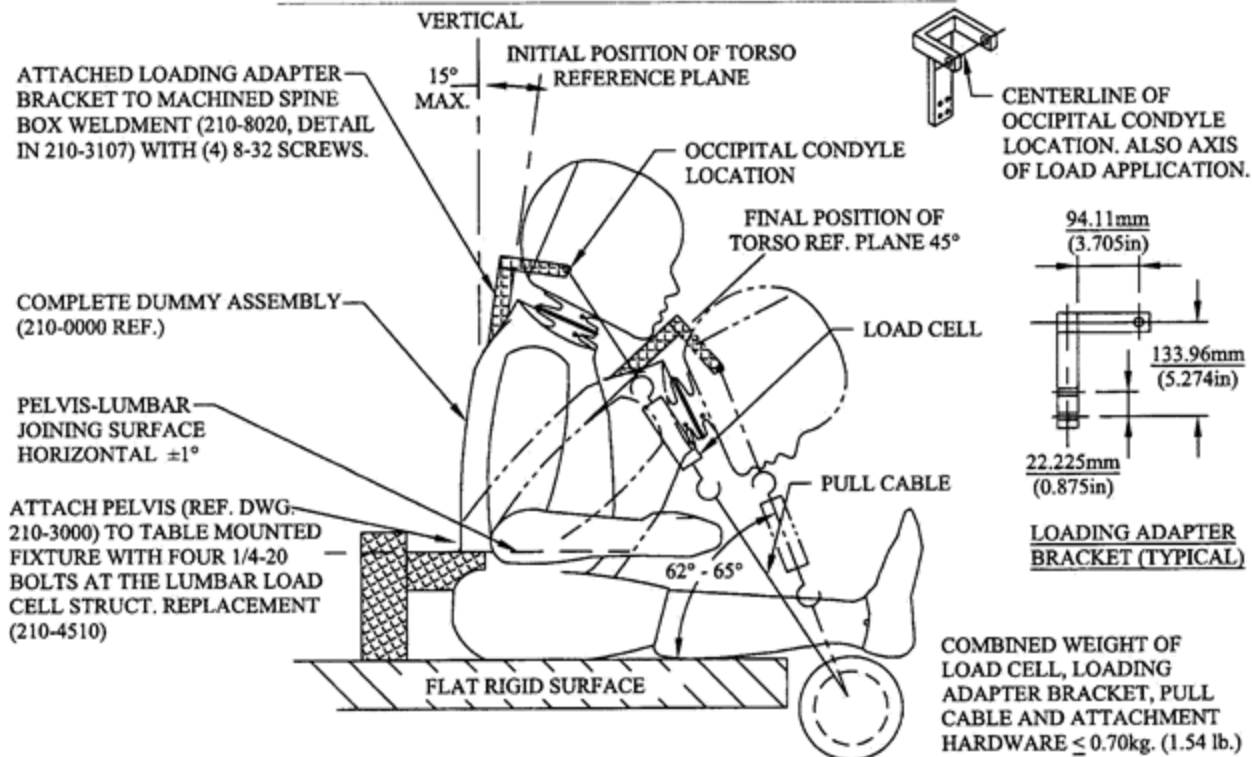


FIGURE 13D

DATA SHEET D8
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

LD. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
NECK TRANSDUCER					
CHEST ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
CHEST POTENTIOMETER					
FEMUR LOAD CELLS					
(1) RIGHT FEMUR					
(2) LEFT FEMUR					
LABORATORY INSTRUMENTATION					
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 QUALIFICATION TEST
PROCEDURE

APPENDIX E
PART 572, SUBPART R DUMMY PERFORMANCE QUALIFICATION TEST
PROCEDURE

1.	PURPOSE AND APPLICATION	1
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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 qualification 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 qualification 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 qualification 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 www.regulations.gov (search Docket No. NHTSA-2000- 7052).

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 qualification 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 COR) 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 qualification tests before and after each vehicle test usage.

No Information concerning the Part 572, Subpart R dummy qualification data shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Branch or Division Chief.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire dummy qualification 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 qualified as test tools to be used in NCAP vehicle crash tests. The schedule for these performance qualification tests must be correlated with that of the vehicle tests. All testing shall be coordinated to allow monitoring by the COR.

6. TEST DATA DISPOSITION

The contractor shall make all dummy qualification data available to the COR for review and analysis as required. All qualification test data for each particular Part 572, Subpart R dummy will be sent to the COR with each test report.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc. shall be either sent to the COR 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.

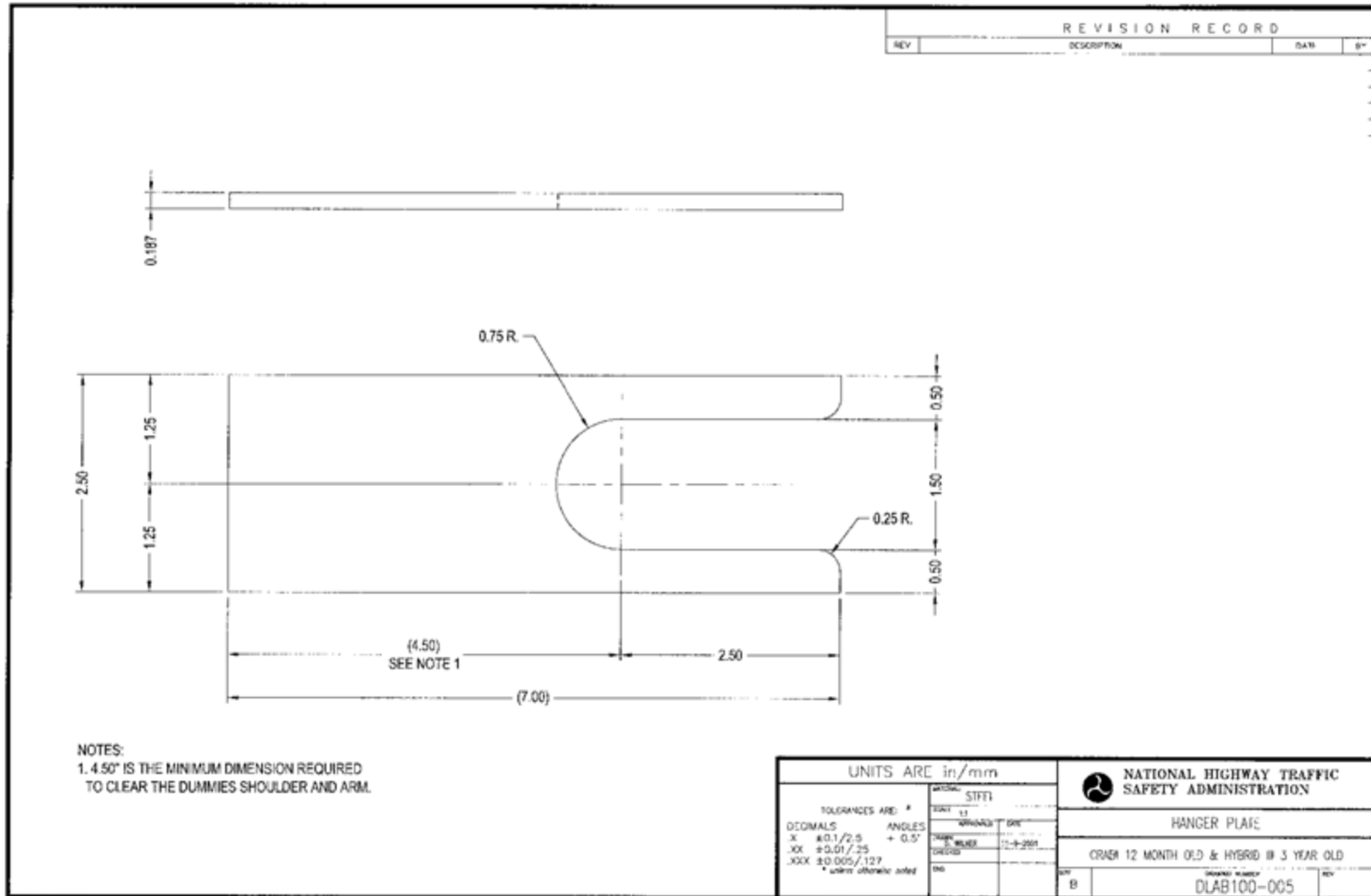


FIGURE 1E

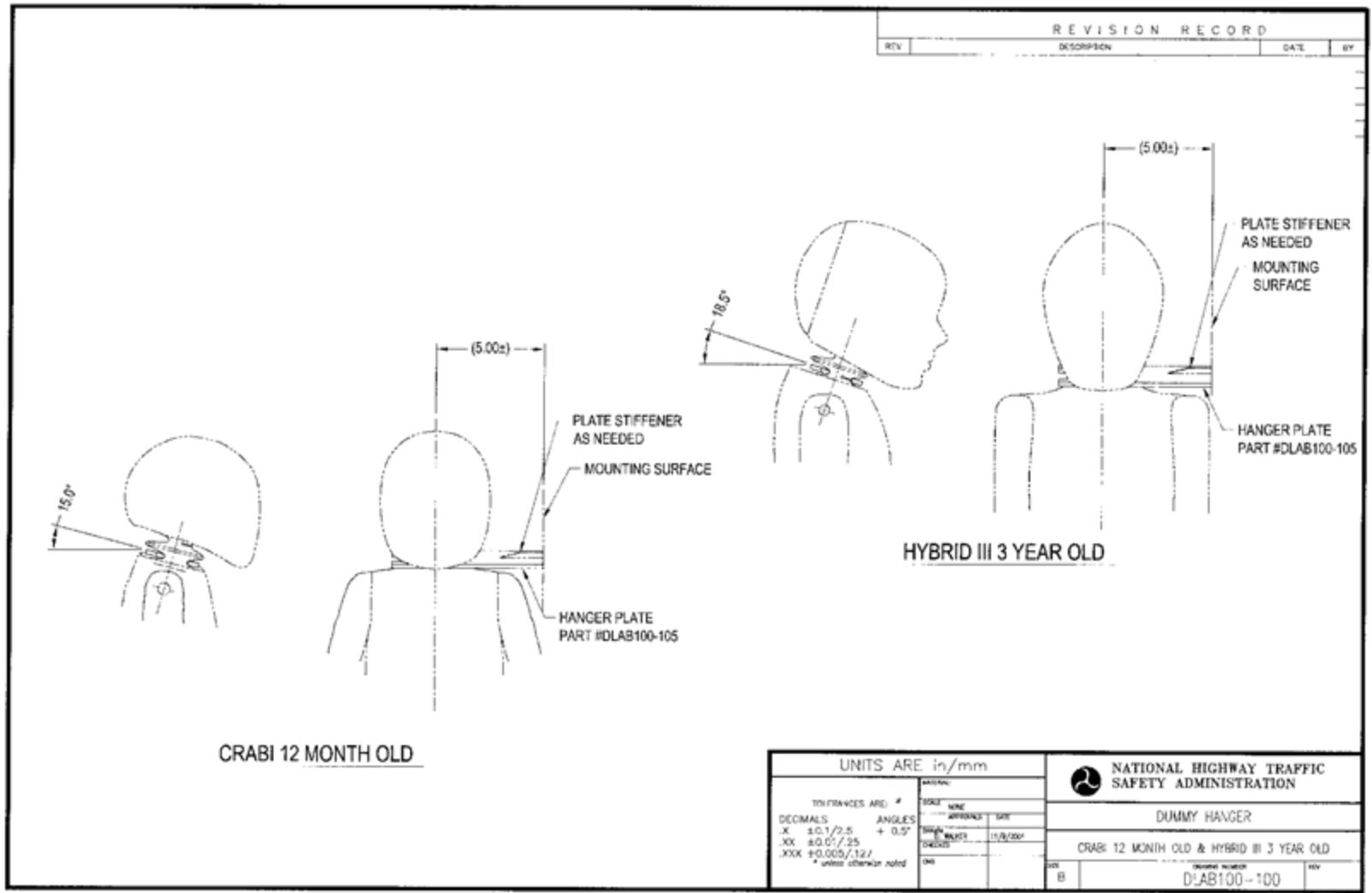


FIGURE 2E

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 qualification, if requested. The COR will be kept informed of the dummies' condition so that replacement parts can be provided. The dummies will be qualified 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 qualification 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 COR. The calibration system will need the written acceptance of the COR 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 qualified as indicated in NCAP test procedure. These qualifications 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. PRE-TEST 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 qualification testing but may be 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 acceleration	Class 180	(572.155(i)(3)(ii))

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 ± 0.02 kg (6.3 ± 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 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 CONVENTIONS FOR PART 572 TEST DUMMIES

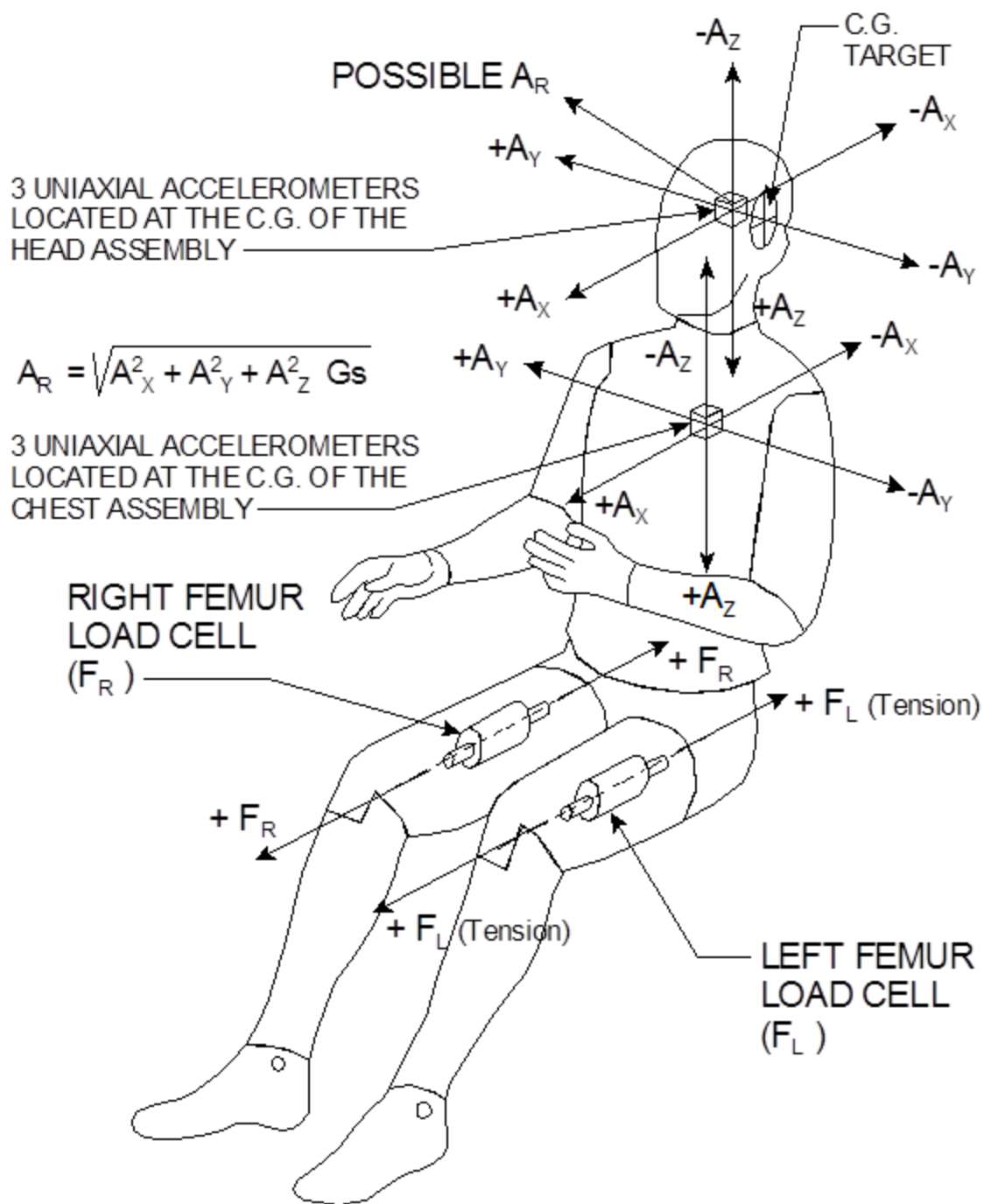


FIGURE 3E

TABLE 1E

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

14. REPORTS

14.1 APPARENT NONCONFORMANCE

During a qualification verification, any indication of apparent nonconformance to the requirements of Regulation P572 shall be communicated by telephone to the COR 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 COR's discretion and shall be performed without additional costs to the OCWS.

14.2 FINAL PERFORMANCE QUALIFICATION REPORTS

14.2.1 COPIES

A report containing the qualification 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 COR. 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 _____
 Technician _____

Test Date _____

This check sheet is completed as part of the qualification 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)

Dummy Serial Number _____
 Technician _____

Test Date _____

__Pre-test qualification

__Post-test qualification 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 ± 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 ± 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 ± 5.1 mm above the seat surface.	447-472.4	
AA	REFERENCE LOCATION FOR DIMENSION Y & O	Reference: 261.6 ± 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 ± 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	

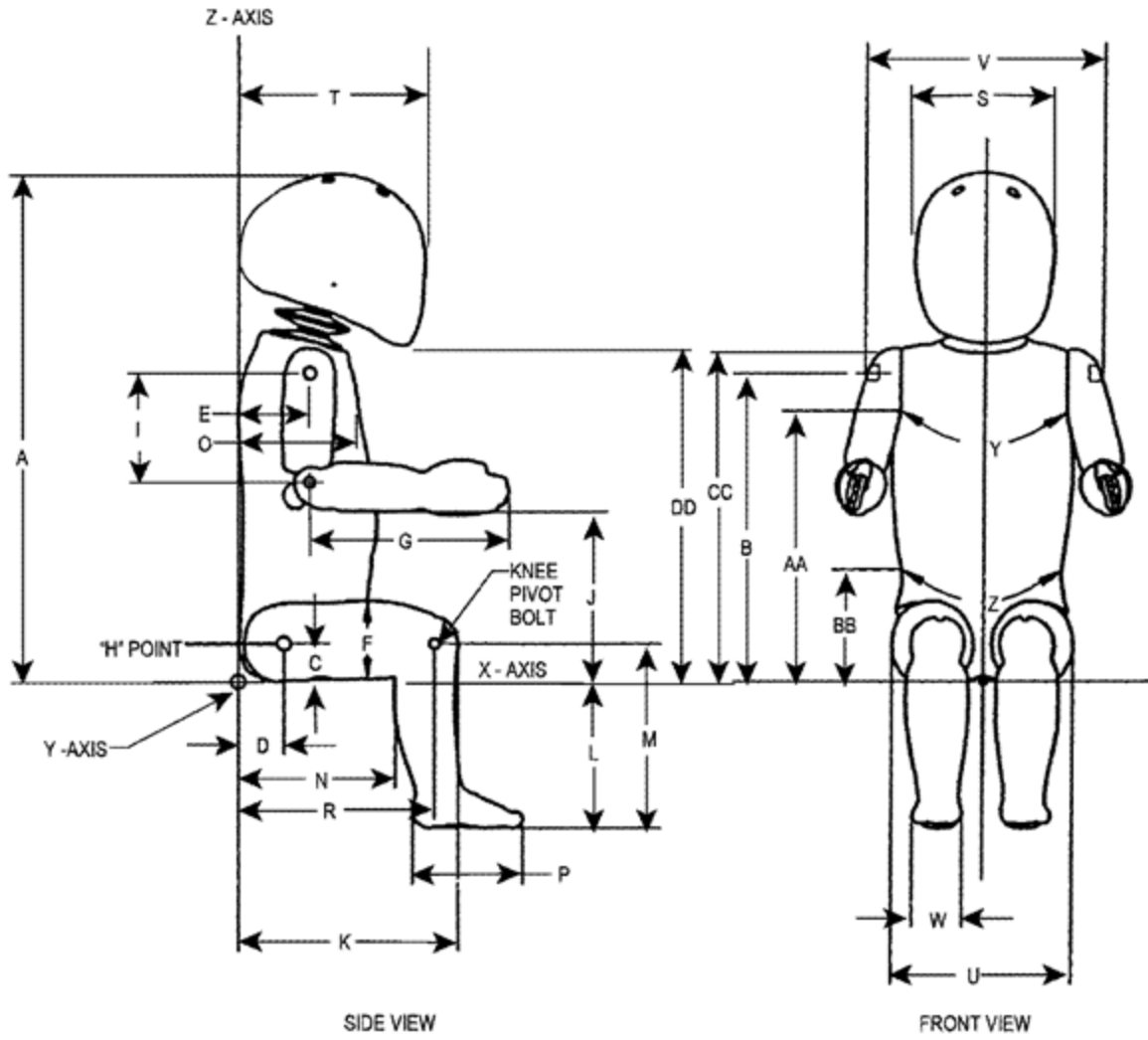


FIGURE 4E

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

Dummy Serial Number _____
Technician _____

Test Date _____

__ Pre-test qualification
__ Post-test qualification 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 qualification 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 ± 1.0 mm (14.8 ± 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 ± 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 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-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 ± 1.0 mm (14.8 inches ± 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

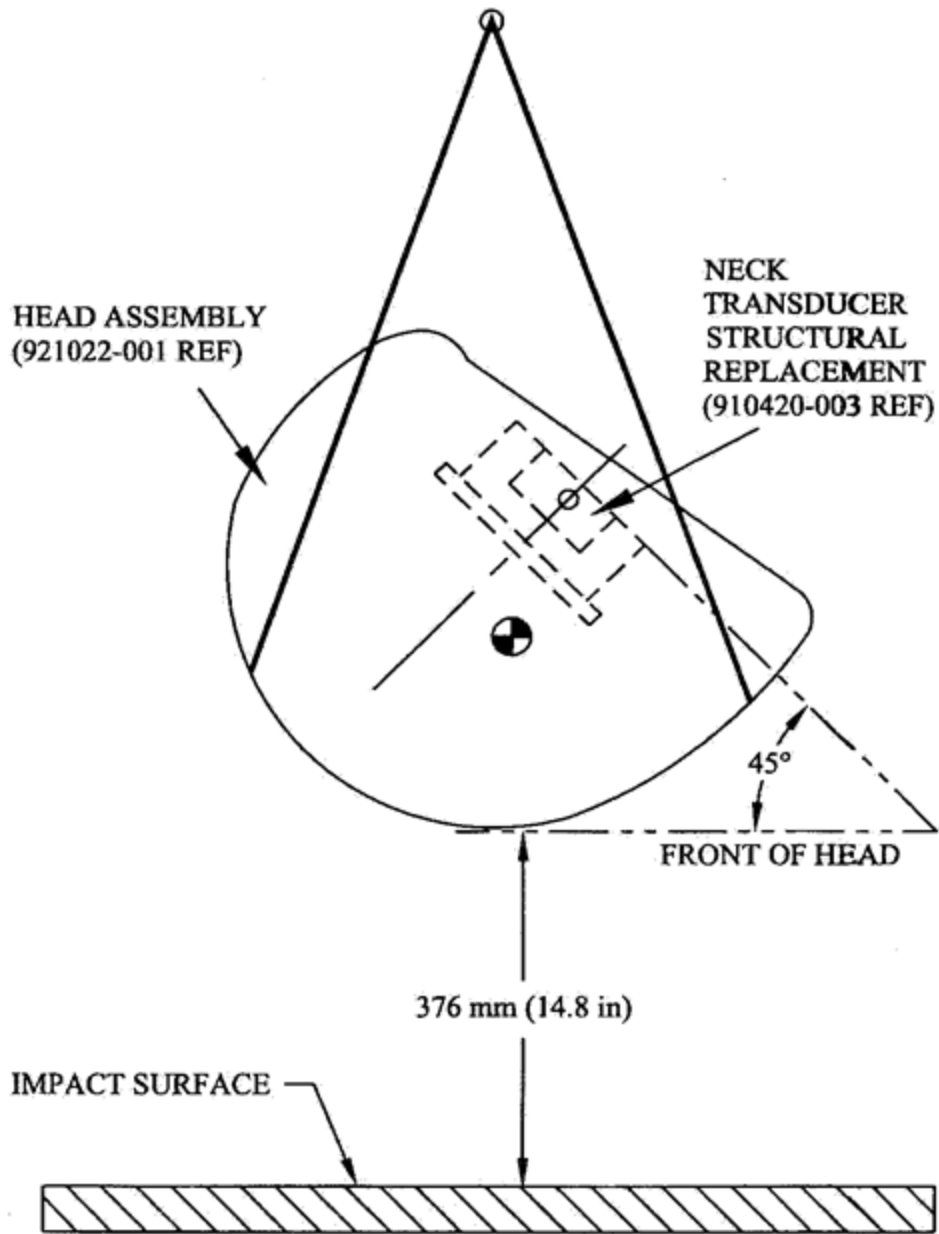


FIGURE 5E

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

Dummy Serial Number _____
 Technician _____

Test Date _____

__ Pre-test qualification
 __ Post-test qualification 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 qualification 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 ± 1.0 mm (14.8 ± 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 ± 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 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-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 ± 1.0 mm (14.8 inches ± 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

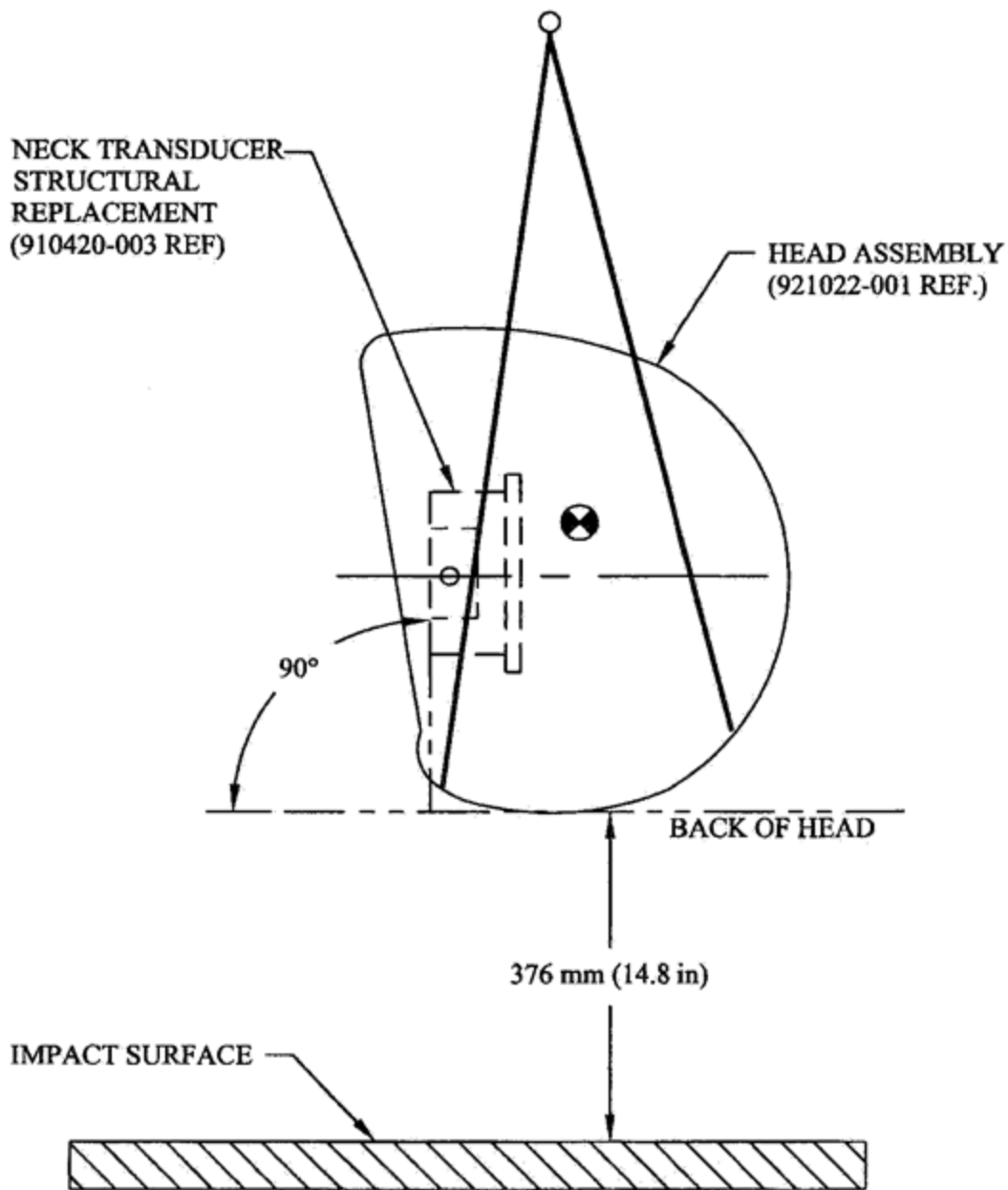


FIGURE 6E

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

Dummy Serial Number _____
Technician _____

Test Date _____

__ Pre-test qualification
__ Post-test qualification 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 qualification verification testing completed before any replacement or repairs are made.
Record findings and actions: _____

- __5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))
- __6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- __7. The test fixture pendulum conforms to the specifications in **Figure 7E**.
- __8. 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))
- __9. 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))
- __10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

- __11. 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))
- __12. 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))
- __13. Complete the following table:

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

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

*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))

- __14. 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 _____

__ Pre-test qualification
__ Post-test qualification 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 qualification verification testing completed before any replacement or repairs are made.
Record findings and actions: _____

- __5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))
- __6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- __7. The test fixture pendulum conforms to the specifications in **Figure 7E**.
- __8. 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))
- __9. 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))
- __10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

- __11. 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))
- __12. 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))
- __13. Complete the following table:

Neck Extension Results (572.143(b)(1) & (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 ΔV with respect 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* $-12 \text{ Nm} \leq \text{moment} \leq -23 \text{ Nm}$ during the following rotation range $80^\circ \leq \text{angle} \leq 92^\circ$	___ Nm @ ___ degrees
Negative Moment Decay** (Extension)	Time to decay to -5 Nm $76 \text{ ms} \leq \text{time} \leq 90 \text{ ms}$	

*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))

- __14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

Signature

Date

PENDULUM SPECIFICATIONS

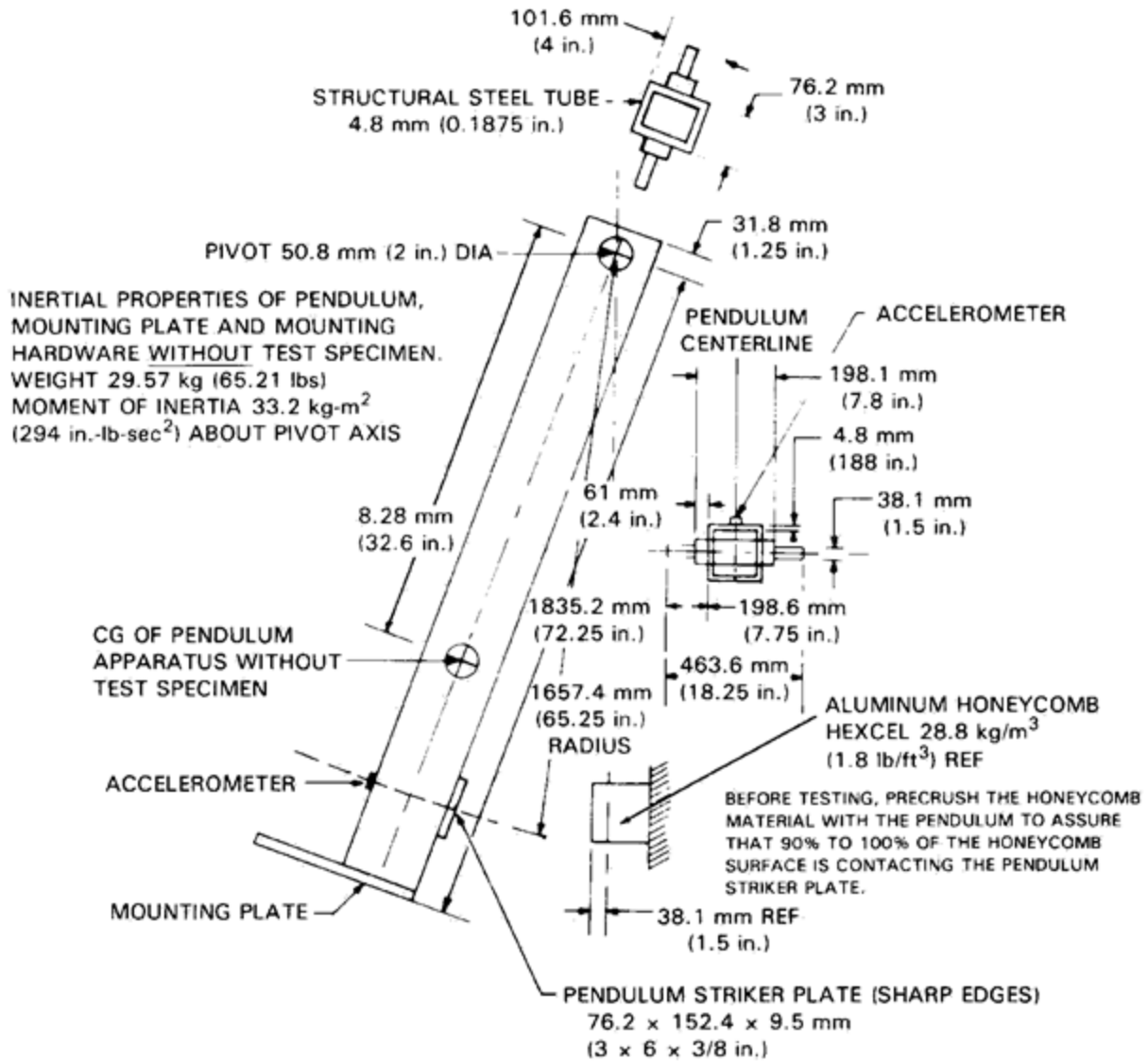
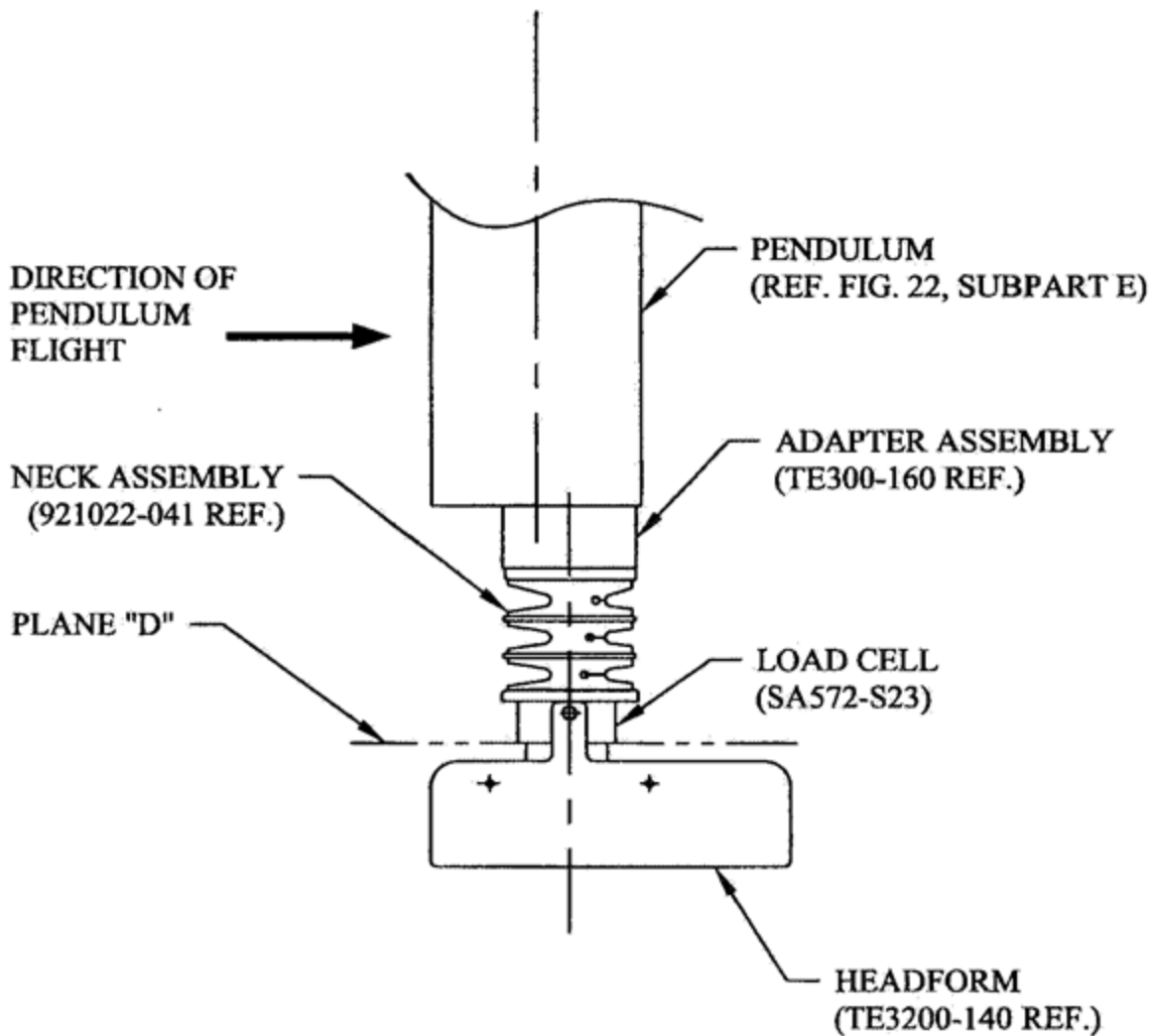


FIGURE 7E

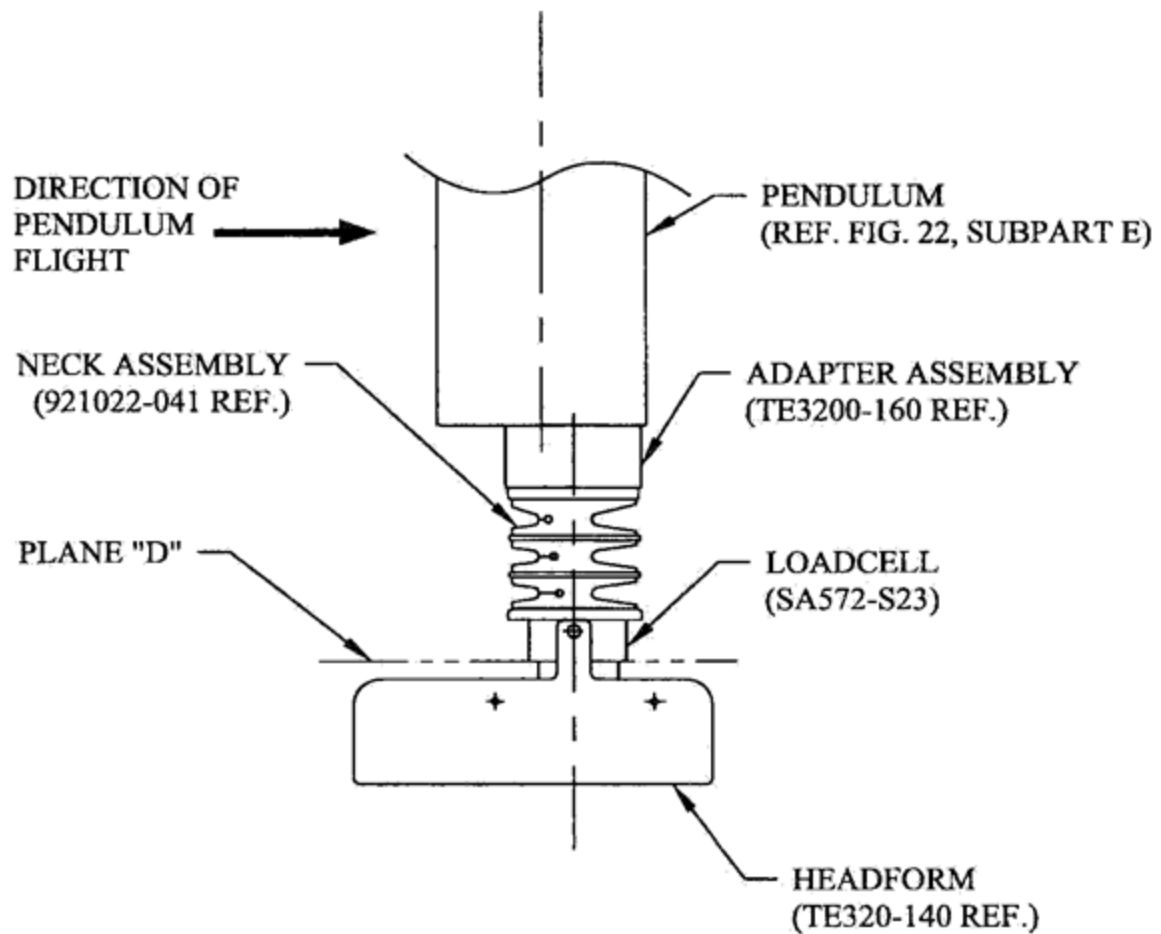
NECK FLEXION TEST SET-UP SPECIFICATIONS



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 _____

__ Pre-test qualification
 __ Post-test qualification 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° to 5° forward of vertical. (572.154(c)(3))
- __9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane, 196 ± 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(l)).
- __11. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° 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.

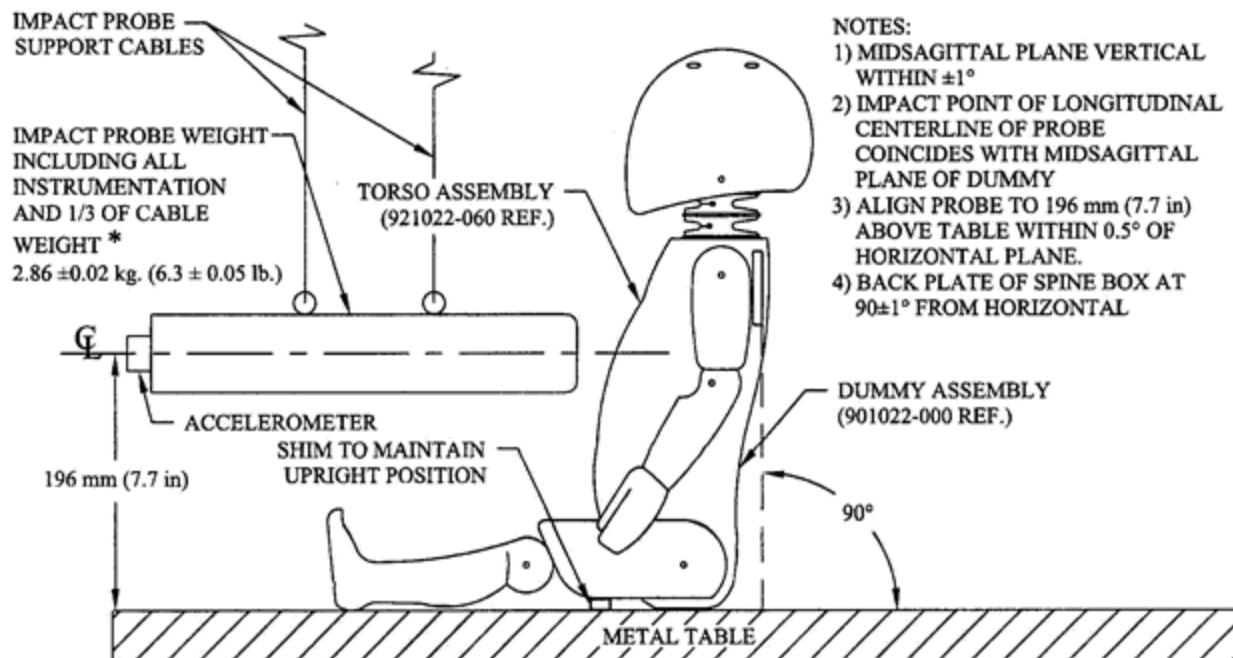
**Force = impactor mass x acceleration (572.144(b)(3))

__13. Plots of pendulum acceleration, and pendulum force, follow this sheet.

Signature

Date

THORAX IMPACT TEST SET-UP SPECIFICATIONS



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

FIGURE 10E

Probe specifications:

1. Rigid metallic construction and concentric about its longitudinal axis.
2. A mass of 2.86 ± 0.02 kg (6.3 ± 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-cm² (0.145 lbs-in-sec²) 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 ± 0.25 mm (4.00 ± 0.01 in) and an 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.

DATA SHEET E8
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

LD. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
NECK TRANSDUCER					
CHEST ACCELEROMETERS					
(1) LONGITUDINAL					
(2) LATERAL					
(3) VERTICAL					
CHEST POTENTIOMETER					
FEMUR LOAD CELLS					
(1) RIGHT FEMUR					
(2) LEFT FEMUR					
LABORATORY INSTRUMENTATION					
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
AND POSITIONING PROCEDURES

1. Seating and Positioning/DATA SHEET 1: Hybrid III 50th Male, Driver
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 effect 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 effect 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.

2. **Seating and Positioning/DATA SHEET 2: Hybrid III 5th Female, Front Passenger**
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 override 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 SCRPs 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 ± 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 ± 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 ± 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 COR.** (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
HYBRID III INSTRUMENTATION AND POLARITY
CHECK PROCEDURES

APPENDIX G: HYBRID III INSTRUMENTATION CHECK PROCEDURES
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1. PURPOSE AND APPLICATION

The New Car Assessment Program's (NCAP's) full frontal rigid barrier impact test procedure is based on a related safety standard, Federal Motor Vehicle Safety Standard (FMVSS) No. 208, which specifies performance requirements for the protection of vehicle occupants in crashes.

This document is an appendix to the main full frontal rigid barrier laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA), Office of Crashworthiness Standards (OCWS) for the purpose of presenting guidelines for a uniform testing data and information recording format, and providing suggestions for the use of related Anthropomorphic Test Device (ATD) equipment for contracted testing laboratories. The data are gathered from instrumentation that may be used when testing with certain Hybrid III frontal test dummies. The OCWS test procedure is not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment that will assist in procuring the required test data. However, applicability of any such testing technique or equipment is subject to prior approval by the COR.

The requirements presented in this appendix are applicable to ATDs equipped with one or more of the following types of instrumentation while tested under the main full frontal NCAP test procedure:

- Redundant Instrumentation
- Nine Axis Accelerometers
- Angular Rate Sensors
- Upper and Lower Neck Load Cells
- Foot Accelerometers

It is the contractor's responsibility to follow the most updated versions of all related test procedures when using test devices equipped with the following instrumentation.

2. GENERAL REQUIREMENTS

This laboratory test procedure provides guidelines for the use of various Hybrid III ATD instrumentation used during full frontal NCAP tests. There may be no minimum performance requirements or any Federal Motor Vehicle Safety Standard (FMVSS)-related requirements associated with the information collected, however, visual inspection of a dummy's parts per the qualification procedure is still required.

2.1 SAE J211

Standardized coordinate systems and recorded polarities for various transducer outputs relative to positive directions of those coordinate systems are defined for crash test dummies, vehicle structures, and laboratory fixtures in the SAE J211 standard. A standardized coordinate system and polarities for data permits comparison of data from different crash test facilities.

NHTSA requires that the polarity of any instrumentation channel be compatible with and

recordable in accordance with SAE J211. A channel, by definition, includes all the instrumentation from the transducer to the data acquisition system output, including connectors, wiring, data acquisition software and hardware.

2.2 SAE J1733

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, respectively.

One technique to document the polarity of the accelerometers is to apply blows to the dummy's head with a rubber mallet (never apply the blow directly to an accelerometer mount) and record the data channel output. **Figure G1** illustrates this technique, including the directions of expected positive polarity.

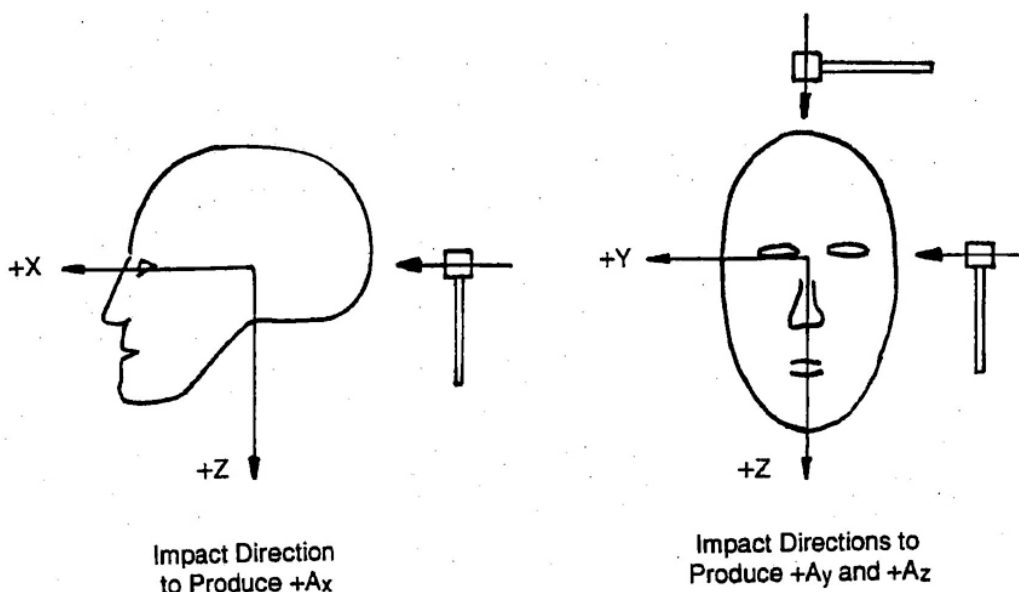


Figure G1: Head Impact Directions that Produce Positive Accelerations Relative to the Head Coordinate System

For example, to document the polarity of the x-axis accelerometer data channel, apply a blow to the back of the head. The polarity of the head x dummy channel should be positive as in **Figure G2** and no changes are needed to conform to the sign convention. Similarly, when applying blows to the left side and top of the head with a rubber mallet, the polarity of the dummy's y and z-axis accelerometer data channels should be positive.

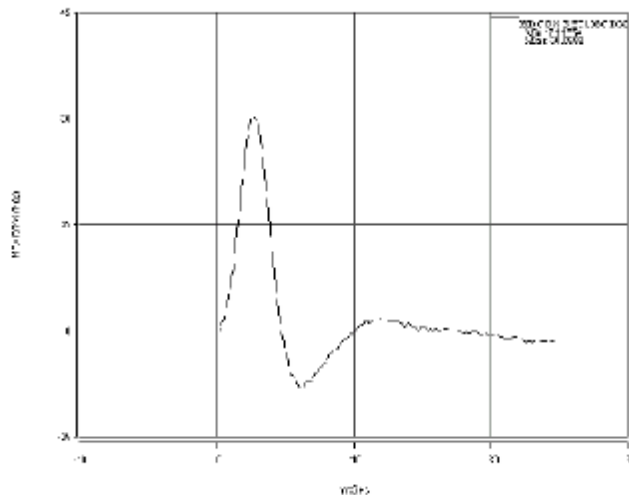


Figure G2: Response of x-axis accelerometer data channel from blow to rear of head showing desired positive polarity

Figure G3 illustrates a negative output from a blow to the left side of the dummy's head, which is the incorrect polarity. In this case, the channel polarity needs to be changed to agree with the sign convention prior to submitting the data to NHTSA. A sign change in the software may be the simplest solution.

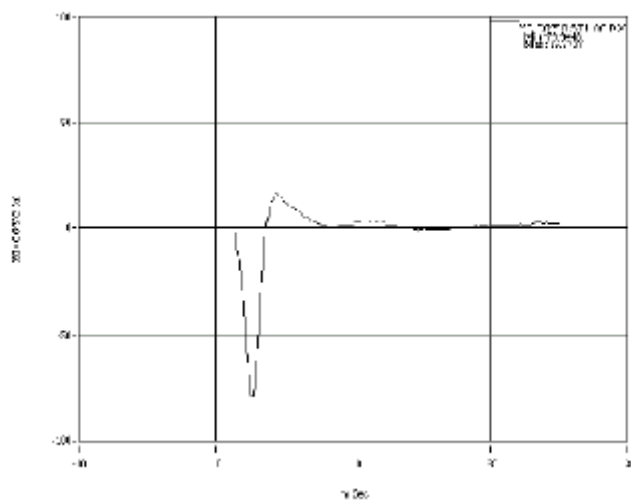


Figure G3: Response of y-axis accelerometer data channel from blow to left side of head showing incorrect negative polarity

2.3 INFLUENCING CHANNEL POLARITY

The polarity of a data channel for any given dummy may be affected by changing the positive and negative pins from the instrumentation to the wiring in a connector, the polarity assigned in the software, or by changing the way it is mounted in the dummy. NHTSA recommends the Contractor adopt standard wiring practices across similar sensor types, such that polarity can be verified through visual inspection of the transducer.

Since there are many ways to influence the polarity of a data channel it is appropriate to document the polarity of the assembled channel upon receipt and just before testing to assure the instrumentation is recording data in the appropriate orientation.

When a test dummy is delivered to the Contractor and connected to the data acquisition system, the polarity of the internal instrumentation should be determined using the following approaches. The procedures require manipulating various dummy body regions to determine the polarities of the channels in question with respect to the sign convention.

NOTE: If the polarity of any instrumentation is incorrect with respect to the sign conventions presented below, then steps must be taken to correct it prior to submitting data to NHTSA.

If, when properly following these procedures, channel polarity cannot be determined, it may indicate that the accelerometer, load cell, or other instrumentation has not been mounted in accordance with the assembly drawings.

3. REDUNDANT INSTRUMENTATION

The following guidelines are for affixing redundant accelerometers or load cells in the heads, chests, and femurs of the Hybrid III dummies. The Contractor is expected to closely follow these guidelines and shall contact the COR if difficulties arise in meeting them or if more details are needed.

The locations of the primary instrumentation (head, chest, or femur, as specified in the test procedure) shall not be altered as a result of installing any redundant instrumentation. In addition, the center of gravity (C.G.) of the head, chest, or femur with the redundant instrumentation installed shall stay within the allowable range as indicated in Hybrid III specifications.

Any weight increases due to the installation of redundant instrumentation in the heads, chests, or femurs shall be within the allowable weight variations specified for these body regions in Hybrid III drawings and/or other documentation.

To simplify and facilitate the installation of accelerometers, for example, the following recommendations are provided:

- Use of SAE572-S4 accelerometers and existing mounting fixtures is desirable because of their light weight.
- Redundant SAE572-S4 accelerometers can be attached directly to the primary ones, either head-to-head or back-to-back. Both can then be attached to one side of the mounting cube.
- The use of spacers between the primary and redundant accelerometers is recommended for better stability. Spacers shall be made of aluminum due to weight considerations.

Any injury criterion values (HIC, 3ms chest clip, and femur loads) generated by redundant instrumentation shall not deviate more than ten (10) percent from the injury criterion values generated by their corresponding primary instrumentation. If a greater than 10 percent deviation is discovered during any testing, the Contractor should investigate to determine whether the primary or redundant instrumentation is producing an incorrect output. The COR should also be notified.

4. HEAD ROTATIONAL INSTRUMENTATION

These guidelines provide a practical methodology for pre-test checking and documenting the recorded polarity of nine axis accelerometer head arrays and head angular rate sensors (ARS) relative to NHTSA sign convention. Documenting the polarity of channels before use serves to increase the confidence that they will record data correctly during an event. The polarities in this document are the same as those of the SAE J211 and SAE J1733.

4.1 NINE AXIS ACCELEROMETER HEAD ARRAY

One approach to check the polarity of the head nine-axis accelerometers is to strike the dummy's head with a rubber mallet from various directions to induce a measurable acceleration.

- Striking the dummy head from the rear should result in a positive A_x .
- Striking the dummy head from the left side should result in a positive A_y
- Striking the dummy head from the top should result in a positive A_z .

If any of these striking 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.

Following this approach, it is possible to determine the polarity of each nine axis accelerometer data channel in the dummy head.

Polarity Check Data Sheet for Head Nine Axis Accelerometer Rate Sensors		
Dummy Type:		Serial No.:
Direction	Action	Date:
A_x	Strike rear of dummy head	+ (positive)
A_y	Strike left side of dummy head	+ (positive)
A_z	Strike top of dummy head	+ (positive)

Table G1: Polarity Check Data Sheet for Head Nine Axis Accelerometer Rate Sensors

An alternate approach to determine the polarity of the accelerometers mounted in the dummy head uses the constant force of gravity as the input. This procedure will yield the same polarity as the previous procedure. Since the sign convention is fixed with respect to the dummy, this procedure can be conducted outside the test vehicle on the laboratory floor or table, but the dummy must be attached to the data acquisition system.

The procedure for each channel requires placing the accelerometers to be checked perpendicular to the axis of gravity in two orientations, each 180 degrees apart, and recording the sign and

value of the acceleration channel due to the earth's gravity for a short period of time. The SA572-S4 accelerometer is defined as perpendicular to the axis of gravity when the plane containing both mounting screw holes is perpendicular to the force of gravity. See **Figure G4**.

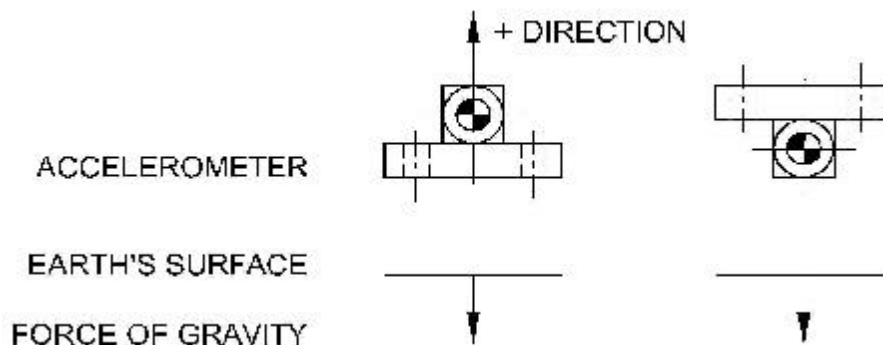


Figure G4: SAE 572-S4 Accelerometer Perpendicular to the Force of Gravity in Two Orientations 180 Degrees Apart

When the SAE 572-S4 accelerometer is mounted in a plane perpendicular to the force of gravity the orientation of the dummy head having the most positive output for that accelerometer channel defines positive polarity when moved away from the earth center. The polarity must agree with the SAE J211 sign convention.

The data collected should be recorded in the Polarity Check Data Sheet respectively for the x, y, and z accelerometers (**Tables G2, G3, and G4** below). As an example, refer to the Polarity Check Data Sheet, **Table G2**, for documenting the x-axis polarity.

To determine the polarity of the head x accelerometer:

1. Lay the dummy face down (FD) and record the x-accelerometer's output in g's in the appropriate column.
2. Then place the dummy face up (FU) and record the channel output in g's in the appropriate column.
3. List the orientation of the most positive value in the next column, either FD or FU, paying attention to the sign from the data acquisition system (-1 is more positive than -2 g's).
4. Next, compare the orientation of the most positive value with the J211 orientation for positive sign convention.
 - a. If the dummy's orientation of the most positive value is consistent with that of the J211 sign convention, then the channel output will be in accordance with the sign convention.
 - b. If, however, the dummy's orientation of the most positive value is different than that of the J211 sign convention, then the channel's output will have to be reversed by the data acquisition software in order to be in accordance with the sign convention.

- Place a check in the column titled “Negative Channels to Be Reversed in Data Acquisition System” for those channels that will require reversal by the data acquisition software.

The procedure for the y-axis accelerometers is similar to that used for the x-axis and can be accomplished on a floor or bench surface. In this instance, the dummy is placed on its side in two different orientations - one where the right shoulder is down (RSD) and one where the right shoulder is up (RSU). Once again, all of the channels can be recorded at one time. Then, flip the dummy onto its other side and record the values again. List the orientation of the most positive value and compare that with that J211 orientation for positive sign convention. Indicate the channels to be reversed, if any.

For the z-axis, turning the larger adult dummies over and standing them on their heads is quite difficult. Thus, for the z-axis check, it is recommended to secure the dummy in a chair, seat it upright and then rotate the dummy in the chair forward or backward about 60 degrees. The force on the accelerometer varies with the cosine of the angle it makes with respect to tangent to the earth’s surface.

With the dummy sitting upright (U) in the chair, record the z-axis accelerometer channel outputs in the appropriate column on the Polarity Check Data Sheet. Next, lean the dummy forward or backward approximately 60 degrees and record the z-axis accelerometer outputs in the column labeled “Lean Down.” It should be noted that the symbol “D” (for down) has been associated with this orientation. Again, follow the procedure outlined for the x-axis and y-axis accelerometers to complete the z-axis Polarity Check Data Sheet.

Polarity Check Data Sheet For X - Axis Accelerometers					
Dummy Type: _____		Serial No. _____		Date: _____	
Component	Channel Output (g)		Orientation of Most Positive Value (FU or FD)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Face Down (FD)	Face Up (FU)			
Head C.G.				FU	
Head C.G. Redundant NAAH*				FU	
Head Top NAAH*				FU	
Head Left NAAH*				FU	

* NAAH - Indicates Nine Accelerometer Array Head

Table G2: Polarity Check Data Sheet for X Nine Axis Accelerometers

Polarity Check Data Sheet For Y - Axis Accelerometers					
Dummy Type: _____		Serial No. _____		Date: _____	
Component	Channel Output (g)		Orientation of Most Positive Value (RSU or RSD)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Right Shoulder Down (RSD)	Right Shoulder Up (RSU)			
Head C.G.				RSU	
Head C.G. Redundant NAAH*				RSU	
Head Top NAAH*				RSU	
Head Front NAAH*				RSU	

* NAAH - Indicates Nine Accelerometer Array Head

Table G3: Polarity Check Data Sheet for Y Nine Axis Accelerometers

Polarity Check Data Sheet For Z - Axis Accelerometers					
Dummy Type: _____		Serial No. _____		Date: _____	
Component	Channel Output (g)		Orientation of Most Positive Value (U or D)	J211 Orientation for Positive Polarity	Negative Channels to be Reversed In Data Acquisition System
	Orientation				
	Upright (U)	Lean Down (D)			
Head C.G.				D	
Head C.G. Redundant NAAH*				D	
Head Left NAAH*				D	
Head Front NAAH*				D	

* NAAH - Indicates Nine Accelerometer Array Head

Table G4: Polarity Check Data Sheet for Z Nine Axis Accelerometers

4.2 HEAD ANGULAR RATE SENSORS (ARS)

To check the polarity of the head ARS, the head and chest must be moved in opposite directions to induce a measurable rotational rate.

- Moving the right ear toward the right shoulder should result in a positive ω_x .
- Moving the chin away from the sternum should result in a positive ω_y .
- Moving the chin towards the right shoulder should have a positive ω_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.

Polarity Check Data Sheet for Head Angular Rate Sensors		
Dummy Type:		Serial No.
Direction	Motion	Polarity
ω_x	Rotate right ear toward right shoulder	+ (positive)
ω_y	Rotate chin away from sternum	+ (positive)
ω_z	Rotate chin toward right shoulder	+ (positive)

Table G5: Polarity Check for Head Angular Rate Sensors

5. UPPER AND LOWER NECK LOAD CELLS

To check the polarity of the upper neck load cells, the head and chest must be moved in opposite directions to make a measurable force in the neck. See **Figure G5** below.

- Moving the head rearward and the chest forward should result in a positive F_x .
- Moving the head leftward and the chest rightward should result in a positive F_y .
- Lifting the head upward and the chest downward should result in a positive F_z .

Polarity Check Data Sheet for Upper and Lower Neck Forces		
Dummy Type:		Serial No.
Direction	Motion	Polarity
F_x	Rotate head rearward and chest forward	+ (positive)
F_y	Rotate head leftward and chest rightward	+ (positive)
F_z	Lift head upward and chest downward	+ (positive)

Table G6: Polarity Check for Upper and Lower Neck Load Cell Forces

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 .
- Moving the chin toward the left shoulder will have a positive M_z .

Polarity Check Data Sheet for Upper and Lower Neck Moments		
Dummy Type:		Serial No.
Direction	Motion	Polarity

M_x	Rotate left ear toward left shoulder	+ (positive)
M_y	Rotate chin toward sternum	+ (positive)
M_z	Rotate chin to left shoulder	+ (positive)

Table G7: Polarity Check for Upper and Lower Neck Load Cell Moments

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. Also see **Table G8** below.

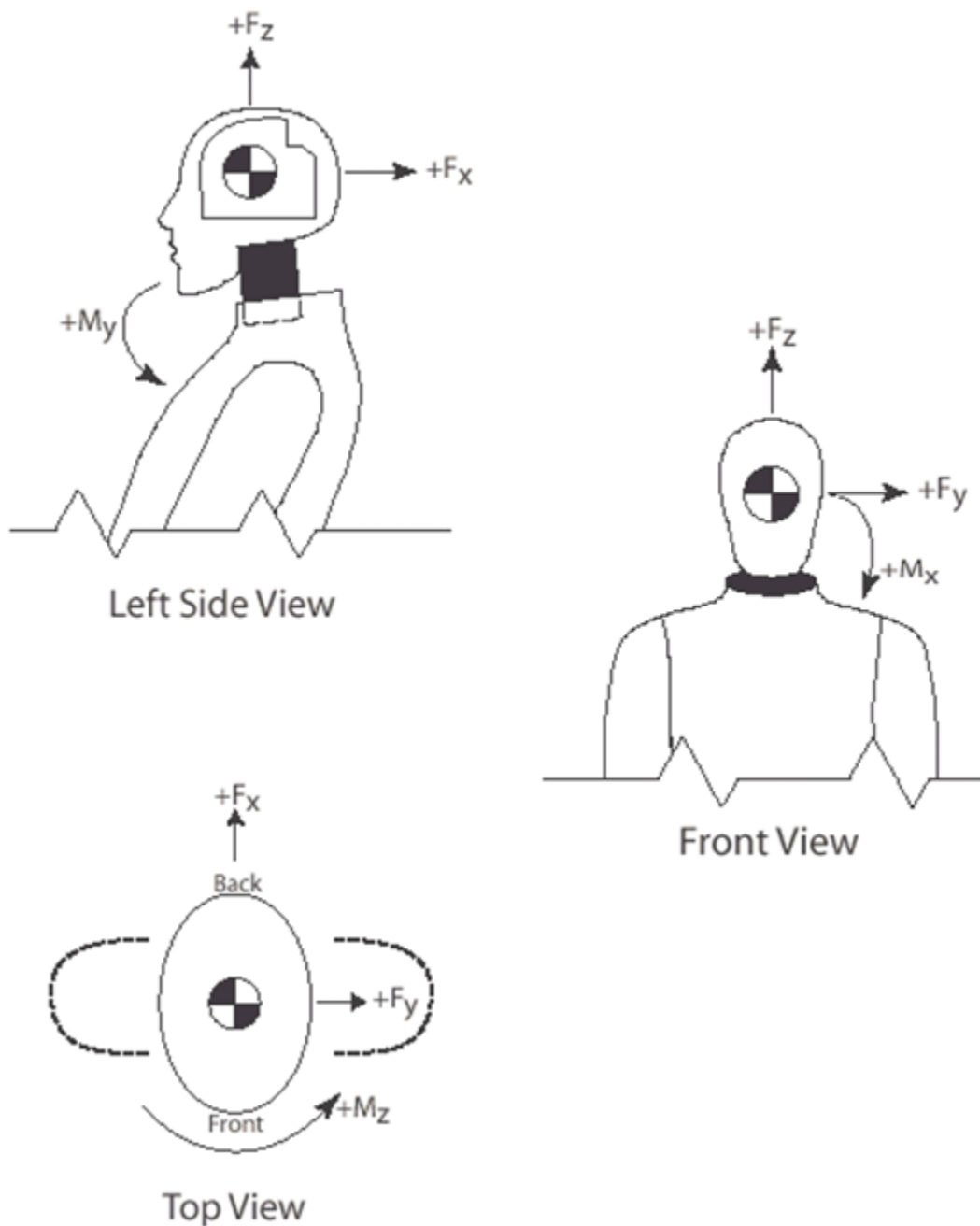


Figure G5: Dummy Upper and Lower Neck Polarity Check

Polarity Check Data Sheet For Upper and Lower Neck Load Cells									
Dummy Type: _____			Serial No. _____				Date: _____		
Load Cell	Motion	Channel Output				Negative Channels to be Reversed in Data Acquisition System			
		Upper Neck		Lower Neck		Upper Neck		Lower Neck	
		+	-	+	-	Y	N	Y	N
F _x	Head Rearward/ Chest Forward								
F _y	Head Left/ Chest Right								
F _z	Head Upward/ Chest Downward								
M _x	Left Ear to Left Shoulder								
M _y	Chin to Sternum								
M _z	Chin to Left Shoulder								

Table G8: Polarity Check Data Sheet for Upper and Lower Neck Load Cells

6. UPPER AND LOWER TIBIA LOAD CELLS

To check the polarity of the upper tibia load cell forces and moments (for each leg), the tibiae and femurs must be moved to induce measurable forces and moments.

- Moving the tibia downward and the femur upward should result in a positive F_z .
- Moving the tibia leftward while holding the knee in place should result in a positive M_x .
- Moving the tibia forward while moving the bottom of the knee clevis rearward should result in a positive M_y .

Polarity Check Data Sheet for Upper Tibia Forces and Moments		
Dummy Type: _____		Serial No. _____
Date: _____		
Direction	Motion	Polarity
F _z	Tibia downward, femur upward	+ (positive)
M _x	Tibia leftward, hold knee in place	+ (positive)
M _y	Tibia forward, bottom of knee clevis rearward	+ (positive)

Table G9: Polarity Check for Upper Tibia Load Cells

To check the polarity of the lower tibia load cell forces and moments (for each leg), the knees and ankles must be moved to induce measurable forces and moments.

- Moving the ankle downward and the knee upward should result in a positive F_z .
- Moving the ankle leftward while holding the knee in place should result in a positive M_x .
- Moving the ankle forward while moving the bottom of the knee clevis rearward should

result in a positive M_y .

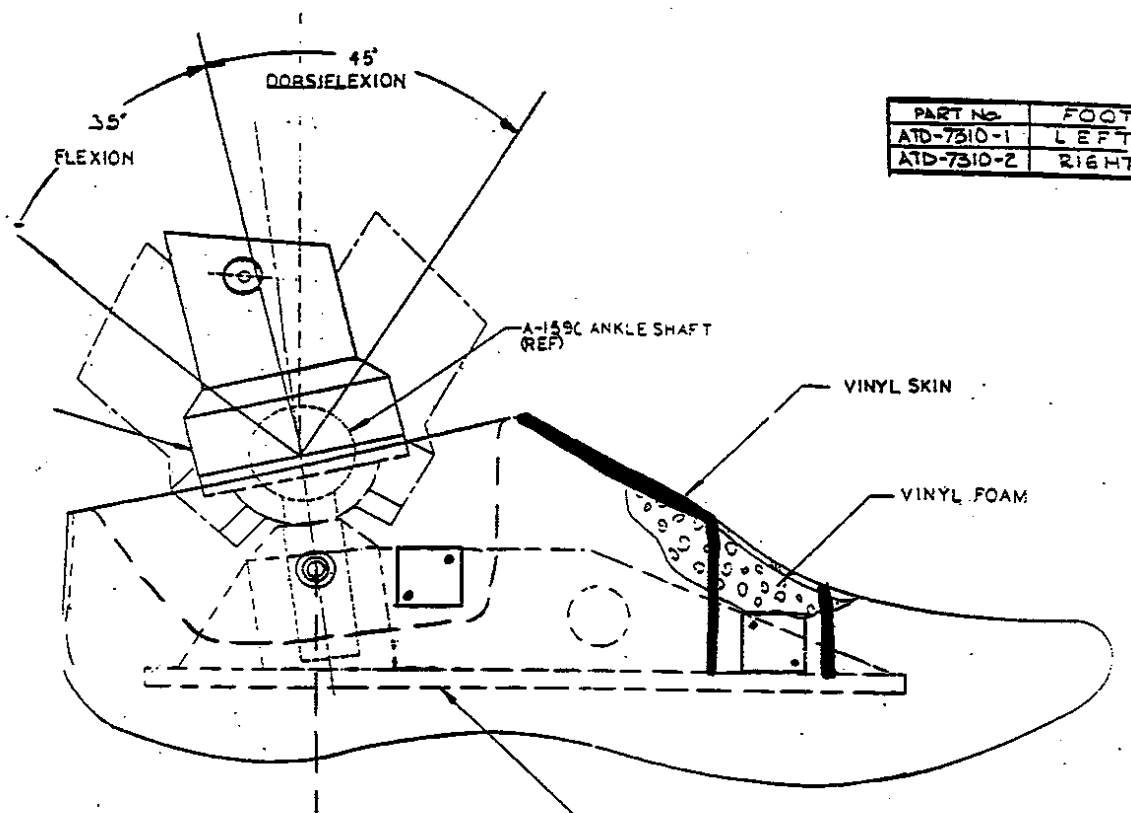
Polarity Check Data Sheet for Lower Tibia Forces and Moments		
Dummy Type:		Serial No.
Date:		
Direction	Motion	Polarity
F_z	Ankle downward, knee upward	+ (positive)
M_x	Ankle leftward, hold knee in place	+ (positive)
M_y	Ankle forward, bottom of knee clevis rearward	+ (positive)

Table G10: Polarity Check for Lower Tibia Load Cells

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.

7. FOOT ACCELEROMETERS

The Hybrid III ATD feet are instrumented to measure accelerations in the x and z directions in the outboard ankle and toe regions, as shown in the following diagrams. A tri-axial cube with SAE572-S4 accelerometers is used.



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	FORM	PART OR	CONTRACT NO.
REQD	NO.	DESCRIPTION NO.	
UNLESS OTHERWISE SPECIFIED		CONTRACT NO.	
DIMENSIONS ARE IN INCHES		DRAWING NO.	
TOLERANCES ARE:		APPROVALS	
FRACTIONS DECIMALS ANGLES		DATE	
1/16 .001 30'		DRAWN	
BY		CHECKED	
HYB III		J. SMOCKA	
PART		DATE	
TEST AND	USED ON	DO NOT SCALE DRAWING	
APPLICATION			

Figure G6

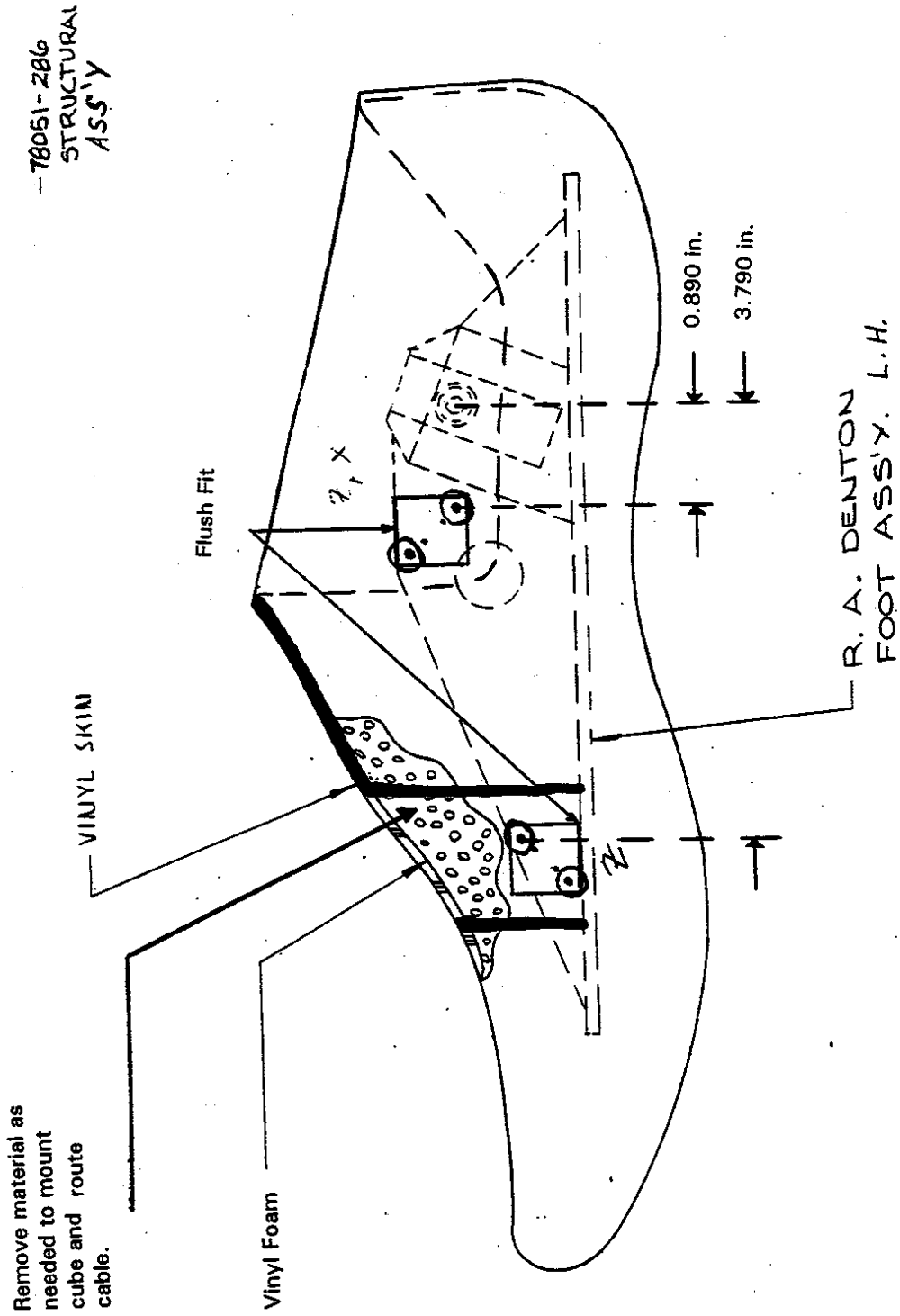
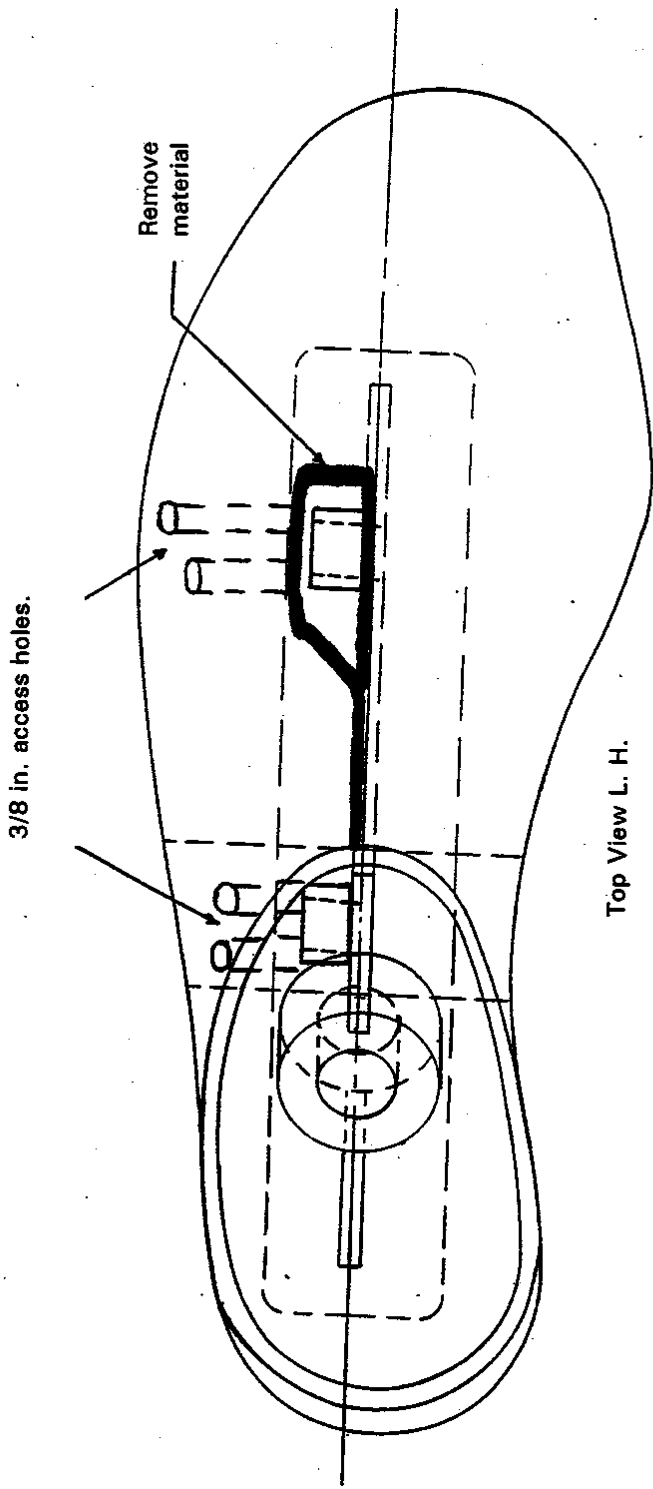


Figure G7

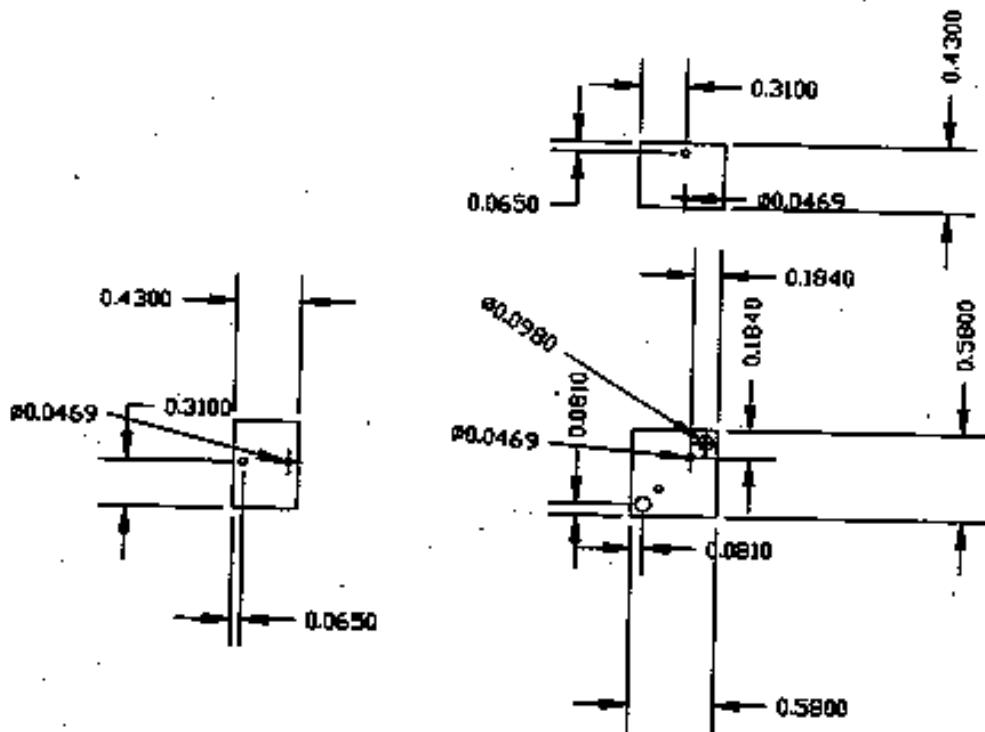
-78051-286
STRUCTURAL
ASS'Y



Accelerometer cables are routed on top of the foot and from the ankle to the lower leg.

Figure G8

Foot cube.



ALL 0.0469 HOLES ARE TAPPED FOR 0-80 SCREWS
 ALL DIMENSIONS ARE IN INCHES

Figure G9

APPENDIX H
LOAD CELL BARRIER CONFIGURATIONS

APPENDIX H LOAD CELL BARRIER CONFIGURATIONS
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2. 36 LOAD CELL BARRIER..... 2

3. HIGH RESOLUTION 176 LOAD CELL BARRIER..... 3

4. OTHER LOAD CELL BARRIERS 4

1. PURPOSE

In conjunction with NHTSA's 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 may be provided to the contractor. The Contractor may also be asked to furnish one if available. The following sections describe some typical load cell wall arrangements.

At the COR's discretion, the Contractor may be instructed to use a plain plywood barrier face rather than one of the load cell arrangements below. In these cases, a 1.5 inch thick depth of plywood (fashioned from two sheets of 3/4" plywood bonded together) should be mounted to the face of the barrier.

A Contractor-supplied load cell barrier may be allowed to deviate from the below specifications if those deviations have been previously approved by the COR.

2. 36 LOAD CELL BARRIER WALL

NHTSA may furnish, or ask that the contractor furnish, a load cell barrier wall that contains 36 load cells, 250 mm x 250 mm nominal in size, arranged in 4 rows of 9 load cells in each as shown in **Figure 1H**. The load cells are single-axis and record force in the x-direction (Fx). Each load cell shall be faced with plywood blocks that are 250 mm x 250 mm square and 1.5 in thick (fashioned from two sheets of 3/4" plywood bonded together). The gap between the load cell wall and the floor should be as close to, but **no more than**, 80 mm (3.15 in). The struck surfaces shall be flat and square.

An 18 x 83-in extension, provided by the Contractor, shall be added to the top of the load cell barrier wall as shown in **Figure 1H** to prevent vehicle hood override. The rigid steel frame shall be faced with plywood 1.5 in thick. The overall height and width of this barrier configuration should be, at a minimum, the size of the high resolution 176 load cell barrier illustrated in **Section 3** of this appendix.

The struck plywood surfaces shall be flat and square. The contractor is responsible for maintaining the plywood facing on the load cells and the extension, including the fabrication and replacement of any damaged plywood. The contractor shall replace any sections of the plywood facing at the COR's request.

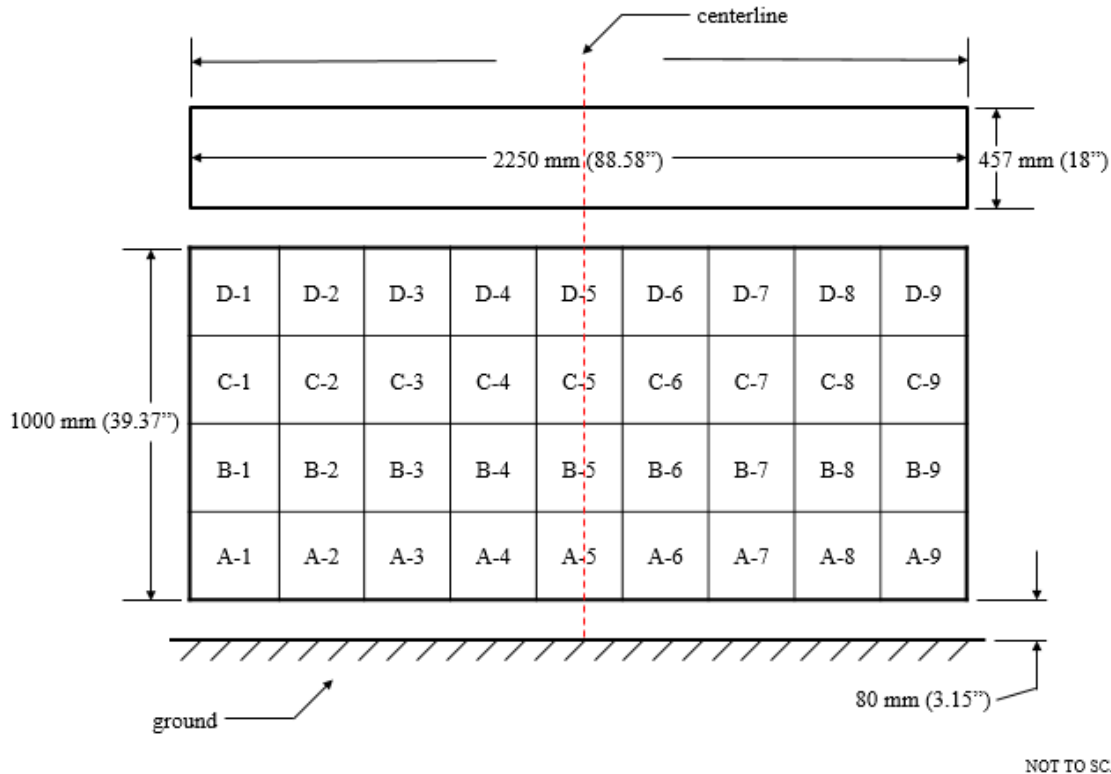


Figure 1H: Load Cell Locations on a 36-Load Cell Barrier with Plywood Height Extension

3. HIGH RESOLUTION 176 LOAD CELL BARRIER WALL

NHTSA may also furnish a load cell wall that contains 176 load cells, 125 mm x 125 mm nominal in size, arranged in 11 rows of 16 load cells in each as shown in **Figures 2H and 3H**. Each load cell shall be faced with plywood blocks that are 125 mm x 125 mm square and 1.5 in thick (fashioned from two sheets of 3/4" plywood bonded together).

The load cells are multi-axis and record force in the x-direction (F_x) as well as moments about the y-axis and z-axis (M_y and M_z , respectively). The Contractor may be directed by the COR to collect data from this load cell wall in the following ways:

1. F_x , M_y , and M_z on all rows; up to 528 channels total
2. F_x on all rows, M_y and M_z on rows G-J; up to 304 channels total
3. F_x only; up to 176 channels total

The nominal size of the load cell barrier wall with plywood facing should be 2000 mm wide by 1375 mm tall. The gap between the load cell wall and the floor should be as close to, but **no more than**, 80 mm (3.15 in).

The struck plywood surfaces shall be flat and square. The contractor is responsible for maintaining the plywood facing on the load cells, including the fabrication and replacement of any damaged plywood. The contractor shall replace any sections of the plywood facing at the COR's request.

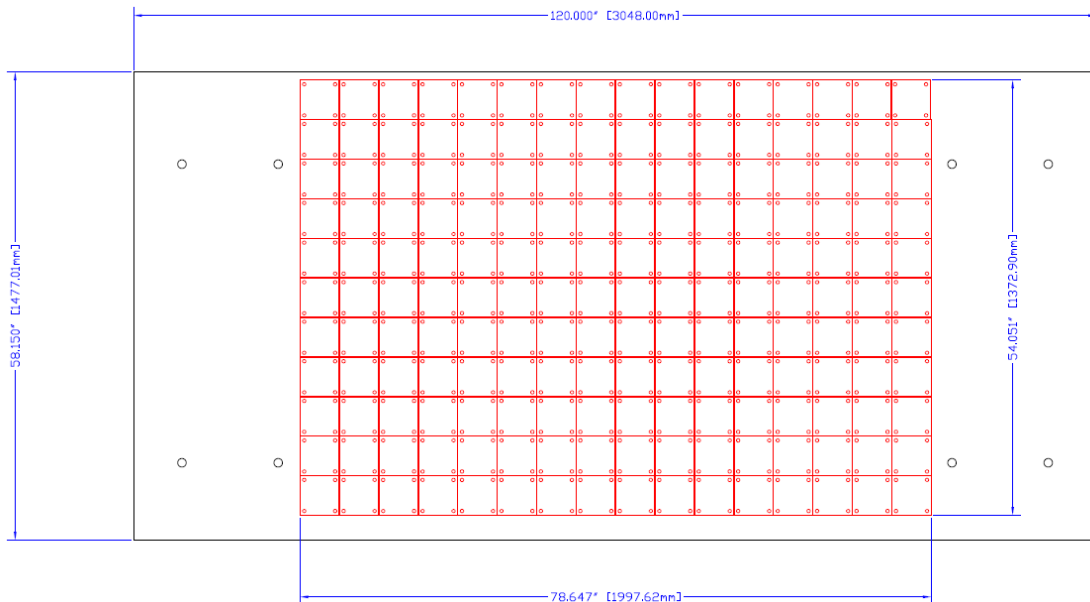


Figure 2H: Dimensions of a 176-Load Cell High Resolution Barrier Mounting Structure

Centerline															
A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Figure 3H: High Resolution 176 Load Cell Barrier Mounting Locations

4. OTHER LOAD CELL BARRIER WALLS

At the COR's request, any Contractor-owned load cell barrier wall for full frontal NCAP testing may be installed. The load cell barrier wall must be, at a minimum, the height and width of the impact face of the high resolution 176 load cell barrier presented in **Section 3** of this appendix. The COR may request a schematic of a laboratory's load cell barrier wall prior to allowing its use in NCAP testing.

APPENDIX I
TEST DELIVERABLES AND REPORT GUIDELINES

APPENDIX I TEST DELIVERABLES AND 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 no later than the 15th day of each month following the month being reported on. The form can be found in **Section 3, Forms**, in this appendix. The report shall be submitted until all vehicles or items of equipment are disposed of.

1.2. APPARENT TEST FAILURE

An apparent test failure, as described by **Section 13** of the main test procedure, shall be communicated by telephone to the COTR within 24 hours with written notification emailed within 48 hours (Saturday and Sundays excluded). A Laboratory Notice of Test Failure (located in **Section 3, Forms**, of this appendix) with a copy of related 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, air bag deployment, and evidence of FMVSS No. 208, FMVSS No. 212, FMVSS No. 219, FMVSS No. 301, and FMVSS No. 305 (if applicable) performance, and should include relevant data traces. Also, anything interesting or out of the ordinary should be included in the Quicklook Report comments section. A sample Quicklook Report is included as **Form 5** in **Section 4** of this appendix.

B. DATA TAPE

Within three (3) working days of the test, the Contractor shall email or upload to the FTP site the test data formatted using NHTSA's software and test data formatting guidelines.

The software may be found in the Downloads area at <https://www.nhtsa.gov/databases-and-software/entree-windows>. Select the latest version of the program to download and use.

The formatting guide may also be found at <https://www.nhtsa.gov/databases-and-software/entree-windows> under NHTSA Test Reference Guides. The latest revision to Volume I: Vehicle Tests should be used.

Any questions pertaining to this software should be directed to NCAP COR or to the following technical support department:

U.S. Dept. of Transportation
NHTSA/NVS-300
W46-318
1200 New Jersey Ave SE
Washington, DC 20590

C. QUALITY CONTROL PACKAGE

The Quality Control Package is a .zip file that includes all the information necessary for NHTSA’s quality control review. It serves as a summary of the test and includes, organized by folders labelled appropriately:

- the test data (data tape)
 - per **Section 1.3, A** of this appendix
- photographs,
 - labeled in order per **Section 2.3** of this appendix
 - “Impact for the web” photo – 710 x 410 pixels, landscape orientation
- videos
 - high speed videos per **Section 9.1** of the main frontal test procedure
 - real-time videos per **Section 9.1** of the main frontal test procedure
 - documentation video per **Sections 9.7** and **9.8** of the main frontal test procedure
- pre- and post-test dummy qualification data
 - per guidelines in appropriate appendices
- Report of Vehicle Condition
 - **Form 2** of this appendix
- a copy of the Quicklook Report previously e-mailed to the OCWS
 - per **Section 1.3, A** of this appendix

The Quality Control Package should be uploaded to the FTP site within five (5) business days of the test for review by the OCWS. Providing this data in a timely manner will ensure that the Contractor and the COR will be able to discuss the details of both test conduct and report content soon after the test is conducted. The filename for the Quality Control Package should be formatted as follows:

<NHTSANO><Model Year><Make & Model><Body><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 78 in the Frontal NCAP photo list found in **Section 3** of this appendix. The photo should be labeled as follows:

<Model Year><Make><Model>Frontal Impact Event for web.jpg

It should also be 710 pixels wide by 410 pixels tall, landscape (horizontal) orientation, and of a high image quality.

Camera No. 1, the Real-Time Left Overall Camera, as described in **Section 9** of the main procedure, should be provided in .wmv format so it may serve as a web-ready video of the impact event in.

D. PRELIMINARY (DRAFT) TEST REPORT

Contractors are required to submit to the OCWS via e-mail a Draft Test Report, an electronic copy in .pdf or .doc form, within two calendar weeks of the test. If the electronic file is larger than 20 MB, the Contractor should upload the file to the FTP site instead.

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

The Contractor should use detailed descriptions of all test events. Any events that are associated with the pass/fail of indicant FMVSS No. 208, FMVSS No. 212, FMVSS No. 219, or FMVSS No. 301 testing, or that are of technical interest should also be included. Events associated with the pass/fail of indicant FMVSS No. 305 testing (if applicable) should also be included.

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

E. FINAL TEST REPORT AND DELIVERABLES

The Final Test Report and associated documentation, including test data, properly labeled and numbered photographs and videos (including documentation, high-speed, real-time, and those for the web), are relied upon as the chronicle of the NCAP test. Each Final Test Report should also be a complete document capable of standing by itself.

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

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

The Contractor shall upload the Final Test Report and final versions of the associated test data, photos, and videos as a .zip file to the FTP site within two (2) weeks of receiving data tape and Draft Test Report corrections from the OCWS. The format for its filename should be as follows:

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

The following is a summary of all NCAP test deliverable requirements:

Crash Test Deliverable	Section of Appendix	File Format & Naming Convention	Time Requirement	Submit Via	Submit To
Quicklook Report	1.3, B	.pdf with filename format: <NHTSANO> <ModelYear> <Make&Model> <Body> <NCAP/> Quicklook.pdf	One (1) day from test	Email	OCWS
Data Tape	1.3, C	.zip with filename format: <NHTSANO> <Model Year> <Make & Model> <Body> <NCAP> Datatape.zip	Three (3) business days from test	Email/ FTP depending on size	OCWS
Quality Control Package	1.3, D	.zip with filename format: <NHTSANO> <Model Year> <Make & Model> <Body> <NCAP> QCPackage.zip	Five (5) business days from test	FTP	FTP
Preliminary (Draft) Test Report	1.3, E	.pdf with filename format: <NHTSANO> <ModelYear> <Make&Model> <Body> <NCAP> DraftReport.pdf	Two (2) weeks from test date	Email/ FTP depending on size	OCWS/ FTP
Final Test Report and Deliverables	1.3, F	.zip with filename format: <NHTSANO> <Model Year> <Make & Model> <Body> <NCAP > FinalDeliverables.zip	Two (2) weeks after receiving corrections to preliminary test report.	FTP	FTP

F. 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 COR. For these reasons, each Final Test Report must be a complete document capable of standing by itself.

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

G. 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 - -

NCAP	is the test
ABC	are the initials for the laboratory
XX	are the last two digits of the fiscal year of the test program
001	is the test number for that fiscal year (001 for the 1st test conducted in the fiscal year, 002 for the 2nd test, 003 for 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 COR shall be provided as follows:

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NCAP-ABC-XX-001

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Final Report of NEW CAR ASSESSMENT PROGRAM Testing
of a 20XX World XYZ Deluxe 4-door sedan
NHTSA No. MX20XXXXXX

Block No. 5 - REPORT DATE

March 1, 20XX

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ABC

Block No. 7 - AUTHOR(S)

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ABC-DOT-XXX-001

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Block No. 10 - WORK UNIT NUMBER

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Final Test Report
Feb. 15 to Mar. 15, 20XX

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NVS-111

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A 56.3 km/h NCAP frontal rigid barrier impact test was conducted on a 20XX XYZ Deluxe 4-door sedan in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. This test was conducted to obtain data related to FMVSS Nos. 208, 212, 219 (partial), 301, and 305 performance. The test was conducted at the ABC Laboratories facility in Detroit, Michigan, on November 15, 20XX.

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			Passenger ATD		
	Units	Threshold	Result	Units	Threshold	Result
Head Injury Criteria (HIC ₁₅)	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

56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test
New Car Assessment Program (NCAP)

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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 Indicant FMVSS No. 212 and FMVSS No. 219 (Partial) Data	X
16	FMVSS 301 Barrier Impact and Static Rollover Results	X
17	Dummy/Vehicle Temperature Stabilization Chart	X
305-1	General Test and Vehicle Parameter Data for Indicant FMVSS No. 305 Testing	X
305-2	Pre-Impact Data for Indicant FMVSS No. 305 Testing	X
305-3	Pre-Impact Electrical Isolation Measurements and Calculations for Indicant FMSS No. 305 Testing	X
305-4	Post-Impact Data for Indicant FMVSS No. 305 Testing	X
305-5	Static Rollover Test Data for Indicant FMVSS No. 305 Testing	X
Appendix		
A		Page No.
A	Photographs	AX
B	Dummy Response Data Traces	BX
C	Dummy Qualification and Performance Verification Data	CX

2.1. 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 language 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 Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

SUMMARY

A load cell barrier consisting of # 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 position and one Part 572O 5th percentile female ATD was placed in the right-front passenger position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

2.2. 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 under the above “SAMPLE TEST REPORT LAYOUT.” Any additional inclusions **MUST** be placed **after** the required sheets.

2.3. REPORT AREA 3: PHOTOGRAPHIC DOCUMENTATION (TEST REPORT APPENDIX A)

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. In cases where it may be unreasonable to include this long form placard, an indication of NHTSA number should suffice. A time/date stamp on each photo is also highly recommended.

The following photographs should be included with the Quality Control Package and 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 indicant FMVSS 305 testing, subsequent photos should be lettered and labeled appropriately.

Additional photographs which further describe what is visible in Photograph Nos. 1 – 79 should be labeled with the most relevant photograph number followed by a, b, c, etc.

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)

Any additional photographs taken for documentation of vehicle anomalies, safety concerns, test details, etc. which **do not** fit under the photograph descriptions above should be appropriately labeled and shall follow the list of preceding required photographs in numerical order.

- No. 01 Load Cell Location (*photograph of vehicle behind mock load cell wall*)
- No. 02 Pre-Test Load Cell Wall
- No. 03 Post-Test Load Cell Wall
- No. 04 Manufacturer's Label (*photograph of certification label, ensure that all text can be seen clearly without glare or blurring*)
- No. 05 Tire Placard (*photograph of tire placard, ensure that all text can be seen clearly without glare or blurring, include a photograph of the reduced load carrying capacity as No. 005a, if applicable*)
- No. 06 <Model Year><Make><Model> Frontal As Delivered
- No. 07 Left Rear 3-4 View, as Received
- No. 08 Pre-Test Front View of Test Vehicle

- No. 09 Post-Test Front View of Test Vehicle
- No. 010 Pre-Test Left View of Test Vehicle (*taken with vehicle at barrier*)
- No. 011 Post-Test Left View of Test Vehicle (*taken without moving vehicle post-test*)
- No. 012 Pre-Test Right View of Test Vehicle
- No. 013 Post-Test Right View of Test Vehicle
- No. 014 Pre-Test Right Front 3-4 View
- No. 015 Post-Test Right Front 3-4 View
- No. 016 Pre-Test Left Rear 3-4 View (*taken with vehicle at barrier*)
- No. 017 Post-Test Left Rear 3-4 View (*taken without moving vehicle post-test*)
- No. 018 Pre-Test Windshield View (*looking through windshield at dummies*)
- No. 019 Post-Test Windshield View (*looking through windshield at dummies*)
- No. 020 Pre-Test Engine Compartment View
- No. 021 Post-Test Engine Compartment View
- No. 022 Pre-Test Fuel Filler Cap View
- No. 023 Post-Test Fuel Filler Cap View
- No. 024 Pre-Test Front Underbody View¹
- No. 025 Post-Test Front Underbody View¹
- No. 026 Pre-Test Rear Underbody View¹
- No. 027 Post-Test Rear Underbody View¹
- No. 028 Pre-Test Dummy Cable Routing
- No. 029 Post-Test Dummy Cable Routing
- No. 030 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. 031 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. 032 Pre-Test Driver Dummy Window View (*taken through the left window with the camera perpendicular to the longitudinal centerline of the vehicle*)
- No. 033 Post-Test Driver Dummy Window View (*taken through the left window with the camera perpendicular to the longitudinal centerline of the vehicle*)

- No. 034 Pre-Test Driver Dummy and Vehicle Interior View (*taken with the door open*)
- No. 035 Post-Test Driver Dummy and Vehicle Interior View (*taken with the door open*)
- No. 036 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. 037 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. 038 Pre-Test View of Belt Anchorage for Driver Dummy (*show the position of the upper belt anchorage; detent or millimeter markings should be shown and labeled, if applicable*)
- No. 039 Post-Test View of Belt Anchorage for Driver Dummy (*show the position of the upper belt anchorage; detent or millimeter markings should be shown and labeled, if applicable*)
- No. 040 Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy (*show the seat belt buckle and latch plate in its buckled condition prior to test*)
- No. 041 Post-Test View of Belt Buckle and Latch Plate for Driver Dummy (*show the seat belt buckle and latch plate in their post-test condition*)
- No. 042 Pre-Test Driver Dummy Feet (*taken with the door open*)
- No. 043 Post-Test Driver Dummy Feet (*taken with the door open*)
- No. 044 Pre-Test Driver's Side Knee Bolster (*without dummy present*)
- No. 045 Post-Test Driver's Side Knee Bolster (*without dummy present, show driver knee contact if it occurred*)
- No. 046 Pre-Test Driver's Side Floorpan
- No. 047 Post-Test Driver's Side Floorpan
- No. 048 Post-Test Driver Dummy Face
- No. 049 Post-Test Driver Dummy Contact with Air bag
- No. 050 Post-Test Driver Dummy Contact with Headrest
- No. 051 Pre-Test View of the Steering Wheel (*do NOT disassemble any parts to take this photograph, take perpendicular to the longitudinal centerline of the vehicle*)
- No. 052 Post-Test View of the Steering Wheel (*do NOT disassemble any parts to take this photograph, take perpendicular to the longitudinal centerline of the vehicle*)
- No. 053 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. 054 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. 055 Pre-Test Passenger Dummy Window View (*taken through the right window with the camera perpendicular to the longitudinal centerline of the vehicle)*
- No. 056 Post-Test Passenger Dummy Window View (*taken through the right window with the camera perpendicular to the longitudinal centerline of the vehicle)*
- No. 057 Pre-Test Passenger Dummy and Vehicle Interior View (*taken with the door open)*
- No. 058 Post-Test Passenger Dummy and Vehicle Interior View (*taken with the door open)*
- No. 059 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. 060 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. 061 Pre-Test View of Belt Anchorage for Passenger Dummy (*show the position of the upper belt anchorage; detent or millimeter markings should be shown and labeled, if applicable)*
- No. 062 Post-Test View of Belt Anchorage for Passenger Dummy (*show the position of the upper belt anchorage; detent or millimeter markings should be shown and labeled, if applicable)*
- No. 063 Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy (*show the seat belt buckle and latch plate in its buckled condition prior to test)*
- No. 064 Pre-Test View of Belt Buckle and Latch for Passenger Dummy (*show the seat belt buckle and latch plate in their post-test condition)*
- No. 065 Pre-Test Passenger Dummy Feet (*taken with the door open)*
- No. 066 Post-Test Passenger Dummy Feet (*taken with the door open)*
- No. 067 Pre-Test Passenger's Side Knee Bolster (*glove compartment without dummy present)*
- No. 068 Post-Test Passenger's Side Knee Bolster (*glove compartment without dummy*

present, show passenger knee contact if occurred)

- No. 069 Pre-Test Passenger's Side Floorpan
- No. 070 Post-Test Passenger's Side Floorpan
- No. 071 Post-Test Passenger Dummy Face
- No. 072 Post-Test Passenger Dummy Contact with Air bag
- No. 073 Post-Test Passenger Dummy Contact with Headrest
- No. 074 Photograph of Ballast Installed in Vehicle
- No. 075 Post-Test Stoddard Solvent Spillage Location View, if Required
- No. 076 Post-Test Speed Trap Read-out
- No. 077 Vehicle at 0° on Static Rollover Device
- No. 078 Vehicle at 90° on Static Rollover Device
- No. 079 Vehicle at 180° on Static Rollover Device
- No. 080 Vehicle at 270° on Static Rollover Device
- No. 081 Vehicle at 360° on Static Rollover Device
- No. 082 <Model Year><Make><Model> Frontal Impact Event
- No. 083 Monroney Label Photograph

If an indicant FMVSS No. 305 test is also conducted, the following additional photographs should also be included with the Quality Control Package. The static rollover photos only need to be included if no FMVSS No. 301 static rollover is conducted:

- No. 305-01 Auxiliary Power Module Warning Label
- No. 305-02 Power Inverter Warning Label
- No. 305-03 First Responder Warning Label
- No. 305-04 First Responder Warning Location
- No. 305-05 Other Vehicle Label(s) Related to Electrical Propulsion System
- No. 305-06 Manual High Voltage Service Disconnect in Place
- No. 305-07 Manual High Voltage Service Disconnect Removed (*show plug*)
- No. 305-08 Manual High Voltage Service Disconnect Removed (*show location where removed*)
- No. 305-09 Pre-Impact View of Propulsion Battery (*if any part of it is visible; do NOT disassemble any parts other than carpet, seats, and other interior pieces to*

- take these photographs unless instructed to do so by the COR)*
- No. 305-010 Post-Impact Front View of Propulsion Battery (*if any part of it is visible; do NOT disassemble any parts other than carpet, seats, and other interior pieces to take these photographs unless instructed to do so by the COR)*
- No. 305-011 Post-Impact Rear View of Propulsion Battery (*if any part of it is visible; do NOT disassemble any parts other than carpet, seats, and other interior pieces to take these photographs unless instructed to do so by the COR)*
- No. 305-012 Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules (*disassembly and removal of parts may be necessary to take these photographs; do not disassemble without prior approval from COR)*
- No. 305-013 Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules (*disassembly and removal of parts may be necessary to take these photographs; do not disassemble without prior approval from COR)*
- No. 305-014 Pre-Impact View of Propulsion Battery Module(s)
- No. 305-015 Post-Impact View of Propulsion Battery Module(s)
- No. 305-016 Pre-Impact View of Electric Propulsion Drive (*take the best photograph possible without removing any parts; use mirrors to view any hidden components where possible)*
- No. 305-017 Post-Impact View of Electric Propulsion Drive (*take best photograph possible without removing any parts; use mirrors to view any hidden components where possible)*
- No. 305-018 Pre-Impact View of High Voltage Interconnect(s)
- No. 305-019 Pre-Impact View Propulsion Battery Venting System(s)
- No. 305-020 Pre-Impact View of Other Visible Electric Propulsion Components
- No. 305-021 Pre-Impact View of Ground Lead Attached
- No. 305-022 Pre-Impact View of High Voltage Leads Attached
- No. 305-023 Pre-Impact Close-Up View of High Voltage Leads Attached
- No. 305-024 Pre-Impact View of Installed Test Interface Port
- No. 305-025 Post-Impact View of Installed Test Interface Port
- No. 305-026 Pre-Impact View of Other Test Devices
- No. 305-027 Post-Impact View of Other Test Devices

- No. 305-028 FMVSS No. 305 Static Rollover at 90°
- No. 305-029 FMVSS No. 305 Static Rollover at 180°
- No. 305-030 FMVSS No. 305 Static Rollover at 270°
- No. 305-031 FMVSS No. 305 Static Rollover at 360°
- No. 305-032 Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery (*show any vehicle areas where intrusion/spillage may occur*)
- No. 305-033 Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery (*show any vehicle areas where intrusion/spillage may have occurred*)
- No. 305-034 Post-Impact Propulsion Battery System Mounting and/or Intrusion Failure(s) (*if applicable*)
- No. 305-035 Post-Impact View of Battery Component Intrusion (*if applicable; disassembly and removal of parts may be necessary to take these photographs. Do NOT disassemble without prior approval from COR*)
- No. 305-036 Post-Impact View of Battery Module Movement or Retention Loss (*if applicable; paint or other highly visible finish, such as machinist blue, should be applied to all attachment fasteners or means (welds) pre-test to indicate component movement or retention loss*)
- No. 305-037 Post-Impact View of Propulsion Battery Electrolyte Spillage Location (*if applicable; should be taken prior to static rollover*)
- No. 305-038 Post-Test View of Propulsion Battery Electrolyte Spillage Location (*if applicable; should be taken after static rollover*)

¹**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 conventions and filenames shown above must be maintained. They are deliberate and intended to keep the photos in a specific order when sorting photos electronically.**

2.4. REPORT AREA 4: DUMMY RESPONSE DATA TRACES (TEST REPORT APPENDIX B)

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

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
Driver Head Angular Velocity X
Driver Head Angular Velocity Y
Driver Head Angular Velocity Z
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
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
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 Forces and Moments

2.5. REPORT AREA 5: DUMMY QUALIFICATION AND PERFORMANCE VERIFICATION (TEST REPORT APPENDIX C)

Data sheets from **Appendices** to this procedure, **Appendix A** (Part 572E (50th Male) Dummy Performance Qualification Test Procedure) and **Appendix B** (Part 572O (5th Female) Dummy Performance Qualification Test Procedure) shall be used to document dummy qualification as Appendix C of the Final Test Report. A copy of Appendix C should also be uploaded to the FTP site along with the Quality Control Package.

2.6. REPORT AREA 6: TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION (TEST REPORT APPENDIX D)

A list of test equipment and instrumentation used during the event, along with calibration data, should be provided as Appendix D of each vehicle Final Test Report. Appendix D should identify all test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test. Calibration dates for each should be provided as indicated in the sample tables below. Comments should also be included, if appropriate.

TABLE 1 – Driver Dummy Instrumentation

Instrumentation		Axis/ Location	Hybrid III 50th S/N		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Head Angular Rate Sensors		X			
		Y			
		Z			
Upper Neck Load Cell		FX, FY, FZ, MX, MY, MZ			
Chest Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Chest Potentiometer		X			
Pelvis Accelerometers		X			
		Y			
		Z			
Femur Load Cells	Left	Primary	Z		
		Redundant	Z		
	Right	Primary	Z		
		Redundant	Z		
Tibia Load Cells	Left	Upper	MX, MY, FZ		
		Lower	MX, MY, FZ		
	Right	Upper	MX, MY, FZ		

		Lower	MX, MY, FZ			
Foot Accelerometers	Left	Rear	X			
			Z			
	Front	Z				
	Right	Rear	X			
			Z			
	Front	Z				
Seat Belt Load Cells		Lap	N/A			
		Shoulder	N/A			

TABLE 2 – Front Passenger Dummy Instrumentation

Instrumentation		Axis/ Location	Hybrid III 5th S/N		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Head Angular Rate Sensors		X			
		Y			
		Z			
Upper Neck Load Cell		FX, FY, FZ, MX, MY, MZ			
Chest Accelerometers	Primary	X			
		Y			
		Z			
	Redundant	X			
		Y			
		Z			
Chest Potentiometer		X			
Pelvis Accelerometers		X			
		Y			
		Z			
Femur Load Cells	Left	Primary	Z		
		Redundant	Z		
	Right	Primary	Z		
		Redundant	Z		
Tibia Load Cells	Left	Upper	MX, MY, FZ		
		Lower	MX, MY, FZ		
	Right	Upper	MX, MY, FZ		
		Lower	MX, MY, FZ		
Foot Accelerometers	Left	Rear	X		
			Z		
	Front	Z			
	Right	Rear	X		
			Z		
	Front	Z			
Seat Belt Load Cells		Lap	N/A		
		Shoulder	N/A		

TABLE 3 – Vehicle Instrumentation

Instrumentation			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember/Rear Seat Accelerometers	Left	Primary	X			
			Z			
	Right	Primary	X			
			Z			
		Redundant	X			
			X			
Engine Accelerometers	Top		X			
	Bottom		X			

3. DATA SHEETS

Data sheets are provided as tools to document test data in the final test report format as outlined in **Section 2** of this appendix. 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 should 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

NHTSA No.		Traction Control System (TCS)	
Model Year		Power Steering	
Make		Power Window Auto-Reverse	
Model		Driver Frontal Air bag	
Body Style		Driver Curtain Air bag	
VIN		Driver Head/Torso Air bag	
Body Color		Driver Torso Air bag	
Odometer Reading (km/mi)		Driver Torso/Pelvis Air bag	
Engine Displacement (L)		Driver Pelvis Air bag	
Type/No. Cylinders		Driver Knee Air bag	
Engine Placement		Front Pass. Frontal Air bag	
Transmission Type		Front Pass. Curtain Air bag	
Transmission Speeds		Front Pass. Head/Torso Air bag	
Overdrive		Front Pass. Torso Air bag	
Final Drive		Front Pass. Torso/Pelvis Air bag	
Roof Rack		Front Pass. Pelvis Air bag	
Sunroof/T-Top		Front Pass. Knee Air bag	
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)	

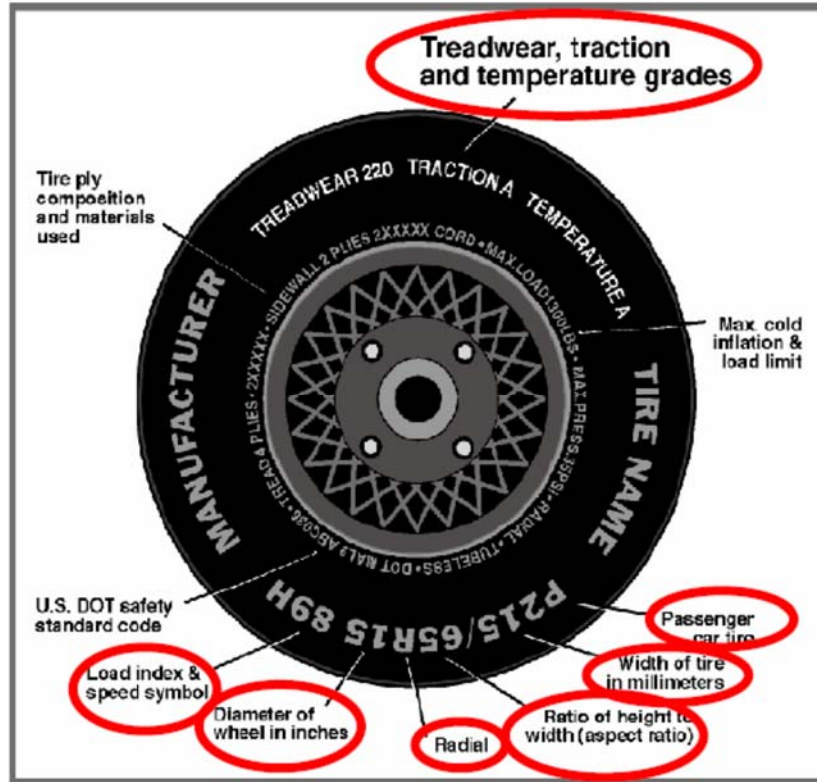
VEHICLE SEATING AND WEIGHT CAPACITY

Measured Parameter	Front	Rear	Third	Total
Type of Seats				
Number of Occupants				
Capacity Wt. (VCW) (kg)				
Cargo Wt. (RCLW) (kg)				

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)

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 - GENERAL TEST AND VEHICLE PARAMETER DATA
(CONT'D)**

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 - GENERAL TEST AND VEHICLE PARAMETER DATA
(CONT'D)**

Test Vehicle: _____

NHTSA No.: _____

Test Program: _____

Test Date: _____

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
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	

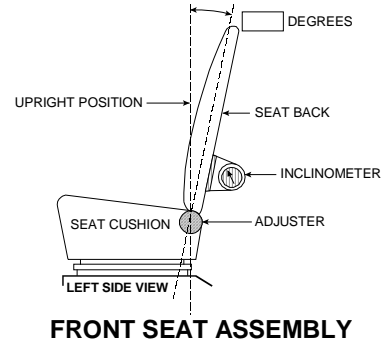
DATA SHEET NO. 2 - SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

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

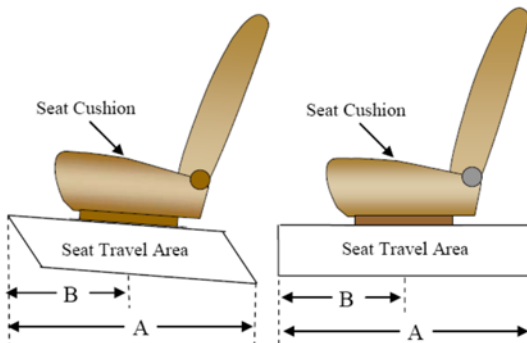
Describe the method used of determining seat fore/aft positions. _____

	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 - SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA (CONT'D)

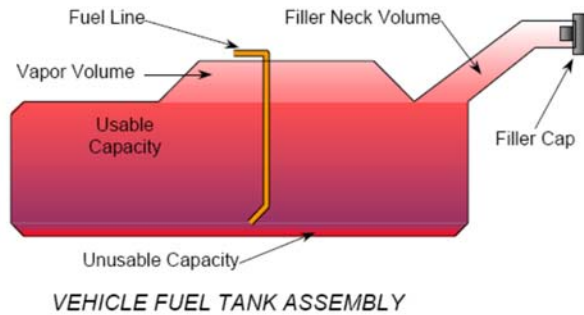
Test Vehicle: _____
 Test Program: _____

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	

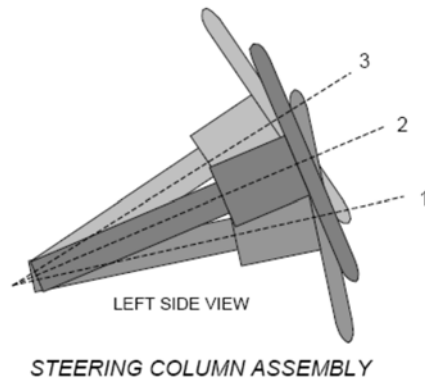
Describe the fuel system - what type of fuel pump, details about how it operates, etc.



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 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		

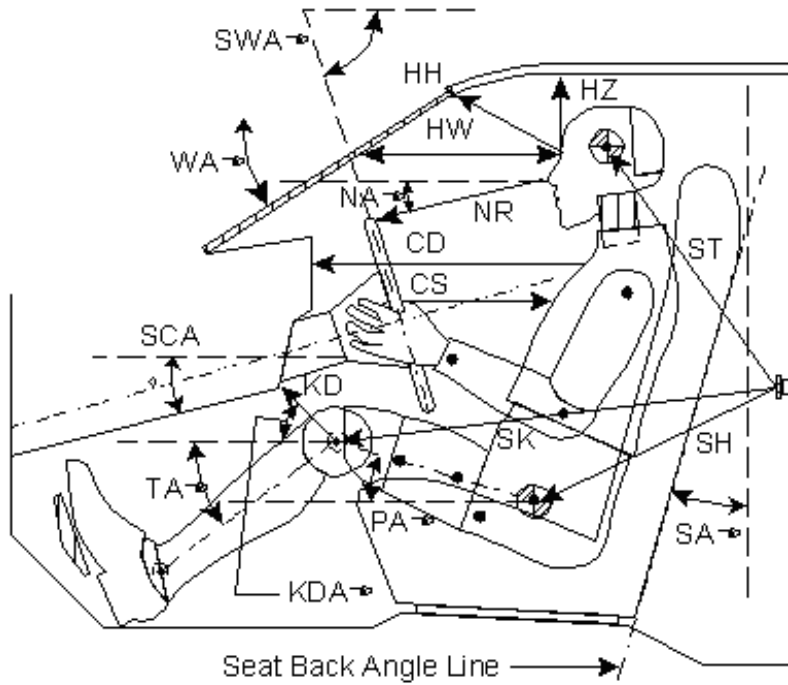
DATA SHEET NO. 3 - DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

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				

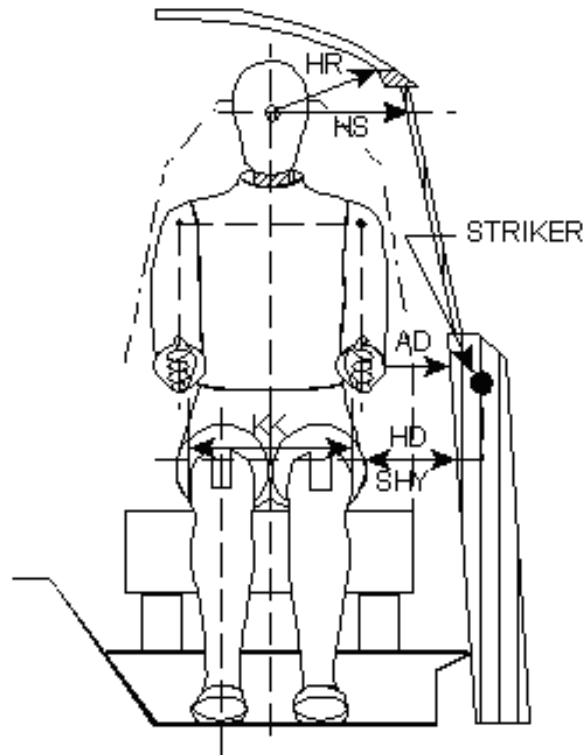
DATA SHEET NO. 4 - DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: _____

NHTSA No.: _____

Test Program: _____

Test Date: _____

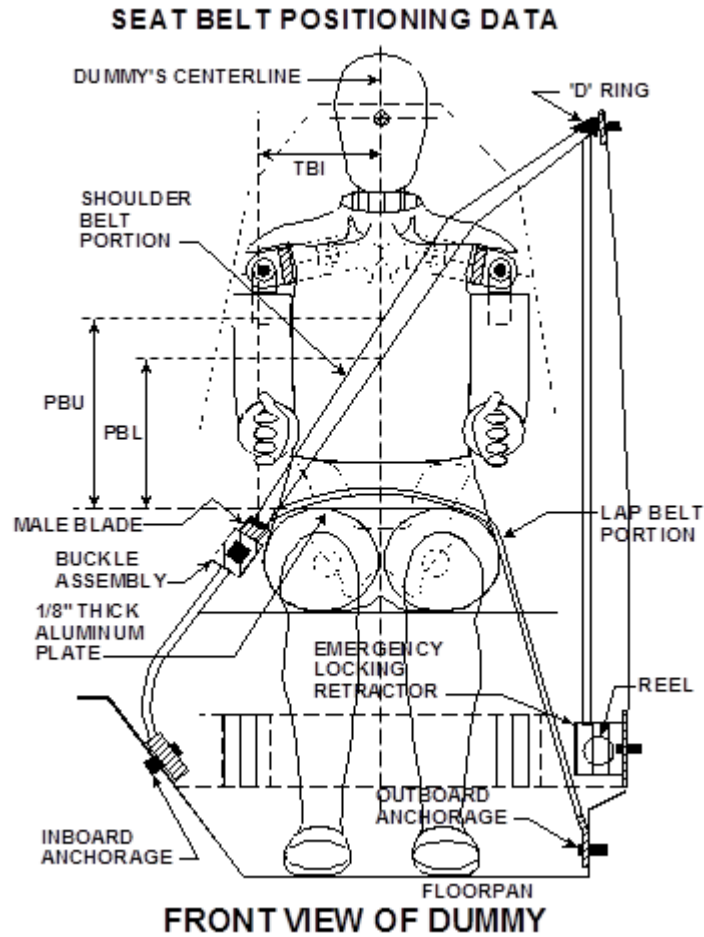


Code	Description	Driver	Passenger
AD	Arm to Door		
HD	H-Point to Door		
HR	Head to Side Header		
HS	Head to Side Window		
KK	Knee to Knee		
SHY	Striker to H-Point (Y Direction)		
AA	Ankle to Ankle		

DATA SHEET NO. 5 - SEAT BELT POSITIONING DATA

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU — Top surface of reference to belt upper edge	mm		
PBL — 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

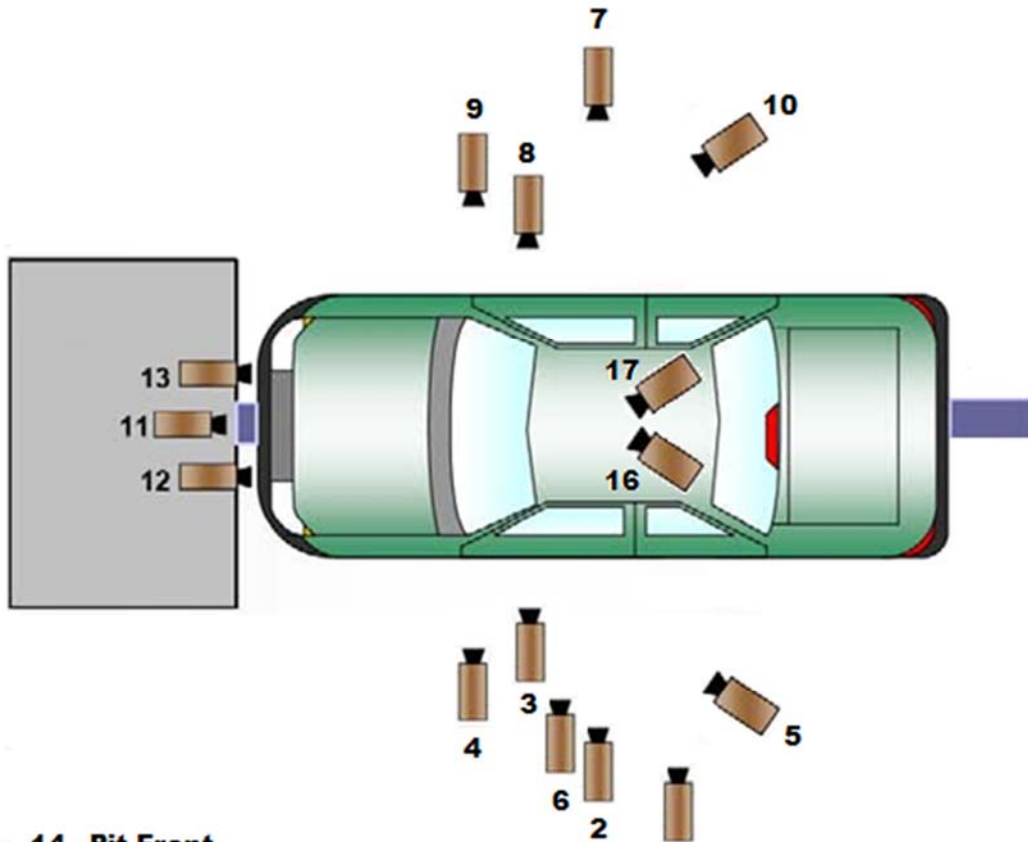
Test Vehicle: _____

NHTSA No.: _____

Test Program: _____

Test Date: _____

CAMERA POSITIONS FOR FRONTAL IMPACTS



14 - Pit Front

15 - Pit Rear

16 & 17 - Driver and Passenger Onboard

1- Real Time Camera

***Camera locations are approximate and not to scale*

DATA SHEET NO. 6 - HIGH-SPEED CAMERA LOCATIONS AND DATA (CONT'D)

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	Left Overall					
3	Driver Close-Up					
4	Left Front Half					
5	Left Angle					
6	Steering Column)					
7	Right Overall					
8	Passenger Close-Up					
9	Right Front Half					
10	Right Angle					
11	Windshield					
12	Driver Windshield					
13	Passenger Windshield					
14	Pit Front					
15	Pit Rear					
16	Driver Onboard					
17	Passenger Onboard					

* COORDINATES:

+X = forward of impact plane

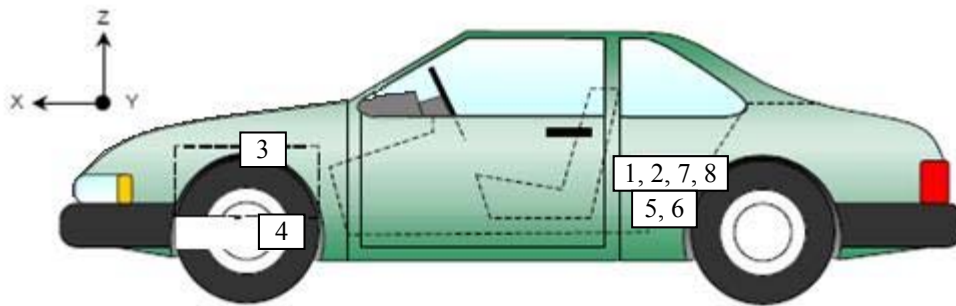
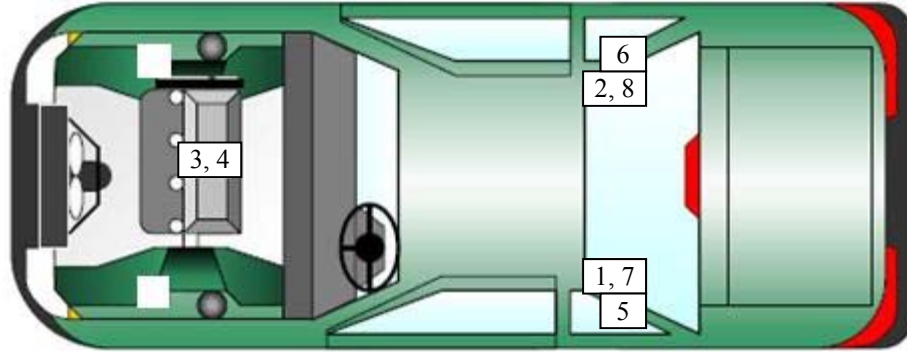
+Y = right of monorail center

+Z = into ground

DATA SHEET NO. 7 - VEHICLE ACCELEROMETER LOCATIONS

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: _____

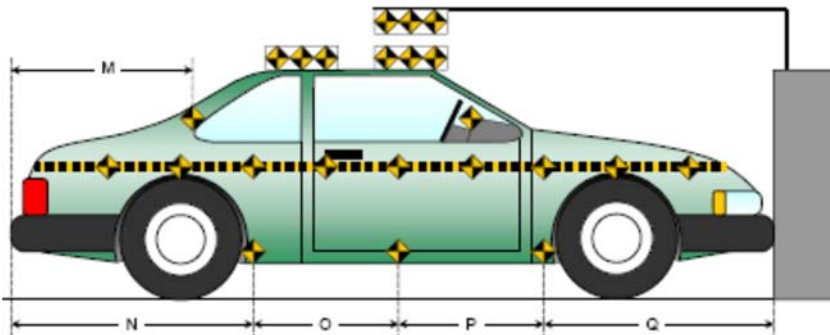
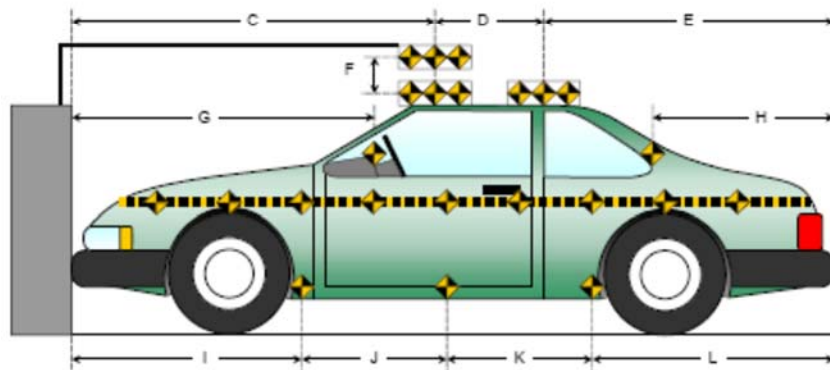
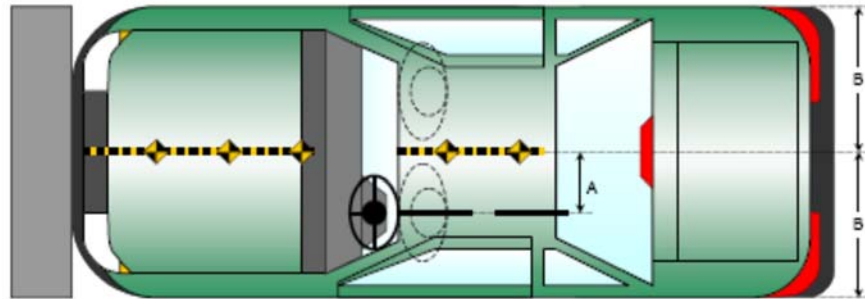
NHTSA No.: _____

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

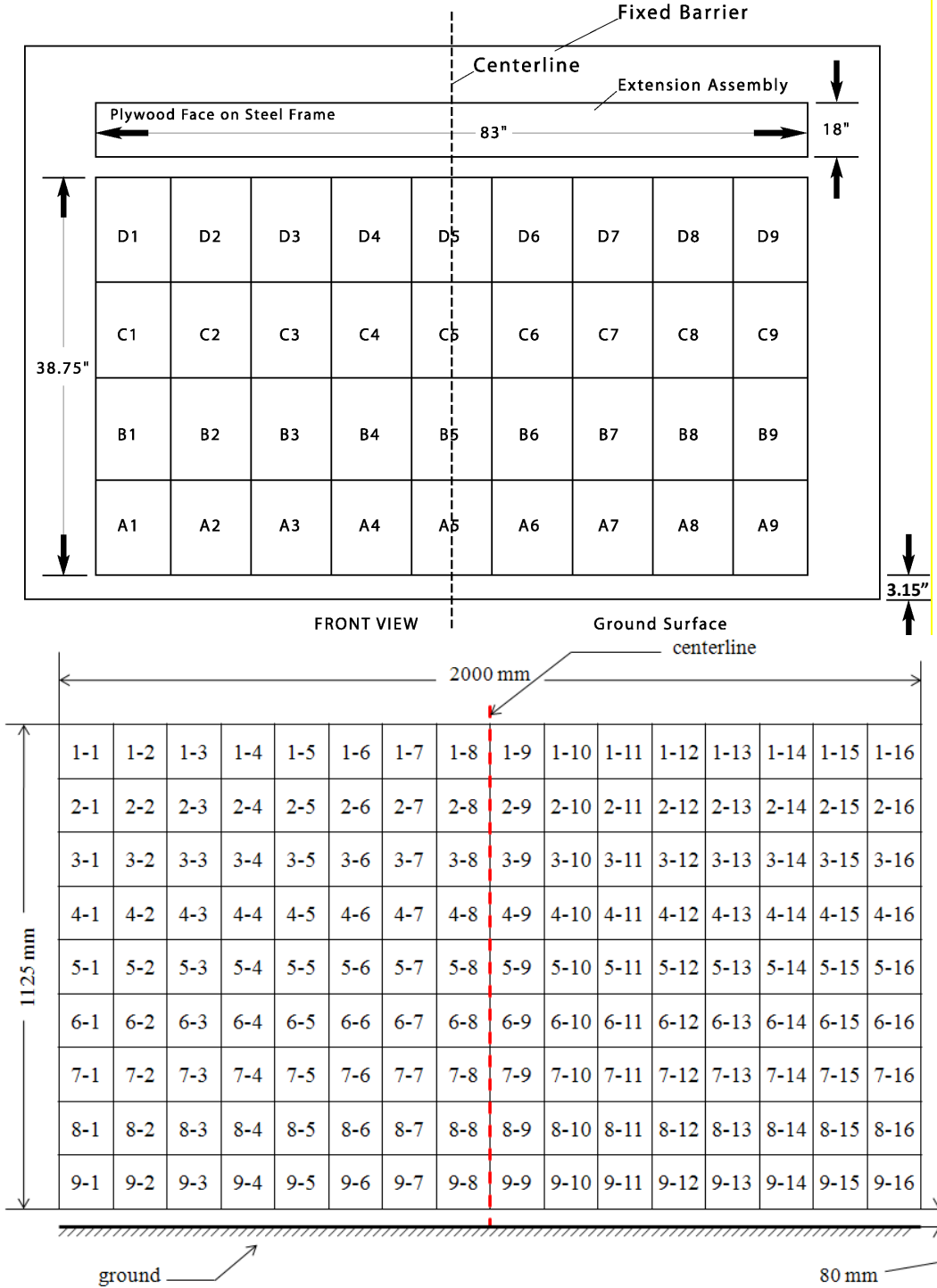


DATA SHEET NO. 9 - LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

Insert Schematic of Load Cell Barrier as Applicable: Also see Appendix H



DATA SHEET NO. 10 -TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: _____

NHTSA No.: _____

Test Program: _____

Test Date: _____

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy	
Passenger Dummy	
Vehicle Structure	
Total	

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	
High-Speed Offboard	
Real-Time Panning	
Total	

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, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger	Other
Locked/Unlocked Doors**			
Front Door Opening**			
Rear Door Opening**			
Trunk/Hatch/Tailgate Opening**			
Seat Track Shift (mm)			
Seat Back Movement from Initial Position**			

**NOTE: Indicate "No", "N/A, or "Yes", and if "Yes", describe

OTHER VEHICLE POST-TEST OBSERVATIONS

Description	Observations
Windshield Damage	
Window Damage	
Other	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	
Center	mm	
Right Side	mm	
Average	mm	

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

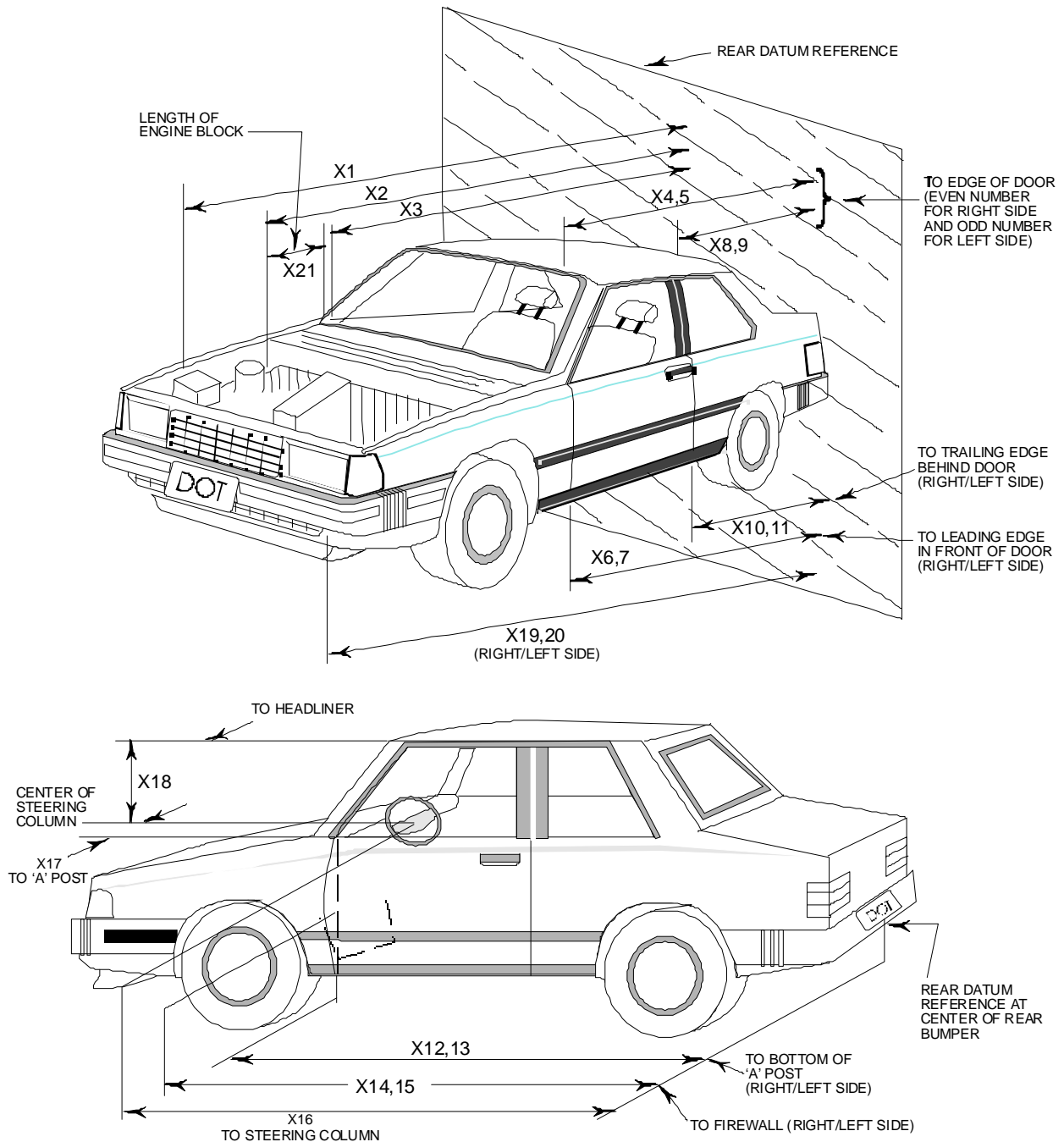
Restraint Type	Driver		Passenger	
	Installed	Deployed	Installed	Deployed
Front Air bag				
Indicate side air bag type in vehicle				
Indicate side air bag type in vehicle				
Knee Air bag				
Seat Belt Pretensioner				
Seat Belt Load Limiter				
Other				

**NOTE: Indicate "No", "N/A", or "Yes"

DATA SHEET NO. 12 - VEHICLE PROFILE MEASUREMENTS

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____



DATA SHEET NO. 12 - VEHICLE PROFILE MEASUREMENTS (CONT'D)

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 category: _____

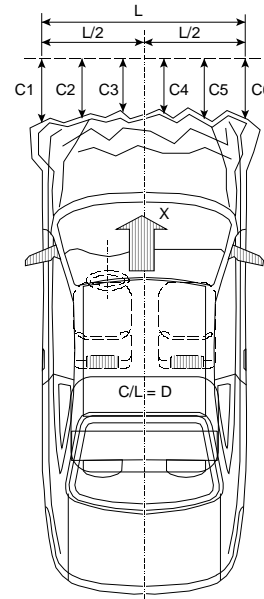
Wheelbase: _____
 Test Weight (kg): _____

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: _____
 Test Program: _____

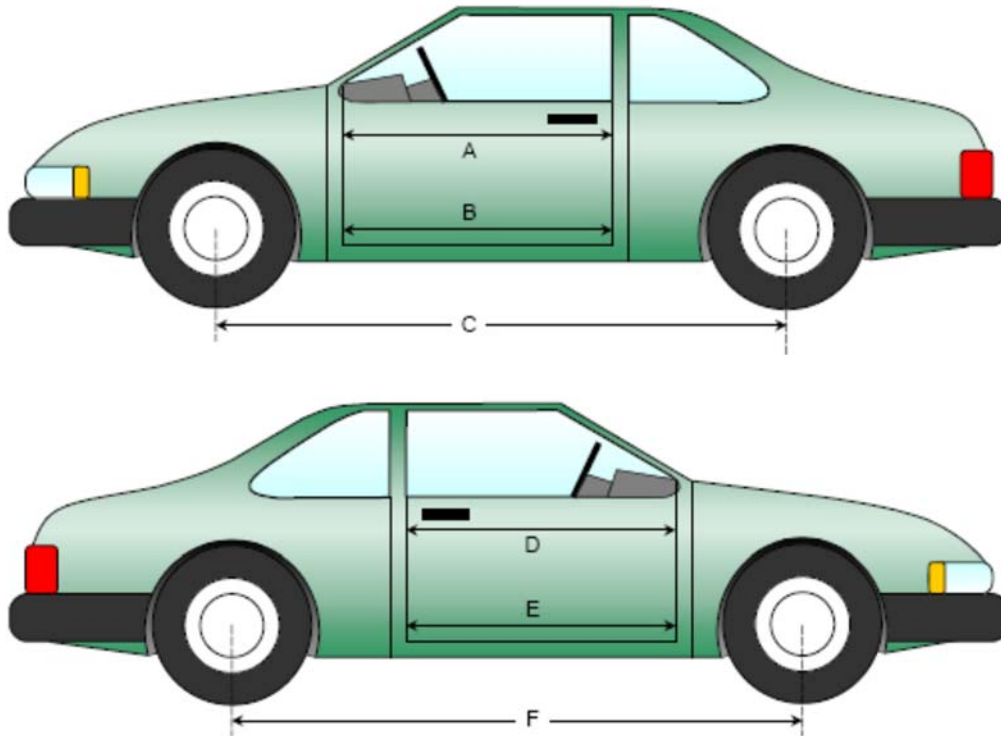
NHTSA No.: _____
 Test Date: _____

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 - VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: _____

NHTSA No.: _____

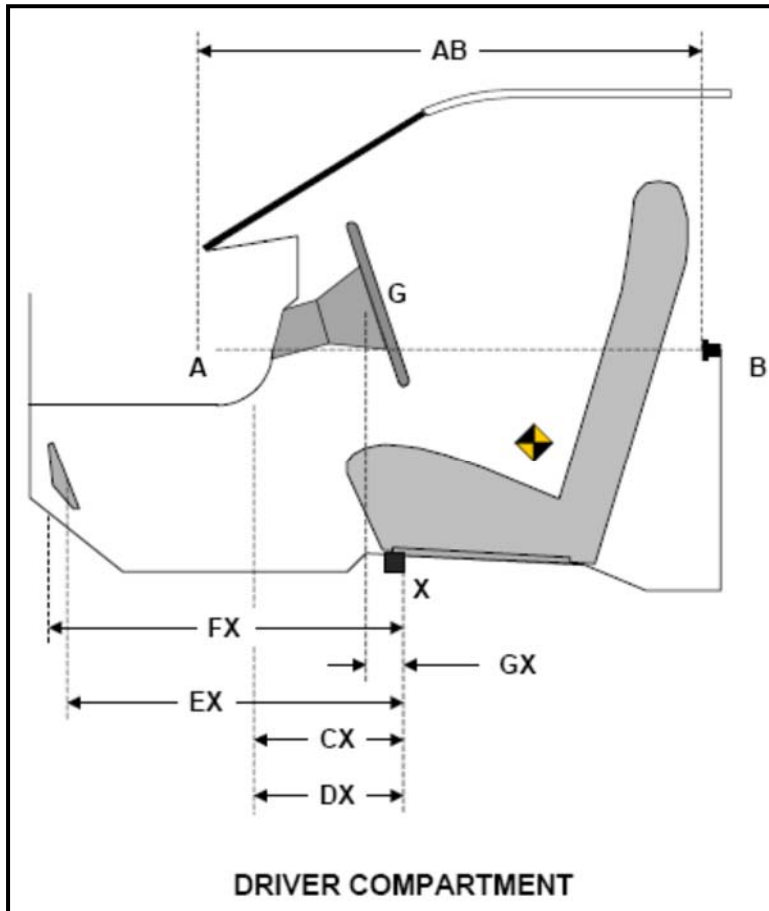
Test Program: _____

Test Date: _____

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (at striker height)	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 INDICANT FMVSS 212 AND FMVSS 219
(PARTIAL) DATA**

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

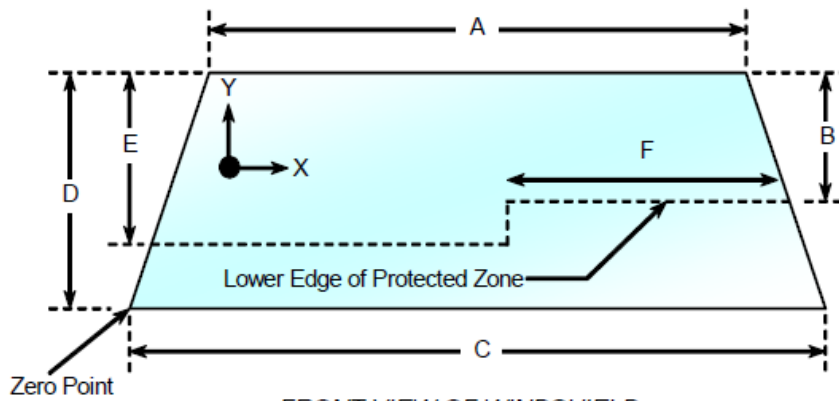
Please provide windshield mounting details. _____

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. 16 - FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

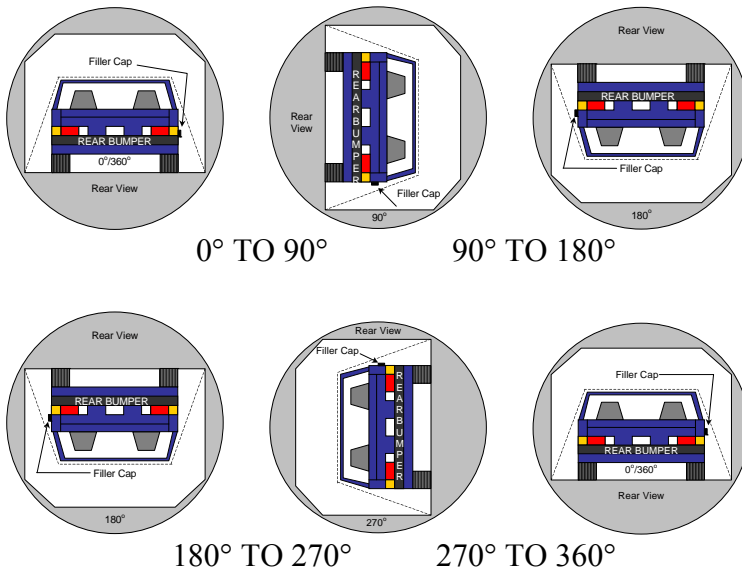
Temperature at Time of Impact: _____

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: _____

FMVSS 301 STATIC ROLLOVER RESULTS



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°			

**DATA SHEET NO. 16 - FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER
RESULTS (CONT'D)**

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.

**DATA SHEET NO. 305-1 - GENERAL TEST AND VEHICLE PARAMETER DATA
FOR INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: _____

NHTSA No.: _____

Test Program: _____

Test Date: _____

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electric Vehicle (Electric/Hybrid): _____

Propulsion Battery Type: _____

Nominal Voltage: _____ V;

Physical Location of Automatic Propulsion Battery Disconnect: _____

Auxiliary Battery Type: _____

PROPULSION BATTERY SYSTEM DATA (COTR-supplied):

Electrolyte Fluid Type: _____

Electrolyte Fluid Specific Gravity: _____

Electrolyte Fluid Kinematic Viscosity: _____ centistokes

Electrolyte Fluid Color: _____

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

Location of Battery Modules:

Inside Passenger Compartment

Outside Passenger Compartment

Propulsion Battery State of Charge:

Maximum state of charge

Test Voltage (No less than 95% of Maximum State of Charge): _____

OR

Range of Normal Operating Voltage

Test Voltage (Within Normal Operative Voltage Range): _____

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATE: _____

**DATA SHEET NO. 305-3 - PRE-IMPACT ELECTRICAL ISOLATION
MEASUREMENTS AND CALCULATIONS FOR INDICANT FMVSS NO. 305
TESTING**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

VOLTMETER INFORMATION

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

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make: _____; Model: _____; S/N: _____
Internal Impedance Value: _____ M Ω
Resolution: _____ V
Last Calibration Date: _____

PROPULSION BATTERY VOLTAGE

The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the “ready-to-drive” (propulsion motor(s) activated) position.

NOTE: If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

V_b = _____ V

ELECTRICAL ISOLATION MEASUREMENTS
PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) will be determined and supplied to the Contractor by the COTR.

V₁ = _____ V
V₂ = _____ V

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

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

R_o = _____ Ω
V₁' = _____ V Pre-Impact
V₂' = _____ V Pre-Impact

**DATA SHEET NO. 305-3 - PRE-IMPACT ELECTRICAL ISOLATION
MEASUREMENTS AND CALCULATIONS FOR INDICANT FMVSS NO. 305
TESTING (CONT'D)**

Test Vehicle: _____
Test Program: _____

NHTSA No.: _____
Test Date: _____

ELECTRICAL ISOLATION CALCULATIONS

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

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

$R_{i1} =$ _____ Ω Pre-Impact

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

$R_{i2} =$ _____ Ω Pre-Impact

$R_i =$ The lesser of R_{i1} and R_{i2}
 $R_i =$ _____ Ω Pre-impact

$R_i/V_b =$ Electrical Isolation Value/ Nominal Battery Voltage
 $R_i/V_b =$ _____ Ω/ V Pre-Impact

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V .

Is the measured Electrical Isolation Value $\geq 500 \Omega/ V$?

Yes No

Comments: _____

RECORDED BY: _____
APPROVED BY: _____

DATE: _____
DATE: _____

DATA SHEET NO. 305-4 POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____

VOLTMETER INFORMATION

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

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

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

ELECTRICAL ISOLATION MEASUREMENTS

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

V1 = _____ V Post-Impact Time: _____ minutes _____ s
 V2 = _____ V Post-Impact Time: _____ minutes _____ s
 V1' = _____ V Post-Impact Time: _____ minutes _____ s
 V2' = _____ V Post-Impact Time: _____ minutes _____ s

ELECTRICAL ISOLATION CALCULATIONS

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

$R_{i1} = R_o (1 + V_2/V_1) [(V_1 - V_1')/V_1']$
 Ri1 = _____ Ω Post-Impact Time: _____ minutes _____ s

$R_{i2} = R_o (1 + V_1/V_2) [(V_2 - V_2')/V_2']$
 Ri2 = _____ Ω Post-Impact Time: _____ minutes _____ s

Ri = The lesser of Ri1 and Ri2
 Ri = _____ Ω Post-Impact Time: _____ minutes _____ s

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage
 Ri/Vb = _____ Ω/V Post-Impact Time: _____ minutes _____ s

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V.

Is the measured Electrical Isolation Value $\geq 500 \Omega / V$?

- Yes No (Fail)

DATA SHEET NO. 305-4 - POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)

PROPULSION BATTERY SYSTEM COMPONENTS

Describe any Propulsion Battery Module movement within the passenger compartment. [Supply photographs as appropriate]:

Has the Propulsion Battery Module moved within the passenger compartment?

- Yes (Fail) No

Describe any intrusion of an outside Propulsion Battery Component into the passenger compartment. [Supply photographs as appropriate]:

Has an outside Propulsion Battery Component intruded into the passenger compartment?

- Yes (Fail) No

Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?

- Yes (Fail) No

RECORDED BY: _____
APPROVED BY: _____

DATE: _____
DATE: _____

DATA SHEET NO. 305-5 - STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: _____
 Test Program: _____

NHTSA No.: _____
 Test Date: _____



PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time (spec. 1-3 min)		FMVSS No. 301 Hold Time		Total Time			Next Whole Minute Interval	
	min.	sec.	min.	sec.	min.	sec.	min.	sec.	
0°-90°									
90°-180°									
180°-270°									
270°-360°									

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0°-90°		
90°-180°		
180°-270°		
270°-360°		

Total Spillage: _____ L

Is the total Propulsion Battery Electrolyte Spillage greater than 5.0 Liters?

- Yes (Fail) No

Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?

- Yes (Fail) No

**DATA SHEET NO. 305-5 - STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS
NO. 305 TESTING (CONT'D)**

VOLTMETER INFORMATION

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

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

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

Internal Impedance Value: _____ MΩ

Nominal Propulsion Battery Voltage (Vb): _____ V

ELECTRICAL ISOLATION MEASUREMENTS

Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.

V1 = _____	V @ 90°	Time: _____	minutes	_____	s
V1 = _____	V @ 180°	Time: _____	minutes	_____	s
V1 = _____	V @ 270°	Time: _____	minutes	_____	s
V1 = _____	V @ 360°	Time: _____	minutes	_____	s

V2 = _____	V @ 90°	Time: _____	minutes	_____	s
V2 = _____	V @ 180°	Time: _____	minutes	_____	s
V2 = _____	V @ 270°	Time: _____	minutes	_____	s
V2 = _____	V @ 360°	Time: _____	minutes	_____	s

V1' = _____	V @ 90°	Time: _____	minutes	_____	s
V1' = _____	V @ 180°	Time: _____	minutes	_____	s
V1' = _____	V @ 270°	Time: _____	minutes	_____	s
V1' = _____	V @ 360°	Time: _____	minutes	_____	s

V2' = _____	V @ 90°	Time: _____	minutes	_____	s
V2' = _____	V @ 180°	Time: _____	minutes	_____	s
V2' = _____	V @ 270°	Time: _____	minutes	_____	s
V2' = _____	V @ 360°	Time: _____	minutes	_____	s

DATA SHEET NO. 305-5 - STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)

ELECTRICAL ISOLATION CALCULATIONS

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

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

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

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

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

Ri = The lesser of Ri1 and Ri2

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

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage

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

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V.

Is the measured Electrical Isolation Value $\geq 500 \Omega/ V$?

Yes No (Fail)

Comments: _____

RECORDED BY: _____
 APPROVED BY: _____

DATE: _____
 DATE: _____

4. FORMS

Forms, like Data Sheets, are provided as **tools** to use in the exchange of data between the COR 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 1 – Test Vehicle Information**

A “Test Vehicle Information” form will be supplied, either by the purchasing Contractor or the COR, 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 2 – Report of Vehicle Condition**

A “Report of Vehicle Condition” form must be submitted to the COR. 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 and submitted with the Quality Control Package. The forms shall be **legible** (handwritten forms are unacceptable) and **complete** (all information requested is filled out).

C. **FORM 3 – Laboratory Notice of Invalid Test or Apparent Test Failure**

A “Laboratory Notice of Invalid Test or Apparent Test Failure” form will be submitted to the NHTSA COR to report either an invalid test or a test failure. The invalid test or potential failure shall be described **thoroughly** in the spaces provided.

D. **FORM 4 – Monthly Status Reports**

a. **Form 4a: Vehicle Inventory Report**

The purpose of a “Vehicle Inventory Report” is to track all vehicles tested under NCAP and in the Contractor’s possession. It should contain all NCAP-owned, optional, and lab-owned retest vehicles. The information should be organized in an Excel file format according to the structure described by **Form 4a** and submitted to the COR each month (no later than the 15th of the month following the reporting month) until all vehicles have been discarded. An alternative schedule may be used if approved by the COR. A sample template will be provided by the COR.

b. **Form 4b: Invoicing Report**

The “Invoicing Report” allows NHTSA to identify and reconcile its internal invoicing records against the Contractor’s. The information should be organized in an Excel file format according to the structure outlined under

Form 4b and submitted to the COR each month (no later than the 15th of the month following the reporting month). A sample template will be provided by the COR.

c. **Form 4c: ATD and Sensor Inventory Report**

An “ATD and Sensor Inventory Report,” in Excel file format and according to the structure outlined under **Form 4c**, shall be submitted to the COR either monthly (no later than the 15th of the month following the reporting month) or upon request, depending on the section of the “ATD and Sensor Inventory Report” in question. An alternative schedule may be used if approved by the COR. A sample template will be provided by the COR.

E. **FORM 5 - Quicklook Report**

A “Quicklook Report” of pertinent test data, as described in **Section 1.3, A** of this appendix, should be prepared and sent via e-mail to pertinent NHTSA personnel within twenty-four (24) hours of test completion.

F. **FORM 6 - Vehicle Air Bag and Restraint Deactivation and Removal**

A “Vehicle Air Bag and Restraint Deactivation and Removal” form should be completed and submitted to the COR within 14 days of receiving authorization to complete restraint deactivation activities.

FORM 1 - TEST VEHICLE INFORMATION
 NCAP Frontal, Side MDB, and Side Pole Tests

Vehicle Model Year and Make: _____

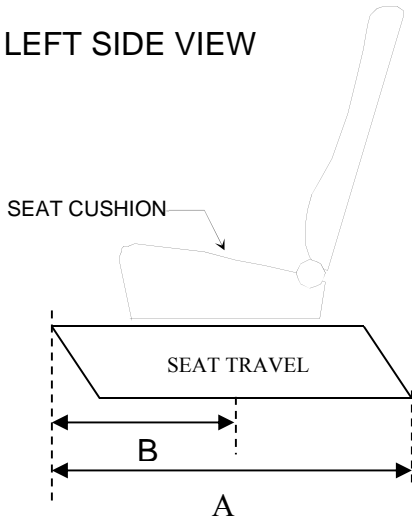
Vehicle Model and Body Style: _____

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 50th male and the Side NCAP 50th male, two diagrams are provided below to assist in positioning the seat. These diagrams assume that the seat will move forward if the seat cushion is moved upward in height.

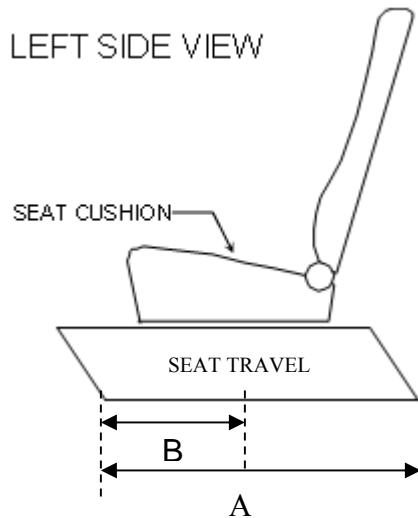
SEAT POSITIONING FOR FRONTAL
 NCAP 50TH PERCENTILE MALE

LEFT SIDE VIEW



SEAT POSITIONING FOR ALL
 OTHER NCAP DUMMIES

LEFT SIDE VIEW



A = Total range of seat travel; B = Mid-track position

For more clarification regarding foremost and rearmost seat positions, please refer to FMVSS 208 S8.1.2 (50th Male Driver), FMVSS 208 S16.2.10.3 (5th Female Front Passenger), FMVSS 214 S8.3.1.3 (50th Male Driver), FMVSS 214 S10.3.2.3 (5th Female Driver), and FMVSS 214 S8.3.3.3 (5th Female Rear Passenger).

1.1 Driver's Seat

1.1A Seat Fore-Aft Positioning

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	

Frontal impact test detent* (50 th percentile male):	
Side impact test detent* (50 th percentile male):	
Side impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel as determined for Frontal NCAP (mm):	
Frontal impact test distance from the foremost position (50 th percentile male):	
Complete range of travel as determined for Side NCAP (mm):	
Side impact test distance from the foremost position (50 th percentile male):	
Side impact test distance from the foremost position (5 th percentile female):	

1.1B *Seat Cushion Angle*

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 50 th Male		
Side Impact – 50 th Male		
Side Impact – 5 th Female		

1.1C *Seat Cushion Height*

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Height Used	Additional Description
Frontal Impact - 50 th Male		
Side Impact – 50 th Male		
Side Impact – 5 th Female		

1.1D Provide any other instructions for positioning the driver's seat at the required test position(s):

Frontal: _____

 Side MDB: _____

 Side Pole: _____

1.2 Front Outboard Passenger Seat (5th percentile dummy in frontal impact only)

1.2A Seat Fore-Aft Positioning

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	
Frontal impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel (mm):	
Frontal impact test distance from the foremost position (5 th percentile female):	

1.2B Seat Cushion Angle

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 5 th Female		

1.2C Seat Cushion Height

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Frontal Impact - 5 th Female		

1.2D Provide any other instructions for positioning the front passenger seat at the required test position:

Frontal: _____

In addition, please indicate (1) the manufacturer of the 5th percentile dummy used for FMVSS 208 crash test certification and (2) the manufacturer of the 5th percentile dummy used for your internal frontal NCAP testing. (Please indicate N/A if such testing was not performed). If a manufacturer other than FTSS or Denton was used for your internal frontal NCAP testing, or if you did not perform internal frontal NCAP tests for this vehicle, state which of these dummies (FTSS or Denton) you prefer to be used for NHTSA’s frontal NCAP test:

(1) _____
 (2) _____

1.3 Rear Seats (5th percentile dummy in MDB side impact only)

1.3A Seat Fore-Aft Positioning

Depending on the seat track adjuster type, complete one of the tables below.

<i>Manual Seat Track Adjuster</i>	
Total number of detents:	
Side impact test detent* (5 th percentile female):	

* For manual seat track adjustments, test detent is measured from foremost detent, which is defined as 0.

<i>Power Seat Track Adjuster</i>	
Complete range of travel (mm):	
Side impact test distance from the foremost position (5 th percentile female):	

1.3B Seat Cushion Angle

If the seat cushion angle is adjustable while maintaining the test fore-aft seat track position, describe the angle used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Side Impact - 5 th Female		

1.3C Seat Cushion Height

If the seat and/or seat cushion height is adjustable at the test fore-aft seat track position and can be adjusted so that the seat cushion angle can be at the angle used in the certification test, describe the height used during certification testing and how to measure it. Include any reference points and photographs.

Dummy	Angle Used	Additional Description
Side Impact - 5 th Female		

1.3D Provide any other instructions for positioning the rear seat at the required test position:

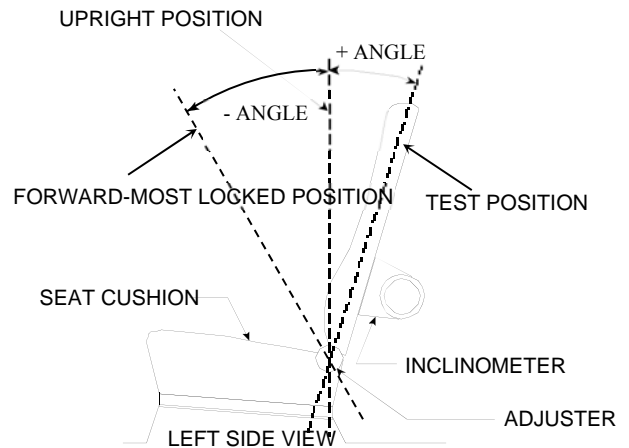
Side MDB: _____

2. **SEAT BACK ANGLE**

2.1 **Driver's Seat**

With the seat in the test fore-aft seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Frontal Impact – 50 th Male	
Side Impact – 50 th Male	
Side Impact – 5 th Female	



With the seat in the test fore-aft seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: For the frontal impact test and the side impact test with the 50th male dummy, the seat back angle will be set to the Nominal Design Position. For the side impact test with the 5th female dummy, the seat back angle will be determined by the related dummy seating procedure.)

Dummy	Angle
Frontal Impact – 50 th Male	
Side Impact – 50 th Male	
Side Impact – 5 th Female	

For the 50th percentile male, is the seat back angle measured with the dummy in the seat?

Frontal: YES NO
 Side: YES NO

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).) *If possible, include measurement from bottom front of head rest post to outboard sun visor anchor, or from bottom back of head rest post to middle of rear door striker.*

Frontal: _____
 Side MDB: _____

Side Pole: _____

2.2 Front Outboard Passenger Seat (5th percentile female in frontal impact only)

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Frontal Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the frontal impact test.)

Dummy	Angle
Frontal Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).) *If possible, include measurement from bottom front of head rest post to outboard sun visor anchor, or from bottom back of head rest post to middle of rear door striker.*

Frontal: _____

Side MDB: _____

Side Pole: _____

2.3 2nd Row Seat (5th percentile female in side impact only)

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Side Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the side impact barrier test.)

Dummy	Angle
Side Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

2.4 3rd Row Seat (side impact only)

The seat should be set to accommodate a 5th percentile female dummy; however, this dummy will not be part of the test(s).

With the seat in the test seat track position, what is the angle of the seat back when it is in the forward-most locked position?

Dummy	Angle
Side Impact – 5 th Female	

With the seat in the test seat track position, what is the angle of the seat back when it is set to the **test** position? (Note: The seat back angle will be determined by the related dummy seating procedure for the side impact barrier test.)

Dummy	Angle
Side Impact – 5 th Female	

Describe any references used for measuring the seat back angle, e.g., door sill. (Include photograph(s).)

3. ADJUSTABLE D-RING SEAT BELT ANCHORAGE POSITION

Nominal Design Position (NDP)

Please complete the following table for adjustable seat belt anchorages.

Dummy	Total Range of Travel (mm)	Dist. from Upper-most Position to NDP (mm)	Total No. of Detents (if applicable)	Detent No. of NDP*
Driver/Front Passenger - 50 th Male				
Driver/Front Passenger – 5 th Female				
Rear Passenger - 5 th Female				

* The detent number of the Nominal Design Position is counted with respect to the upper-most detent, which is defined as 0.

4. SEAT BELT GUIDES

Is this vehicle equipped with a seat belt guide for any of the following seating positions?

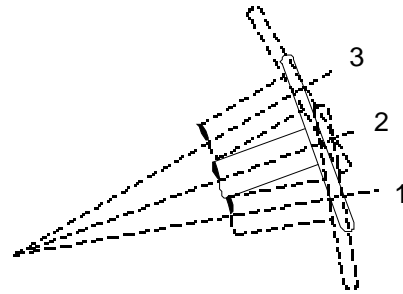
- Driver: YES NO
 Right Front Passenger: YES NO
 Left Rear Passenger: YES NO

If YES for any position, please provide instructions for use:

5. STEERING COLUMN AND WHEEL ADJUSTMENTS

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.

STEERING COLUMN ASSEMBLY



LEFT SIDE VIEW

Angle of the steering wheel with respect to vertical when the steering wheel hub is positioned at the geometric center of the locus it describes when it is moved through its full range of positions:	
Total number of detents:	
Test detent* when the wheel hub is positioned at the geometric center of the locus it describes when it is moved through its full range of positions:	

* Test detent is taken with respect to the upper-most detent, which is defined as 0.

6. SEATING REFERENCE POINT (SgRP)

Please give the location of the Seating Reference Point (SgRP) for each vehicle seating position.

Seating Position	Coordinates (mm)		
	X (+ forward)	Y (+ right)	Z (+ down)
Left Front (Driver)			

Right Front (Front Passenger)			
Left Second Row (Rear Passenger)			

Describe any references used for measuring the SgRP, e.g., center of the front door striker. (Include photograph(s).)

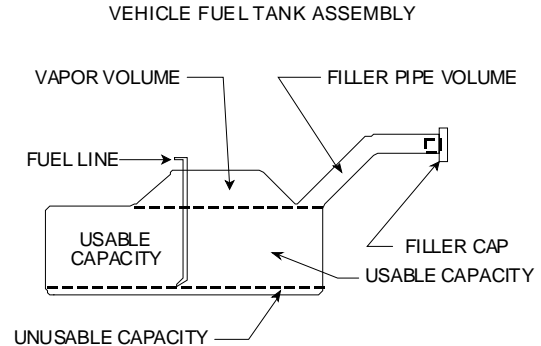
7. DUMMY MEASUREMENTS FOR THE 50TH MALE AND 5TH FEMALE

See the attached instructions and diagram and provide measurements for the following seat configurations:

	HH	NR	CS	KDL/KDR	SH	SHY	HS
Driver (Manual Seat)							
Driver (Power Seat)							
Passenger (Manual Seat)							
Passenger (Power Seat)							
2nd Row Occupant (Side only)							

8. FUEL TANK CAPACITY DATA

“Usable capacity” of standard equipment fuel tank (gal):	
“Usable capacity” of optional equipment fuel tank (gal):	
Capacity used when certification testing to requirements of FMVSS No. 301 (gal):	



Operational instructions:

Suggested methods for draining:

Is the vehicle equipped with an electric fuel pump?

YES NO

If YES, does the pump normally operate when the vehicle's electrical system is activated?

YES NO

If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel:

Provide a drawing (or description) that shows the undercarriage view and/or location of the fuel tank.

9. DEACTIVATION OF SIDE AIR BAGS

If this vehicle has side air bags, will they deploy in a Frontal NCAP test? *For information purposes only; SABs are not disabled in Frontal NCAP.*

YES NO

If this vehicle has side air bags, will the side air bags on the non-struck side deploy in a Side MDB test?

YES NO

IF YES, please be prepared to disable the non-struck side air bags on Side MDB test days. 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 air bags, will the side air bags on the non-struck side deploy in a Side Pole test?

YES NO

IF YES, please be prepared to disable the side air bags on the non-struck side on Side Pole 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 air bags activated when a 5th percentile female or 50th percentile male dummy is in the seat? (Please choose YES or NO for each.)

Frontal: YES NO
 Side MDB: YES NO
 Side Pole: YES NO

If NO, please provide system bypass information.

Frontal: _____

 Side MDB: _____

 Side Pole: _____

11. SHOULDER BELT LOAD CELL POSITIONING (Frontal NCAP)

Can a shoulder belt load cell be mounted on the seat belts?

YES NO

If YES, please provide the following:

Distance from the driver’s side D-ring to the load cell centerline (mm):	
Distance from the passenger’s side D-ring to the load cell centerline (mm):	

Can a lap belt load cell be mounted on the seat belts?

YES NO

If there are specific instructions on how best to position the lap belt load cell, please provide those here:

12. HEIGHT ADJUSTABLE SUSPENSION

Does this vehicle have a height adjustable suspension? (Off-road modes that must be manually activated are not applicable.)

YES NO

If YES, and the suspension does not automatically adjust to a default ride mode (comfort-ride, sport-ride, etc.) when the ignition is set to “on” (but, the engine is not running), please list and describe the ride mode options available on the vehicle, and discuss when and how they are activated.

If YES above, designate ONE ride mode to be used for all three crash tests (frontal, side MDB, and side pole tests) and provide instructions for adjusting the test vehicle to that designated ride mode.

13. HEAD RESTRAINTS

Do any of the head restraints in this vehicle have a “non-use” position? Please note that “use” positions are defined in FMVSS No. 202a.

YES NO

If YES, please indicate seating positions that apply and how to properly put the applicable head restraint(s) in the lowest “use” position.

14. LOCATION OF CARGO AREA AND LIST OF REMOVABLE PARTS

On occasion, NCAP needs to add ballast weight to vehicles in order to achieve target test weight. If a traditional cargo-carrying area like a trunk, rear hatch area, or truck bed is not present on this vehicle, please describe the nature and location of the vehicle’s intended cargo-carrying area below.

NCAP will also 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, tail lights, 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:

Side MDB NCAP test:

Side Pole NCAP test

15. SPECIAL INSTRUCTIONS

Please make note of any special instructions that you would like NHTSA to consider or be made aware of for the tested vehicle (ex. towing setup, refrain from using seat belt load cells, etc.):

Frontal NCAP test:

Side MDB NCAP test:

Side Pole NCAP test:

16. **SEAT LATCHING VERIFICATION PROCEDURE**

Describe, in as much detail as possible, your best practice for ensuring the proper engagement of any *manual* seat adjustment components into their proper seat track detents. This may include, but is not limited to: a description of the functionality of the manual seat adjustment mechanisms and all possible indications of full engagement, including visual, auidial, and tactile methods of ensuring said engagement with tools such as a boroscope. Photographs and/or schematics along with suggestions of physical methods for ensuring engagement are highly suggested.

17. **CRASH AVOIDANCE SYSTEMS**

Does this vehicle come equipped with any crash avoidance (CA) systems that could potentially affect frontal or side NCAP tests? Please keep in mind the test conditions specific to each mode (ignition in the “ON” position in all tests, transmission in neutral for all tests except side MDB and pole tests with manual transmissions, which are placed in 2nd gear).

YES NO

If YES, please describe each affecting system’s operation below and be prepared to disable the specific CA system on test day. If a representative will not be present, you must provide the laboratory with detailed instructions on how to deactivate the system prior to test day.

18. ELECTRICAL LOAD SHEDDING SYSTEMS

Does this vehicle have an electrical load shedding system that may activate when vehicle ignition is in the “ON” position and the engine is not running?

YES NO

If YES, for each specific trim level (if applicable) or equipment type (e.g. traditional key vs. push-button ignitions), identify all parameters that may activate load shedding while the ignition is on and the engine is not running (e.g. battery voltage, time since ignition was turned on, etc.).

Describe, in as much detail as possible, your best practice for ensuring that the electric load shedding system does **not** activate and/or interfere with the crashworthiness related systems prior to impact when vehicle ignition is in the “ON” position and the engine is not running.

DESCRIPTIONS OF DUMMY MEASUREMENTS

When a level is to be used, it is to ensure that the line containing the two points described is either parallel or perpendicular to the ground. If a measurement to be made is less than 10 inches ignore the directions to use a level and approximate a level measurement. Also, when a measurement is to be taken to or from the center of a bolt on the dummy, take the measurement from the center of the bolt hole if the bolt is recessed.

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

HH - Head to Header, taken from the point where the dummy's nose meets his forehead (between his eyes) to the furthest point forward on the header.

CS - Steering Wheel to Chest, taken from the center of the steering wheel hub to the dummy's chest. Use a level.

NR - Nose to Rim, taken from the tip of the dummy's nose to the closest point on the top of the steering wheel rim. Also indicate the angle this line makes with respect to the horizontal (NA).

KDL, KDR - Left and Right Knees to Dashboard, taken from the center of the knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard. Also reference the angle of this measurement with respect to the horizontal for the outboard knee (KDA).

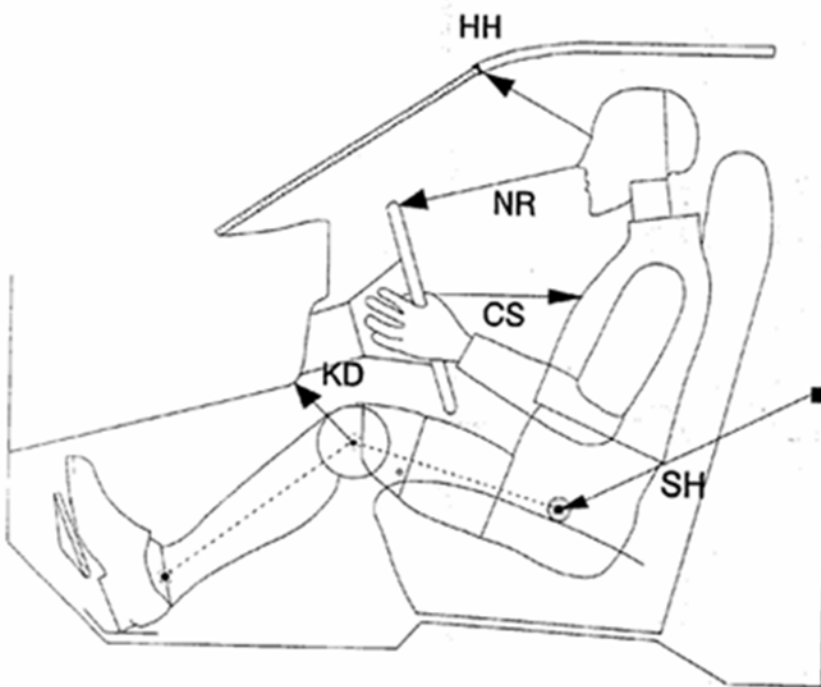
SH - Striker to Hip, this measurement is to be taken in the X-Z plane measured from the forward most center point on the striker to the center of the H-point. When taking this measurement a firm device that can be rigidly connected to the striker should be used. The measurement in the Y (transverse) direction from the striker to the H-point should also be taken (SHY).

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

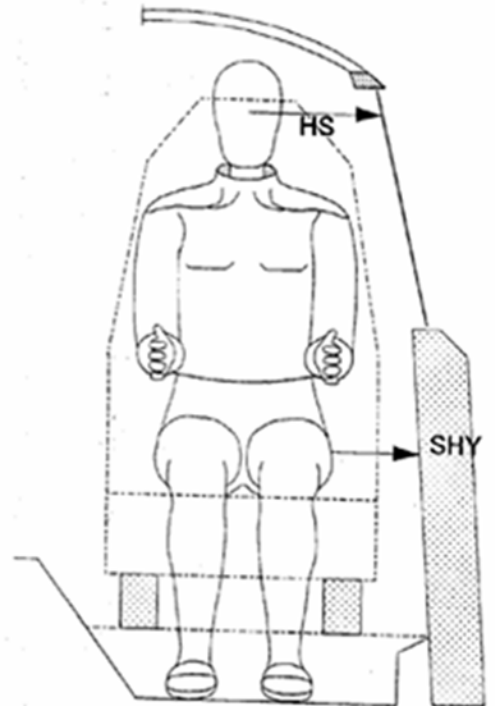
HS - Head to Side Window, taken from the point where the dummy's nose meets his forehead (between his eyes) to the outside of the side window. In order to make this measurement, roll the window down to the exact height which allows a level measurement. Use a level.

SHY - Striker to H-point, taken from a rod rigidly connected to the forward most center point on the striker to the H-point. Use a level.

DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS



HH - Head to Header
 NR - Nose to Rim
 CS - Steering Wheel to Chest
 KDL/KDR - Knee to Dash
 SH - Striker to H-Point



SHY - Striker to H-Point (Y Dir.)
 HS - Head to Side Window

FORM 2 - REPORT OF VEHICLE CONDITION

Contract Number: _____
NHTSA Number: _____

Date: _____
Test Lab: _____

This vehicle was inspected upon delivery at the laboratory and was found to contain all the required equipment. This form should be submitted to NCAP within 2 working days of the vehicle arrival. Any and all variances should be noted. NCAP should be notified immediately if the received vehicle is not in good working order or is damaged. Submission of this form acknowledges that the vehicle was received in good working order and was undamaged.

Model Year	
Make	
Model	
Body Style	
Engine Type	
Final Drive	
# Seating Positions	

NCAP Test Type	
Transmission	
VIN	
Body Color	
Delivery Date	
Odometer Reading	
Dealer	

VEHICLE RESTRAINTS AS EQUIPPED – CHECK ALL THAT APPLY

	Frontal Air Bag	Side Torso Air Bag	Side Curtain Air Bag	Knee Air Bag	Pre-tensioner	Other Air Bag (Specify)
Driver						
Right Front Passenger						
Left Rear Passenger						
Center Rear Passenger						
Right Rear Passenger						
Other Positions						

PLEASE LIST OTHER PERTINENT INFORMATION BELOW:

FORM NO. 2 - REPORT OF VEHICLE CONDITION (CONT'D)
POST-TEST CONDITION

Remarks:

Equipment that is no longer on the test vehicle:

Explanation for equipment removal:

	Left Front – Driver	Right Front – Passenger	Left Rear – Passenger	Right Rear – Passenger
Is seat adjustable along track?				
Is seat back adjustable?				
Is seat damaged or deformed?				
Is window operable?				
Does door open and close?				
Is seat air bag deployed?				
Is curtain air bag deployed?				
Is headliner or pillar trim damaged?				

Describe the nature of and damage and if the damage is repairable/replaceable:

FORM 3 - LABORATORY NOTICE OF INVALID TEST OR APPARENT TEST FAILURE

Test Vehicle:
Test Type:
NHTSA Number:
VIN:
Test Lab:
Test Date:
Contract Number:

Reporting:

- Invalid Test:** Contractor did not comply with all aspects of the relevant Test Procedure.
Please fill Section 1, Invalid Test

- Test Failure:** Dummy exceeded relevant FMVSS injury criteria or vehicle structure criteria, as stated in the relevant Test Procedure.
Please fill Section 2, Test Failure.

1. Invalid Test

Describe the nature of the nonconformance in the space below. Briefly describe the reason(s) for the nonconformance if known. Provide related supplemental information as a separate attachment.

2. Test Failure

Fill the table below with information relevant to the potential test failure. Provide related supplemental information, such as pre- and post-test qualification data, photographs, etc., as a separate attachment.

Seating Position	
Dummy Serial Number	
Relevant Injury Value(s)	
Vehicle Structure Anomalies (if applicable to FMVSS failure to comply)	

NHTSA COR Approval: _____

Date: _____

FORM 4a - VEHICLE INVENTORY REPORT

Each month, the Contractor should provide the COR with a report of the NCAP-related vehicles they have in inventory. This should include NCAP-owned, optional, and lab-owned retest vehicles. If the Contractor is in possession of vehicles that are associated with more than one NCAP contract, each tab in the file should only include details related to one contract number. Each tab should be named using the contract number along with an indication of the test direction (e.g., front or side). The chart below should be recreated in an Excel file with data added according to the chart key below.

The Excel file name should be structured as follows:

< 3 Letter Lab Name/TSTPRF><Year><Month>Form 4a Vehicle Inventory Report.xlsx

All columns shown below must be included, in the same order shown. Additional columns of pertinent information may be added to (but not inserted in between) these columns.

No.	Test Mode	Year/Make/Model	NHTSA No.	Owner	VIN	Delivery Date	Crash Test Date	Final Odometer	Restraints Deactivated?	Vehicle Disposal Date	Transferred to?
1											
2											

Chart Key:

- **No.:** Sequential number identifying each vehicle purchased under the contract.
- **Test Mode:** Indicate the type of crash test performed on the vehicle: frontal, side MDB, or side pole
- **Year/Make/Model:** Indicate the year, make, and model of the vehicle
- **NHTSA No.:** Indicate the vehicle's NHTSA number
- **Owner:** Indicate the owner of the NCAP vehicle
- **VIN:** Indicate the vehicle's 17-digit identification number (VIN)
- **Delivery Date:** Indicate the date the vehicle was received at your laboratory
- **Crash Test Date:** Indicate the date the vehicle was subject to crash testing.
- **Final Odometer:** Indicate the final odometer reading just prior to releasing or transferring the vehicle out of your possession
- **Restraints Deactivated?:** Indicate "no" in this field until instructions are received from the COR to deactivate all of the vehicle restraints. After those activities are completed, indicate "yes."
- **Vehicle Disposal Date:** Indicate the date the vehicle is transferred out of your possession.
- **Transferred to?:** Indicate the recipient of the vehicle once it is transferred out of your possession.

FORM 4b – INVOICING REPORT

Each month, the Contractor should supply the COR with a report of current invoicing activities.

The Excel file name should be structured as follows:

< 3 Letter Lab Name/TSTPRF><Year><Month>Form 4b Invoicing Report.xlsx

If the Contractor is invoicing items on multiple NCAP contracts, each tab in the Excel file should only include details related to one contract number. Each tab should be named using the contract number along with an indication of the test direction (e.g., front or side).

The header and chart information detailed below should be replicated for each separate delivery order issued under the contract, so that all delivery orders issued under a contract are contained on one tab in the Excel file. The lab should construct a completely new chart for each delivery order issued under a contract based on the items included in each subsequent delivery order.

All header items and chart columns shown below must be included, in the same order shown. Additional chart columns of pertinent information may be added to (but not inserted in between) these chart columns. For ease of discussion, the “left” and “right” sides of the chart are discussed separately. Spreadsheets should be designed according to the header, “left,” and “right” chart keys below.

In addition to building in the calculations and functionality described throughout the following sections, the Contractor should use conditional formatting or other functions in Excel to flag or highlight information that could lead to problems such as invoicing more contract line item numbers (CLINs) than were ordered or charging the incorrect price.

Header Key:

Contract No: DTNH221XD00XXX

Delivery Order:	DTNH221XF00XXX	DO PoP Start Date:	12/11/2016	Total Award:	\$5,000.00
Requisition No:	DTNH221XRQ0XXX	DO PoP End Date:	12/10/2017	Invoiced:	\$4,200.00
		PoP Extension End Date:	6/10/2018	Balance:	\$800.00

- **Contract No:** Place the contract number in a larger font at the top left corner of the sheet. This should be duplicated towards

the top left corner of each delivery order chart generated on the tab.

- **Delivery Order:** Delivery order number.
- **Requisition No:** Requisition number.
- **DO PoP Start Date:** The start date for the delivery order’s period of performance (PoP).
- **DO PoP End Date:** The end date for the delivery order’s period of performance (PoP).
- **PoP Extension End Date:** The new period of performance end date (PoP) if the delivery order end date has been extended.
- **Total Award:** The total funds awarded on the delivery order.
- **Invoiced:** Subtotal of items invoiced on the delivery order thus far. This field should contain a function to calculate the sum of the **Line Total** column described under “**Left**” **Chart Key** below.
- **Balance:** The remaining funds on the delivery order. This field should contain a function to calculate the difference between **Total Award** and **Invoiced**.

“Left Side” of Chart:

The “left side” of the chart should be located below the header information described above. These columns headers are static and each listed below should be included.

Year/ Make/ Model or Test Item	NHTSA or Item Number	Test Description	Work Start Date	Test Date	Invoice Number	Invoice Date	Invoice Paid	Line Total	Comments
2018 Make Model	M20180000	Frontal crash test	1/2/2018	1/16/2018	ABC123456	2/25/2018	Yes	\$2,500.00	
Hybrid III 5th	ATD 666	Qualification	1/2/2018	1/5/2018	ABC123457	2/25/2018	Yes	\$700.00	
2018 Make Model	M20180000	SAB-OOP	4/10/2018	4/25/2018	ABC123458	4/30/2018	No	\$1,000.00	

- **Year/ Make/ Model or Test Item:** For the item being invoiced, describe the year, make and model (if a vehicle), or provide other identifying information.
- **NHTSA or Item Number:** Indicate the NHTSA number, serial number, or other related identifier describing the item being invoiced.
- **Test Description:** Provide a short description of the work conducted on the test item.
- **Work Start Date:** The date work on this test item began.
- **Test Date:** The date the test (listed in “Test Description”) was conducted. If testing occurred over multiple days, use the completion date.
- **Invoice Number:** A laboratory-assigned number to track this invoice. It is suggested that each line in this tracking document

contain information from one invoice. Typically, one crash test should be submitted per invoice.

- **Invoice Date:** Date invoice was submitted.
- **Invoice Paid:** Whether the invoice has been paid or not; enter “Yes” or “No.”
- **Line Total:** A sum of all the contract line item numbers (CLINs) being charged for this test item. This field should be functional and sum the **Total** fields from the “**Right Side**” of the spreadsheet.
- **Comments:** Comments related to this test item that are relevant to the invoicing process.

In the example below, header information from above is included as a guide for how to position it with respect to the columns on the left side of the spreadsheet:

Delivery Order: DTNH221XF00XXX		DO PoP Start Date: 12/11/2016					Total Award:	\$5,000.00	
Requisition No: DTNH221XRQ0XXX		DO PoP End Date: 12/10/2017					Invoiced:	\$4,200.00	
		PoP Extension End Date: 6/10/2018					Balance:	\$800.00	
Year/ Make/ Model or Test Item	NHTSA or Item Number	Test Description	Work Start Date	Test Date	Invoice Number	Invoice Date	Invoice Paid	Line Total	Comments
2018 Make Model	M20180000	Frontal crash test	1/2/2018	1/16/2018	ABC123456	2/25/2018	Yes	\$2,500.00	
Hybrid III 5th	ATD 666	Qualification	1/2/2018	1/5/2018	ABC123457	2/25/2018	Yes	\$700.00	
2018 Make Model	M20180000	SAB-OOP	4/10/2018	4/25/2018	ABC123458	4/30/2018	No	\$1,000.00	

“Right Side” of Chart

The columns on the “right side” of the spreadsheet are more dynamic than the “left side” columns. For each new delivery order, a different set of contract line item numbers (CLINs) will be included. For **each** CLIN contained on a delivery order, a block of specific information should be placed to the right of the information described in the “**Left Side**” section above. The number of these blocks depends on the variety of CLINs included on a delivery order. In turn, this dictates how many columns will need to be summed to propagate the **Line Total** field described in the “**Left Side**” section.

Each line under this heading block is aligned with a **Test Item** line from the “Left” side of the chart. The following is an example of the column and field headers needed for each block:

CLIN_Description CLIN #####		
Unit Price:	\$1,000.00	
Qty Ordered:	10	
Qty Balance:	3	
Qty	Total	Count
1	\$1,000.00	1 of 10
2	\$2,000.00	2 & 3 of 10
1	\$1,000.00	4 of 10
	\$0.00	
	\$0.00	
	\$0.00	

- **CLIN Description and Number:** Each block should be titled with a description of the CLIN and its associated number
- **Unit Price:** The unit price for the subject CLIN.
- **Qty (Quantity) Ordered:** The number of items ordered under the subject CLIN on the delivery order.
- **Qty (Quantity) Balance:** The remaining number of items under the subject CLIN. This field should contain a function to calculate the difference between the sum of the items in the **Qty** column and the **Qty Ordered** cell.
- **Qty (Quantity):** The total number items under the subject CLIN charged for that **Test Item**.
- **Total:** This field should contain a function to calculate the total cost under the subject CLIN charged for the **Test Item**, using the related **Qty** and **Unit Price** fields. All **Total** cells on a given line should sum to inform the **Line Total** cell for that **Test Item**.
- **Count:** This field should be used to track the quantity of this CLIN used versus the **Qty Ordered** as reported on the invoice.

- **Sensor Type:** Indicate the sensor type.
 - eg: accelerometer, load cell, angular rate sensor
- **Sensor Location:** Indicate the ATD location where this sensor is currently installed; otherwise, indicate N/A.
 - eg: head, upper neck, pelvis.
- **Manufacturer:** Indicate the manufacturer of the sensor.
- **Model:** Indicate the model name or number of the sensor.
- **Serial Number:** Indicate the serial number of the sensor.
- **Axis:** If installed in an ATD along a particular axis, indicate that axis; otherwise, indicate N/A.
- **P/R:** If installed in an ATD, indicate whether it is in the primary (P) or redundant (R) location.
- **Date Received:** The date the Contractor received the GFP from NCAP.
- **Date Installed (in ATD):** If installed in an ATD, the date the installation occurred.
- **Last Cal Date:** The date the sensor was last calibrated.
- **ATD Type:** If the sensor is installed in an ATD, indicate the ATD type. Otherwise indicate N/A.
 - eg: ES2-re, Hybrid III 3YO
- **ATD S/N:** If installed in an ATD, indicate the ATD serial number. Otherwise, indicate N/A.

Issue Tracking

The Contractor shall have an internal process for resolving and tracking issues with dummy parts and sensors, whether they occur during inspection, qualification, crash testing, SAB-OOP, or other activities. Information related to dummy part and sensor issues should be summarized in this report on a tab titled “**IssueTracking.**”

At a minimum, the following information should be recorded:

NHTSA No.	Make/Model	Test Type	Test Date	ATD Type	ATD S/N	Sensor or Part Description	Sensor or Part S/N	Channel No	Issue	Inspection	Fix/Remedy	NOTES

- **NHTSA No:** If the entry is tracking a sensor issue that occurred during a vehicle test, indicate the NHTSA number of the vehicle. Otherwise, indicate N/A.
- **Make/Model:** If the entry is tracking a dummy sensor issue that occurred during a vehicle test, indicate the make and model of the vehicle. Otherwise, indicate N/A.
- **Test Type:** Indicate the test (or other activity) in which the sensor issue occurred or was discovered during.
 - eg: frontal crash test, side pole crash test, neck extension qualification, pre-test ATD inspection.
- **ATD Type:** Indicate the type of ATD that the sensor was installed in, if any. Otherwise, indicate N/A.

- **ATD S/N:** Indicate the serial number of the ATD the sensor is installed in, if any. Otherwise, indicate N/A.
- **Sensor or Part Description:** Describe the part or sensor exhibiting the issue being tracked, including the axis and whether the sensor is primary or redundant, if applicable.
 - eg: head CG primary x accelerometer, upper neck load cell, head skin.
- **Sensor or Part S/N:** Indicate the serial number for the sensor or part in question.
- **Channel No.:** If the issue occurred during a vehicle test, indicate the channel number in the EV5 file. Otherwise, indicate N/A.
- **Issue:** Describe the event that initiated the investigation into the sensor or part.
 - eg: noticed during routine inspection, data loss during frontal crash test, ATD failed to pass neck extension qualification.
- **Inspection:** Describe the results of having inspected the sensor or part.
 - eg: wire found cut, nodding block cracked.
- **Fix/Remedy:** Indicate the solution being employed to remedy the sensor or part issue.
 - eg: head skin replaced, accelerometer replaced, re-soldered wire, neck nodding blocks replaced.
- **Notes:** Include additional information about the issue.

FORM 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. MXXXXXXXXX Test Date (Month, Day, Year)								
	Driver, 50th Percentile Male				Passenger, 5th Percentile Female				
Injury Reading	Units	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	

	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

	Standards Passed Post-Test	
	212 - Windshield Periphery Retention	Yes/No/NA
219 (partial) - Windshield Zone Intrusion	Yes/No/NA	Yes/No/NA
301- Fuel System Integrity	Yes/No/NA	Yes/No/NA
If No, amount in ounces		
305 - Electrolyte Spillage	Yes/No/NA	Yes/No/NA
If No, amount in ounces		
305 - Electrical Isolation	Yes/No/NA	Yes/No/NA
If No, Ohms/Volt		
305 - Battery Retention	Yes/No/NA	Yes/No/NA
If No, location of failure		

	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	

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: _____

FORM 6 – VEHICLE AIR BAG AND RESTRAINT DEACTIVATION AND REMOVAL

Contract Number: _____

Date: _____

NHTSA Number: _____

Test Lab: _____

Model Year	
Make	
Model	
Body Style	

After all testing is completed and the NHTSA COR has given approval, deactivate and remove all air bags and restraints as outlined in the contract. Return this form to the NHTSA COR once the work has been completed.

In the table below, initial all restraints that have been deployed during testing or manually deployed/deactivated/removed. Mark non-applicable restraints “N/A”.

	Frontal Air bag	Side Torso Air bag	Side Curtain Air bag	Knee Air bag	Pre- tensioner	Seat Belts	Other Air bag (Specify)
Driver							
Front Center Passenger							
Front Right Passenger							
2nd Row Left Passenger							
2nd Row Center Passenger							
2nd Row Right Passenger							
3rd Row Left Passenger							
3rd Row Center Passenger							
3rd Row Right Passenger							

RECORDED BY: _____

DATE: _____

APPENDIX J
FMVSS No. 212, 219 (PARTIAL), 301, AND 305
INDICANT TEST REQUIREMENTS FOR FULL
FRONTAL RIGID BARRIER NCAP

APPENDIX J: FMVSS Nos. 212, 219 (PARTIAL), 301, AND 305 INDICANT TEST REQUIREMENTS FOR FULL FRONTAL RIGID BARRIER NCAP

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1. PURPOSE AND APPLICATION

The New Car Assessment Program's (NCAP's) full frontal rigid barrier impact test procedure is based on a related safety standard, Federal Motor Vehicle Safety Standard (FMVSS) No. 208, which specifies performance requirements for the protection of vehicle occupants in crashes. The assessment of certain FMVSS-related parameters during NCAP testing allows the Office of Crashworthiness Standards (OCWS) to gain supplemental information on the test vehicle.

NOTE: All variables are to be evaluated at NCAP's 35mph (56.3km/h) full frontal rigid barrier test vehicle velocity.

This document is an appendix to the main full frontal rigid barrier laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA), Office of Crashworthiness Standards (OCWS) for the purpose of presenting guidelines for a uniform testing data and information recording format, and providing suggestions for the use of specific equipment and procedures for contracted testing laboratories. The data correspond to requirements for indicant testing in accords with FMVSS No. 212, 219, 301, and 305. The OCWS test procedure is not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment that will assist in procuring the required test data. However, applicability of any such testing technique or equipment is subject to prior approval by the COR.

The indicant test procedures presented in this appendix are applicable to vehicles tested under the main full frontal rigid barrier NCAP test procedure. It is the contractor's responsibility to follow the most updated versions of all related test procedures when conducting these assessments as part of full frontal rigid barrier NCAP testing. These vehicles must also meet the requirements set forth in this appendix.

Vehicles will be tested to the requirements contained herein in conjunction with the dynamic requirements for full frontal NCAP tests. The test facility must be able to conduct these NCAP tests. The facility must meet the minimum requirements regarding weighing capability, speed measurement systems, test surface, tow-road, abort system, barriers, and all other requirements.

2. DEFINITIONS

See main **Frontal NCAP Procedure, Section 10** for additional **Definitions**.

DAYLIGHT OPENING (DLO)

Maximum unobstructed opening through the glazing surface (windshield), including reveal or garnish moldings adjoining the surface, as measured parallel to the outer surface of the glazing material.

ELECTROLYTE SPILLAGE

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

FORWARD CONTROL VEHICLE (FCV)

Configuration in which more than half of the engine length is rearward of the foremost

point of the windshield base and the steering wheel hub is in the forward quarter of the vehicle length.

PROPULSION BATTERY SYSTEM COMPONENT

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

3. PRE-TEST REQUIREMENTS

3.1. DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

Prior to conducting the indicant test, if requested by the COR, the Contractor may be required to submit a detailed in-house test procedure (to the COR) that includes:

- a. A step-by-step description of the methodology to be used.
- b. A written Quality Control (QC) Procedure which shall include calibrations, the data review process, report review, and the people assigned to perform QC on each task.
- c. A complete listing of test equipment with instrument accuracy and calibration dates.
- d. Detailed check off lists to be used during the test and during data review. These lists shall include all test procedure requirements and any additional requirements pertaining to the applicable safety standard for which testing is being performed. Each separate check off sheet shall identify the laboratory, test date, vehicle, and test technicians. These check sheets shall be used to document that all requirements and procedures have been complied with. If requested, these sheets shall be submitted with the test report.
- e. There shall be no contradiction between the OCWS Laboratory Test Procedure and the Contractor's in-house test procedure.

4. FMVSS No. 212 INDICANT TEST

4.1. GENERAL REQUIREMENTS

This indicant test is based on FMVSS No. 212, which establishes windshield retention requirements for motor vehicles during a full frontal rigid barrier test.

When a vehicle is subject to a full frontal rigid barrier NCAP test, the windshield mounting of the vehicle shall retain NOT LESS than the minimum portion of the windshield periphery as follows:

- a. Vehicles equipped with automatic occupant (passive) restraint systems shall retain not less than 50% of the portion of the windshield periphery on each side of the vehicle longitudinal centerline.
- b. Vehicles NOT equipped with automatic occupant restraint systems shall retain not less than 75% of the windshield periphery.

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.

4.2. *PROCEDURE*

The following test conditions shall apply:

- a. The windshield mounting material and all vehicle components in direct contact with the mounting material are at any temperature between -9.4°C and 43.3°C .
- b. Temperature measurement shall be made 15 minutes before the frontal impact test.
- c. Windshield retention must be checked directly after a full frontal rigid barrier impact.
- d. Loss of windshield protection can be determined when a piece of paper can pass between the windshield edge and the vehicle body.
- e. Photographs of the windshield periphery should be taken before the vehicle is placed in the static rollover machine to conduct an FMVSS No. 301 or No. 305 indicant test.

The Contractor should complete **Data Sheet No. 15** in **Appendix I** to this procedure and include it with the test report.

5. FMVSS No. 219 (PARTIAL) INDICANT TEST

5.1. *GENERAL REQUIREMENTS*

This indicant test is based on FMVSS No. 219, which specifies limits for the displacement of vehicle components into the windshield area during a full frontal rigid barrier test.

When a vehicle is subject to a full frontal rigid barrier test as defined by FMVSS No. 219, 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 6 mm (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 word “partial” is used since the 219 Styrofoam windshield protected zone template is eliminated for NCAP 56.3km/h (35mph) full frontal rigid barrier impact tests so 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, and any points where a part of the vehicle exterior has marked, penetrated, or broken the windshield should be documented, which accounts for a partial standard test.

	Windshield In “Protected Zone”	Windshield Below “Protected Zone”
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Vehicle Component Penetration	Must not mark, penetrate, or break by a part of the vehicle exterior	Must not penetrate inner surface of windshield
--------------------------------------	--	--

The windshield must be checked directly after a full frontal rigid 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.

5.2. *PROTECTED ZONE LOWER EDGE MARKING PROCEDURE*

The lower edge of the protected zone is determined as follows:

- a. Place a 16.5 cm (6.5 in) diameter rigid sphere weighing 6.8 kg (15 lbs) in a position such that it simultaneously contacts the inner surface of the windshield glazing and the surface of the instrument panel, including padding. If any accessories or equipment such as the steering control system obstruct positioning of the sphere, remove them, and then replace them prior to barrier impact testing.
- b. Draw the locus of points on the inner surface of the windshield contactable 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.

- c. Draw a line on the inner surface of the windshield below and a 1.3 cm (0.5 in) distance from the locus line.
- d. The lower edge of the protected zone is the longitudinal projection onto the outer surface of the windshield on the line determined in item 3.

The Protected Zone is the space enclosed by the following surfaces:

- a. The outer surface of windshield in the pre-crash configuration.
- b. The locus of points 7.6 cm (3 in) outward along perpendiculars drawn to each point on the outer surface of the windshield.
- c. 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.

The following test conditions shall also apply:

- a. The hood, hood latches, and any other hood retention components are engaged prior to the frontal barrier impact test.
- b. Adjustable cowl tops or other adjustable panels in front of the windshield are in the position used under normal operating conditions when windshield-wiping systems are not in use.

The Contractor should complete **Data Sheet No. 15** in **Appendix I** to this procedure and include it with the test report

6. FMVSS No. 301 INDICANT TEST

6.1. GENERAL REQUIREMENTS

This indicant test is based on FMVSS No. 301, which specifies performance requirements for the integrity of motor vehicle fuel systems. It is the contractor's responsibility to follow the most updated test procedure when conducting this assessment as part of NCAP testing.

1. FRONTAL IMPACT

When a vehicle is subject to a full frontal rigid barrier NCAP test, the following fuel leakage conditions must be met:

TIME	MAX. FLUID SPILLAGE
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

After a vehicle is subject to a full frontal rigid barrier NCAP test and placed on a static rollover machine, the following fuel leakage conditions must be met:

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

6.2. FACILITY AND EQUIPMENT – PRE-TEST REQUIREMENTS)

1. STATIC ROLLOVER MACHINE

The Contractor must have a rollover machine 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.

2. STODDARD COLLECTION CONTAINERS AND STOPWATCH

Containers for the collection of Stoddard solvent and a calibrated stopwatch for timing the fluid collection intervals are required. 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 must be labeled before they are photographed.

6.3. *FUEL SYSTEM INTEGRITY PROCEDURE*

After the vehicle impact, fuel system Stoddard solvent leakage (if any) should be collected by hand and documented with a real-time (24-30 fps) video 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 reach 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.

6.4. *STATIC ROLLOVER PROCEDURE*

Do not proceed to the static rollover in the case of a potentially invalid test, apparent test failures, or test anomalies. In those cases, the Contractor should contact the COR for instructions on how to proceed.

The Contractor must conduct a static rollover test within 45 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 1ounce by weight.

6.5. *STATIC ROLLOVER TEST CONDITIONS*

Prior to conducting any static rollover test, ATDs should be removed from the vehicle. Within 45 minutes of vehicle impact, the Contractor should place the vehicle in the test fixture, where it may be rotated in a test fixture about its longitudinal axis, with the axis kept horizontal, to each successive increment of the following:

- Rotation 1 - 90°
- Rotation 2 - 180°
- Rotation 3 - 270°
- Rotation 4 - 360°

Rotation must take place at a uniform rate, with 90° of rotation taking place in any time interval from 1 to 3 minutes. After reaching each 90° increment, the vehicle is held in that position for 5 minutes.

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.

7. FMVSS No. 305 INDICANT TEST

7.1. GENERAL REQUIREMENTS

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

It is the contractor's responsibility to follow the most updated test procedure when conducting this assessment as part of NCAP testing.

When a vehicle is subject to a full frontal rigid barrier NCAP test, it shall **NOT**:

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

7.2. FACILITY AND EQUIPMENT: PRE-TEST REQUIREMENTS

1. VOLTAGE MEASUREMENT DEVICE AND INTERFACE

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

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

a barrier crash test. The test interface port shall incorporate a fusible link and any other necessary safety device or usage procedure to protect the data measurement and recording equipment from damage, and the test technicians from electrical shock.

A terminal block or circuit board is recommended as a means to providing an external interface

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

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

2. STATIC ROLLOVER MACHINE

The rollover machine must be capable of rotating, and holding in place, the impacted NCAP 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. Voltage measurements shall be able to be made continuously throughout the rollover test.

3. STODDARD AND ELECTROLYTE COLLECTION CONTAINERS AND STOPWATCH

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

4. OTHER TEST INSTRUMENTATION

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

7.3. *ELECTROLYTE SPILLAGE AND ELECTRICAL SHOCK PROTECTION PROCEDURE*

1. DATA COLLECTION SET-UP

- a. Remove the key from the keylock and ensure the vehicle is not powered.

- b. Remove barriers to access the propulsion battery module (e.g. seat backs, carpet, covers).
- c. Wear high-voltage protection gloves, nonconductive shoes, eye protection and any other safety equipment deemed necessary to safely prepare the vehicle and conduct the test.
- d. Set the propulsion battery module switch, service plug, or otherwise to the “OFF” or depowered, position (See **Figure 1J** below). Follow any Manufacturer instructions provided by the COR. Wait 5 minutes.

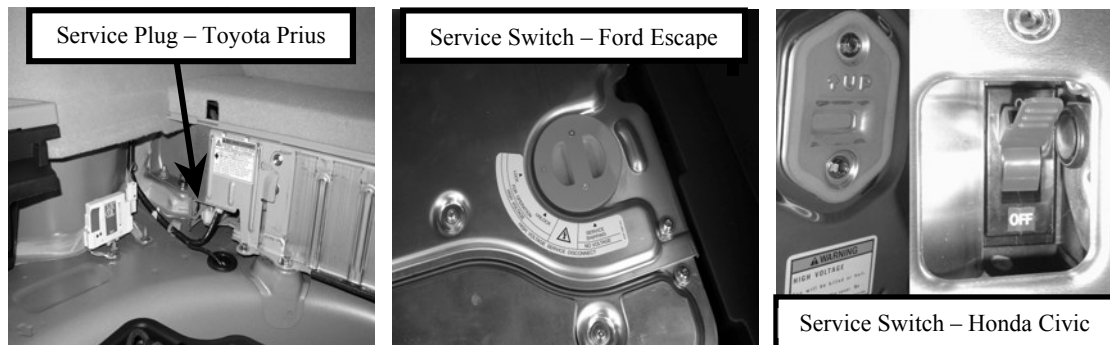


Figure 1J: Examples of Service Switches and Plugs

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

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

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

- k. Re-install the propulsion battery module service cover, or otherwise close the battery compartment. Take great care to preserve the integrity of the connection wiring and propulsion battery hold-downs.

2. TEST VEHICLE PREPARATION

- a. Apply paint or other highly visible finish, such as machinist blue, to all *battery system component* attachment fasteners or attachment means (e.g., welds), to indicate component movement or separation after the governing NCAP barrier test.
- b. If the vehicle is equipped with a liquid cooling system, assure that the coolant is a different color than the Stoddard solvent in use.
- c. Reset the propulsion battery module switch, service plug, or otherwise to the “ON”, or powered, position. Verify proper function of propulsion system.
- d. Charge the propulsion battery system to:
 - 1. The maximum state of charge recommended by the manufacturer, as stated in the vehicle Owner’s Manual, or on a label that is permanently affixed to the vehicle;
OR
 - 2. A state of charge of not less than 95 percent of the maximum capacity of the battery system, if the manufacturer has made no recommendation. Maximum capacity can be verified by consulting the COR;
OR
 - 3. The maximum practicable state of charge within the normal operating range, as specified by the manufacturer, and as indicated by the vehicle’s instrumentation, if the batteries are rechargeable only by an energy source on the vehicle. Discuss with COR prior to operating the vehicle.
- e. Complete **Data Sheets No. 305-1** and **No. 305-2** in **Appendix I**.
- f. Prepare the test vehicle per the remainder of this test procedure.
- g. Document and photograph the test vehicle per the requirements set forth in this test procedure.

3. ELECTRICAL ISOLATION BASELINE MEASUREMENT

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

- a. Check that the battery system is connected to the vehicle’s propulsion system, and the vehicle is in the “ready-to-drive” (propulsion motor(s) activated) position. Start **Data Sheet No. 305-3** in **Appendix I**.
- b. Measure the voltage of the propulsion battery as shown in **Figure 2J**. Before any vehicle impact test, verify that V_b is equal to or greater than the nominal operating voltage, as specified by the vehicle manufacturer, or as supplied by the COR. If V_b is not equal to or greater than the nominal operating voltage, as specified by the vehicle manufacturer, or as supplied by the COR, repeat the propulsion battery charging **Step d** of **Item 2** Test Vehicle Preparation and promptly call the COR for guidance. The voltmeter used in this test measures

direct current values and has an internal impedance of at least 10M Ω . Record the voltage measurement as V_b on **Data Sheet No. 305-3** in **Appendix I**. Make certain all voltages are DC. If there is AC voltage on the traction side connection, consult the COR for additional guidance.

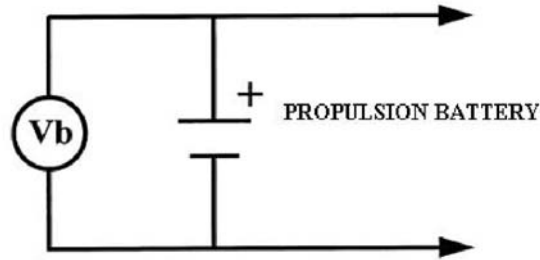


Figure 2J

- c. Measure the voltage (V_1) from the negative side of the propulsion battery to the vehicle chassis point(s) as shown in **Figure 3J**. Record the voltage measurement as V_1 on **Data Sheet No. 305-3** in **Appendix I**.

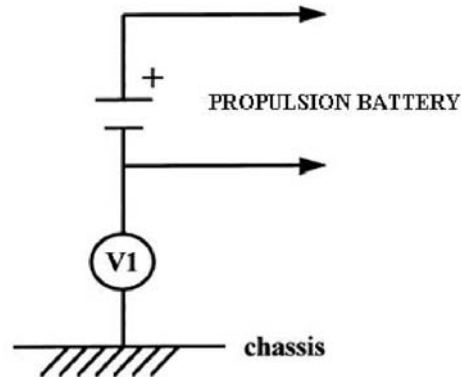


Figure 3J

- d. Measure the voltage (V_2) from the positive side of the propulsion battery to the vehicle chassis point(s) as shown in **Figure 4J**. Record the voltage measurement as V_2 on **Data Sheet No. 305-3** in **Appendix I**.

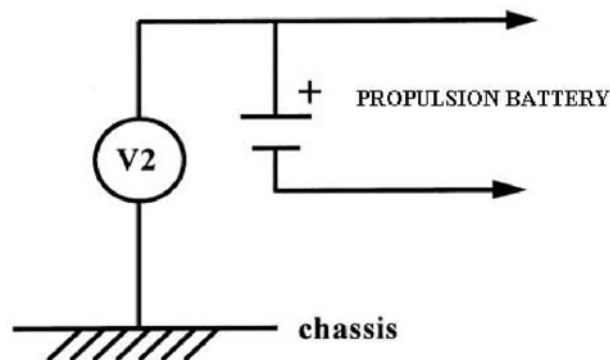


Figure 4J

- e. Insert a resistor (R_o) of a known resistance (in ohms) approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766, between the negative side of the propulsion battery and the vehicle chassis. With R_o installed, measure and record the voltage (V_1') as shown in **Figure 5J** between the negative side of the propulsion battery and the vehicle chassis point(s). Calculate the electrical isolation value (in ohms) as shown in **Figure 5J**. Record the electrical isolation value as R_{i1} on **Data Sheet No. 305-3** in **Appendix I**.

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

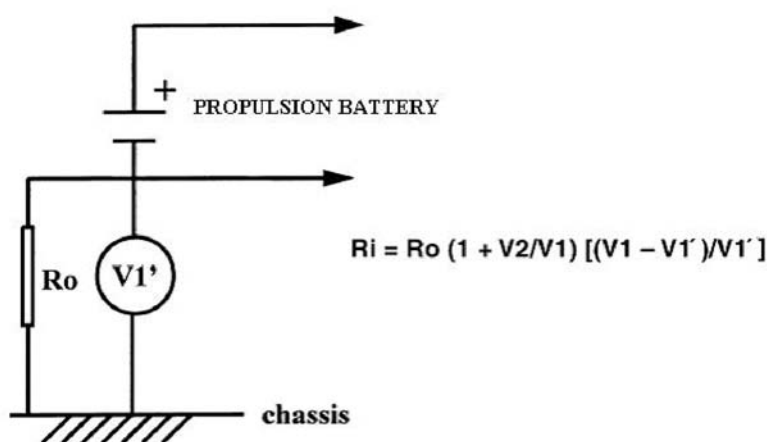


Figure 5J

- f. With R_o installed, measure and record the voltage (V_2') as shown in **Figure 6J** between the positive side of the propulsion battery and the vehicle chassis point(s). Calculate the electrical isolation value (in ohms) as shown in **Figure 6J**.

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

Record the electrical isolation value as R_{i2} on **Data Sheet No. 305-3** in **Appendix I**.

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

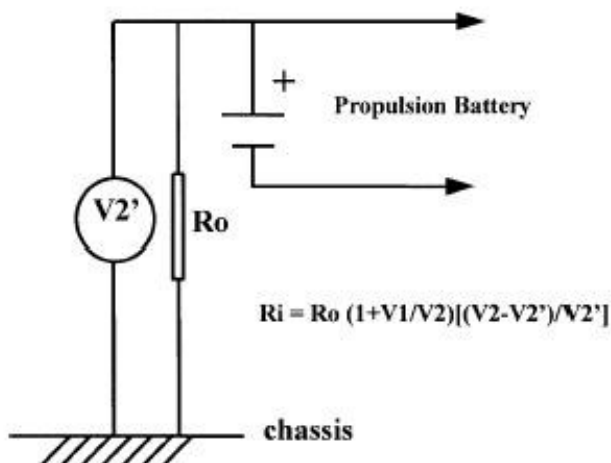


Figure 6J

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

- g. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 5J.

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

Record this value as R_i / V_b , on Data Sheet No. 305-3 in Appendix I. This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.

- h. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in Figure 5J.

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

Record this value as R_i / V_b , on Data Sheet No. 305-3 in Appendix I. This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.

- i. Recheck that the battery system is connected to the vehicle’s propulsion system, and that the vehicle in the “ready-to-drive” (propulsion motor(s) activated) position.
- j. Verify that the parking brake and transmission are set in accordance with this full frontal NCAP procedure.
- k. Perform the full frontal rigid barrier NCAP test.

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

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

4. ELECTRICAL ISOLATION COMPLIANCE MEASUREMENT

NOTE: All voltage measurements shall be recorded immediately after the governing NCAP barrier impact test, and at the start of each increment of 90°, 180°, 270°, and 360° of the FMVSS No. 301 indicant static rollover test.

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

- a. Immediately following the crash test, measure V_1 , V_2 , V_1' , and V_2' voltages per **Figure 6J** with R_0 installed and record the values on **Data Sheet No. 305-4** in **Appendix I**.
- b. Calculate the electrical isolation value (in ohms) as shown in **Figure 5J**. Record the electrical isolation value as R_{i1} on **Data Sheet No. 305-4** in **Appendix I**.
- c. Calculate the electrical isolation value (in ohms) as shown in **Figure 6J**. Record the electrical isolation value as R_{i2} on **Data Sheet No. 305-4** in **Appendix I**.
- d. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in **Figure 5J**. Record this value as R_i / V_b , on **Data Sheet No. 305-4** in **Appendix I**. This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- e. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in **Figure 5J**. Record this value as R_i / V_b , on **Data Sheet No. 305-4** in **Appendix I**. This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- f. Visually inspect for electrolyte leakage in the passenger compartment and record and photograph findings on **Data Sheet No. 305-4** in **Appendix I**. Additional photographs to document such findings should be included per the requirements set forth in the Photographic Documentation section in **Appendix I**.

- g. Visually inspect for external battery component entry into the occupant compartment and record and photograph findings on **Data Sheet No. 305-4** in **Appendix I**.
- h. Visually inspect for internal battery component movement in the occupant compartment and record and photograph findings on **Data Sheet No. 305-4** in **Appendix I**. Additional photographs to document such findings should be included per the requirements set forth in the Photographic Documentation section in **Appendix I**.
- i. Photograph the test vehicle per the deliverables outlined in the governing NCAP barrier test procedure and in this test procedure and record any additional findings in the applicable data sheets.
- j. Prepare the vehicle for the static rollover test by following **Section 6** (FMVSS No. 301 Indicant Test) of this appendix.

5. ELECTROLYTE SPILLAGE PROCEDURE

After the vehicle impact, any propulsion battery electrolyte leakage shall be collected by hand and documented with a real time (24 fps) digital video camera. Like FMVSS 301 indicant testing, the "tea cup method" may be used to collect electrolyte spillage from any leakage source(s), though Contractors are invited to suggest alternative methods for fluid collection. The collected propulsion battery electrolyte samples can subsequently be measured and spillage volume calculated. If the "tea cup method" is used, the test personnel must be in position to reach observation points around the test vehicle at the instant the vehicle comes to rest after the impact event. If possible, the collections of Stoddard solvent, propulsion battery electrolyte, or any other fluids should be segregated (if leakage of fluids is present). If it is not possible to collect leakage samples separately, provide a collection vessel that is adequately sized to collect the leakage mixture and separate by suitable means, post-test. Take adequate safeguards when collecting leakage, as it may be hazardous.

The passenger compartment must be visually checked directly after a barrier impact for evidence of electrolyte leakage, battery system component intrusion, and retention of interior mounted battery modules. There should be no visible traces of electrolyte in the passenger compartment. Spillage of battery electrolyte outside the passenger compartment, which cannot exceed 5.0 liters, is measured from the time the vehicle ceases motion after a barrier impact test until 30 minutes thereafter, and throughout any static rollover after a barrier impact test.

Photographs of the propulsion battery system components should be taken before the vehicle is placed on the static rollover machine.

6. STATIC ROLLOVER TEST AND TEST CONDITIONS

Do not proceed to the static rollover in the case of a potentially invalid test, apparent test failures, or test anomalies. In those cases, the Contractor should contact the COR for instructions on how to proceed.

The Contractor must conduct a static rollover test within 45 minutes after the vehicle impact. The Contractor must keep the test vehicle under constant observation for electrolyte leakage during the transition between impact and static rollover testing. Any ATDs used for governing NCAP test should also be removed prior to the rollover.

NOTE: When the test vehicle is rotated in a fixture on its longitudinal axis to each successive increment of 90° following the full frontal NCAP test, propulsion battery electrolyte leakage shall not exceed 5 liters.

Additionally, electrical isolation shall not be less than 500 ohms/volt throughout the full frontal NCAP test or at each 90° increment of the static rollover test.

- a. Reference static rollover preparation and procedure from **Section 6** (FMVSS No. 301 Indicant Test) of this appendix.
- b. Mount the test vehicle on the static rollover fixture and position at 0° (wheels down).
- c. Immediately following the rollover transition of each successive increment of 90° (e.g. at 90°, 180°, 270°, 360°), perform the following:

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

- i. Measure V_1 , V_2 , V_1' , and V_2' voltages per **Figures 3J -6J** with R_o installed, and record the values on **Data Sheet No. 305-5** in **Appendix I**.
- ii. Calculate the electrical isolation value (in ohms) as shown in **Figure 5J**. Record the electrical isolation value as R_{i1} on **Data Sheet No. 305-5** in **Appendix I**.
- iii. Calculate the electrical isolation value (in ohms) as shown in **Figure 6J**. Record the electrical isolation value as R_{i2} on **Data Sheet No. 305-5** in **Appendix I**.
- iv. If R_{i1} is less than R_{i2} then, divide R_{i1} by the nominal operating voltage of the propulsion battery (V_b) shown in **Figure 5J**. Record this value as R_i / V_b on **Data Sheet No. 305-5** in **Appendix I**. This value must be equal to or greater than 500. If this value is less than 500, a test failure has occurred.
- v. If R_{i2} is less than R_{i1} then, divide R_{i2} by the nominal operating voltage of the propulsion battery (V_b) shown in **Figure 5J**. Record this value as R_i / V_b on **Data Sheet No. 305-5** in **Appendix I**. This value must be equal to

or greater than 500. If this value is less than 500, a test failure has occurred.

- d. Repeat **Step c** for increments of 180°, 270°, and 360°.

7. POST-ROLLOVER REQUIREMENTS

- a. After the required tests are completed, the Contractor shall:
 - i. Verify all data sheets are complete and take any remaining photographs.
 - ii. Complete **Form 2 of Appendix I, the Report of Vehicle Condition Form**, including a word description of the vehicle's post-test condition.
 - iii. Copy applicable pages of the Vehicle Owner's Manual for attachment to the test reports.
 - iv. Remove all instrumentation from vehicle. Return vehicle to its pre-test condition and move the test vehicle to a secure area.
 - v. Place all original records in a secure and organized file to await test data disposition.