

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

LABORATORY TEST PROCEDURE

FOR

FMVSS 203

**Impact Protection for the Driver
from the Steering Control System**



SAFETY ASSURANCE
Office of Vehicle Safety Compliance
Room 6115, NSA-30
400 Seventh Street, SW
Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 203
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1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Test Procedures (TPs) which serve as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures (TPs) is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Test Procedure (TP) is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used.

The OVSC 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 compliance test data.

NOTE:

The OVSC Laboratory Test Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Test Procedures specify test conditions, which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures (TPs).

2. GENERAL REQUIREMENTS

The purpose of S203, Impact Protection For The Driver From The Steering Control System, is to minimize chest, neck and facial injuries. When the steering control is impacted in accordance with SAE J944, Jun 1980, at a velocity of 15 mph, the impact force transmitted to the steering column shall not exceed 2,500 lbs. except for intervals whose cumulative duration is not more than 3 milliseconds (ms) or 0.003 seconds.

FMVSS 203 applies to passenger cars, multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 lb or less. It does not apply to vehicles with air bags or walk-in vans. Forward control vehicles that do not meet the requirements of FMVSS 203 must have a Type 2 seat belt that conforms to FMVSS 209 installed for the driver.

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test vehicles and Government Furnished Property (GFP) from unauthorized personnel during the entire compliance-testing program. The contractor is financially responsible for any acts of theft and/or vandalism, which occur during the storage of test vehicles and GFP. Any security problems, which arise, shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

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

NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM OR OVSC PERSONNEL, SHALL BE ALLOWED TO WITNESS ANY VEHICLE OR EQUIPMENT ITEM COMPLIANCE TEST OR TEST DUMMY CALIBRATION UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a vehicle test schedule to the COTR prior to conducting the first compliance test. The first delivered vehicle shall be tested within 6 weeks after receiving the unit. Subsequent vehicle tests shall be completed in no longer that 1-week intervals.

Scheduling of vehicle tests shall be adjusted to permit vehicles to be tested to other FMVSSs as may be required by the OVSC. All vehicle compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired. The contractor shall submit a monthly test status report and a vehicle status report to the COTR. The vehicle status report shall be submitted until all vehicles are disposed of. Samples of the required monthly status reports are contained in the Forms section.

6. TEST DATA DISPOSITION

The contractor shall make all vehicle preliminary compliance test data available to the COTR at the test site immediately after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR within five working days. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR.

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

7. GOVERNMENT FURNISHED PROPERTY (GFP)

GFP shall consist of test vehicles.

ACCEPTANCE OF TEST VEHICLE

The Contractor has the responsibility of accepting the test vehicle from either a new car dealer or a vehicle transporter. In both instances, the contractor acts in the OVSC's behalf when signing an acceptance of the test vehicle. If the vehicle is delivered by a dealer, the contractor must check to verify the following:

- A. All options listed on the "window sticker" are present on the test vehicle.
- B. Tires and wheel rims are new and the same as listed.
- C. There are no dents or other interior or exterior flaws.
- D. The vehicle has been properly prepared and is in running condition.
- E. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
- F. Proper fuel filler cap is supplied on the test vehicle.

If the test vehicle is delivered by a government-contracted transporter, the contractor should check for damage, which may have occurred during transit.

A "Vehicle Condition" form, which is shown on the next page, will be supplied to the contractor by the COTR when the test vehicle is transferred from the new car dealer or between test contracts. The upper half of the form describes the vehicle in detail, and the lower half provides space for a detailed description of the posttest condition. Vehicle Condition forms must be returned to the COTR with the copies of the Final Test Report or the reports will NOT be accepted.

NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a test vehicle has been delivered.

REPORT OF VEHICLE CONDITION AT THE COMPLETION OF TESTING

CONTRACT NO.: DTNH22- _____ DATE: _____

FROM: _____

TO: _____

The following vehicle has been subjected to compliance testing for FMVSS _____

The vehicle was inspected upon arrival at the laboratory for the test and found to contain all of the equipment listed below. All variances have been reported within 2 working days of vehicle arrival, by letter, to the NHTSA Industrial Property Manager (NAD-30), with a copy to the OVSC COTR. The vehicle is again inspected, after the above test has been conducted, and all changes are noted below. The final condition of the vehicle is also noted in detail.

MODEL YEAR/MAKE/MODEL/BODY STYLE: _____

NHTSA NO.: _____ BODY COLOR; _____ VIN: _____

ODOMETER READINGS: ARRIVAL - _____ miles DATE - _____

COMPLETION - _____ miles DATE - _____

PURCHASE PRICE: \$ _____ DEALER'S NAME: _____

ENGINE DATA: _____ Cylinders _____ Liters _____ Cubic Inches

TRANSMISSION DATA: _____ Automatic _____ Manual _____ No. of Speeds

FINAL DRIVE DATA: _____ Rear Drive _____ Front Drive _____ 4 Wheel Drive

TIRE DATA: Size - _____ Mfr. - _____

CHECK APPROPRIATE BOXES FOR VEHICLE EQUIPMENT:

<input type="checkbox"/>	Air Conditioning	<input type="checkbox"/>	Traction Control	<input type="checkbox"/>	Console
<input type="checkbox"/>	Tinted Glass	<input type="checkbox"/>	All Wheel Drive	<input type="checkbox"/>	Driver Air Bag
<input type="checkbox"/>	Power Steering	<input type="checkbox"/>	Speed Control	<input type="checkbox"/>	Passenger Air Bag
<input type="checkbox"/>	Power Windows	<input type="checkbox"/>	Rear Window Defroster	<input type="checkbox"/>	Front Disc Brakes
<input type="checkbox"/>	Power Door Locks	<input type="checkbox"/>	Sun Roof or T-Top	<input type="checkbox"/>	Rear Disc Brakes
<input type="checkbox"/>	Power Seat(s)	<input type="checkbox"/>	Tachometer	<input type="checkbox"/>	
<input type="checkbox"/>	Power Brakes	<input type="checkbox"/>	Tilt Steering Wheel	<input type="checkbox"/>	
<input type="checkbox"/>	Antilock Brake System	<input type="checkbox"/>	Clock	<input type="checkbox"/>	
<input type="checkbox"/>	AM/FM/Cassette Radio	<input type="checkbox"/>	Roof Rack	<input type="checkbox"/>	

LIST OTHER PERTINENT OPTIONAL EQUIPMENT ON NEXT PAGE (REMARKS SECTION)

REPORT OF VEHICLE CONDITION AT THE COMPLETION OF TESTING...Continued

REMARKS:

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

Explanation for equipment removal:

Test Vehicle Condition:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

8. CALIBRATION OF TEST INSTRUMENTS

Before the contractor initiates the safety compliance test program, a test instrumentation calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

- 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 TO EXCEED TWELVE (12) MONTHS! 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 will be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment
- D. A written calibration procedure shall be provided by the contractor which includes as a minimum the following information for all measurement and test equipment:
 - (1) Type of equipment, manufacturer, model number, etc.
 - (2) Measurement range
 - (3) Accuracy
 - (4) Calibration interval
 - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
- E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner, which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration procedure must be approved by the COTR before the test program commences.

9. PHOTOGRAPHIC DOCUMENTATION

Photographs, if required, shall be glossy black and white, 8 x 10 inches, and properly focused for clear images. A tag, label or placard identifying the test vehicle model, NHTSA number and date shall appear in each photograph and must be legible. Each photograph shall be labeled as to the subject matter.

As a minimum the following photographs shall be included in EACH vehicle final test report:

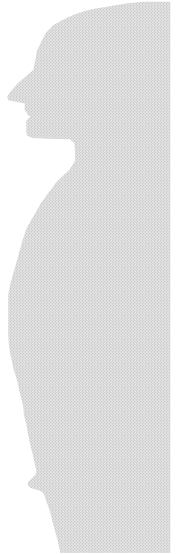
- A. 3/4 frontal view from left side of vehicle
- B. 3/4 rear view from right side of vehicle
- C. Vehicle's certification label
- D. Vehicle's tire information label
- E. Load cell and displacement transducer and attachment to the steering assembly (SEVERAL VIEWS)
- F. Any device installed into the steering assembly before and after the test
- G. Steering assembly before and after the test
- H. Steering column shear capsule before and after the test
- I. Side view from the driver side of test specimen and test device before and immediately following the test
- J. Instrumentation setup
- K. Any damage or apparent test failure condition that cannot be seen in the above photographs

10. DEFINITIONS

BODY BLOCK, BLAK TUFFY DEVICE or IMPACT DUMMY

Torso-shaped body block which has the following characteristics:

- A. SPRING RATE — 107 to 143 kg/cm when the chest is loaded by a 4" wide by 15" long beam, 90° to the longitudinal axis of the body block and parallel to the backing plate.
- B. Weight — 75 lbs + 5 lbs, - 0 lbs
- C. Center of gravity (CG) — 21.7" \pm 0.25" from the top of the head
- D. Moment of inertia — around the lateral axis through the CG shall be 20 in.-lb. seconds² \pm 2 in.-lb seconds².
- E. Specific details can be found in SAE Recommended Practice SAE J944



FORWARD CONTROL

Configuration in which more than ½ the engine length is rearward of the forward point of the windshield base and the steering wheel hub is in the forward quarter of the vehicle length.

JEWELRY

Watches, rings, and bracelets without loosely attached or dangling members.

PELVIC RESTRAINT

Seat belt assembly or portion thereof intended to restrain movement of the pelvis.

SEATING REFERENCE POINT (SRP)

Manufacturer's design reference point which —

- (A) Establishes the rearmost normal design driving or riding position of each Designated Seating Position (DSP) in a vehicle
- (B) Has coordinates established relative to the designed vehicle structure

10. DEFINITIONS....Continued

- (C) Simulates the position of the pivot center of the human torso and thigh
- (D) Is the reference point employed to position the two dimensional templates described in SAE Recommended Practice J826, "Manikins for Use in Defining Vehicle Seating Accommodations," Nov62

DESIGNATED SEATING POSITION (DSP)

Any plan view location capable of accommodating a person at least as large as a 5th percentile adult female.

STEERING COLUMN

Structural housing that surrounds a steering shaft

STEERING CONTROL SYSTEM

Basic steering mechanism and its associated trim hardware, including any portion of a steering column assembly that provides energy absorption upon impact

STEERING SHAFT

Component that transmits steering torque from steering wheel to steering gear

TYPE 2 SEAT BELT ASSEMBLY

Combination pelvic and upper-torso restraint

UNLOADED VEHICLE WEIGHT (UVW)

Weight of 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

UPPER-TORSO RESTRAINT

Portion of a seat belt assembly intended to restrain movement of the chest and shoulder regions

VEHICLE TEST ATTITUDE

Distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition.

10. DEFINITIONS...Continued

"AS DELIVERED" CONDITION

Test vehicle as received at the test site, with 100% of all fluid capacities and all tires inflated to the manufacturer's specifications as listed on the vehicle's tire placard

11. PRETEST REQUIREMENTS

Prior to conducting any vehicle compliance tests, contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes a step-by-step description of the methodology to be used. Written approval must be obtained from the COTR before initiating the vehicle compliance test program so that all parties are in agreement.

The contractor's test procedure shall contain a complete listing of test equipment and a detailed check-off list. There shall be no contradiction between the OVSC Laboratory Test Procedure and the contractor's in-house test procedure. The list of test equipment shall include instrument accuracy and calibration dates.

TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in the applicable OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the applicable OVSC Laboratory Test Procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement vehicle (with the same equipment as the original vehicle) and all costs associated with conducting the retest. The original test specimen (vehicle) used for the invalid test shall remain the property of OVSC, and the retest specimen shall remain the property of the contractor. If there is a test failure, the contractor shall retain the retest specimen for a period not exceeding 180 days. If there is no test failure, the Contractor may dispose of the test specimen upon notification from the COTR that the final test report has been accepted.

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after receipt of notification by the Contracting Officer that a retest is required. If a retest is conducted, no test report is required for the original test.

12. COMPLIANCE TEST EXECUTION

PREPARATION OF SPECIMENS

All testing shall be performed with the steering control system in its INSTALLED DESIGN CONFIGURATION. Due to the limited space inside a vehicle and the normal fixturing requirements of an impact test device, the test vehicle shall be cut in half as described later. All vehicle procedures shall be described in detail in the laboratory operating test procedure which shall be accepted by the NHTSA COTR before testing commences.

VEHICLE PREPARATION

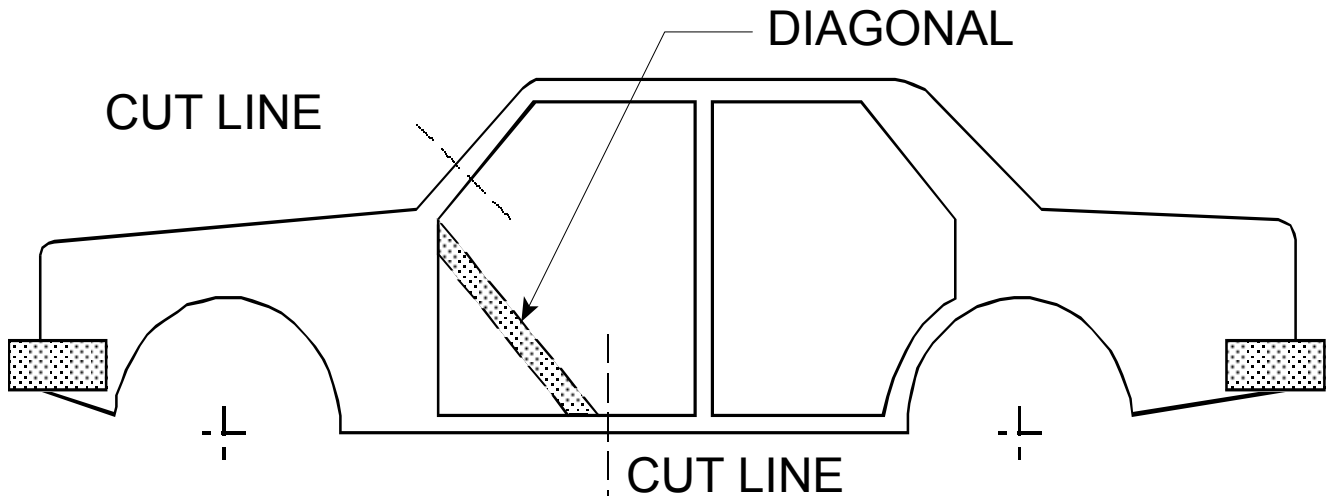
- A. Wash and clean the vehicle. Inspect the test vehicle per receiving inspection procedures to ascertain completeness, function, and operation. Record and notify the COTR of any abnormal conditions that could influence the test results.
- B. Determine if any component or attachment hardware, including the horn actuating mechanism or trim hardware can catch the driver's clothing or jewelry during normal driving maneuvers. Record findings on the data sheets.
- C. Obtain all necessary photographs.
- D. Tire inflation pressure — All tires shall be inflated to the vehicle manufacturer's specifications as listed in the owner's manual for the vehicle and on the vehicle tire placard.
- E. Weigh the vehicle.
- F. Locate the vehicle on a flat, horizontal surface. Record the normal vehicle ride attitude. This is accomplished by measuring the angles relative to a horizontal plane, from front-to-rear and from the left side to the right side. The front-to-rear angle shall be measured along a fixed reference on the steering column, and the side-to-side angle shall be measured along the bottom center portion of the windshield frame as these references shall be a part of the body buck throughout the test sequence.
- G. Drain the fuel tank and fuel lines (run engine until no fuel is available).
- H. Remove the windshield, front doors, and front seats. Any components removed from the vehicle shall be placed in a container with the vehicle NHTSA number.
- I. Remove the drive shaft (if rear wheel drive only).

12. COMPLIANCE TEST EXECUTION....Continued

- J. Examine the floor pan and underside of the vehicle to determine a suitable area for cutting the vehicle as shown in Figure 1. The lateral cut across the floor pan should be elected to minimize the removal of underbody components such as transmission, etc. Components shall not be removed or damaged where such action could affect the stiffness of the steering control system. (i.e. steering box, steering linkage, etc.)

NOTE: Whatever is used to establish the SRP must be retained with the test specimen.

INSTALL DIAGONAL BEFORE CUTTING VEHICLE BODY



SIDE VIEW OF VEHICLE DIAGONAL REINFORCEMENT

FIGURE 1

- K. Select a cut line along the A-pillars slightly above the lower windshield frame, both sides. The A-pillars should remain if the test device can be situated in the vehicle without their removal.
- L. If the cut line across the floor pan lies aft of the forward seat anchor, a suitable reinforcement shall be installed on both sides between the A-pillar and the door sill as shown on the next page. This is done to maintain the installed design configuration of the steering control system. (i.e. steering box, steering linkage, etc.)

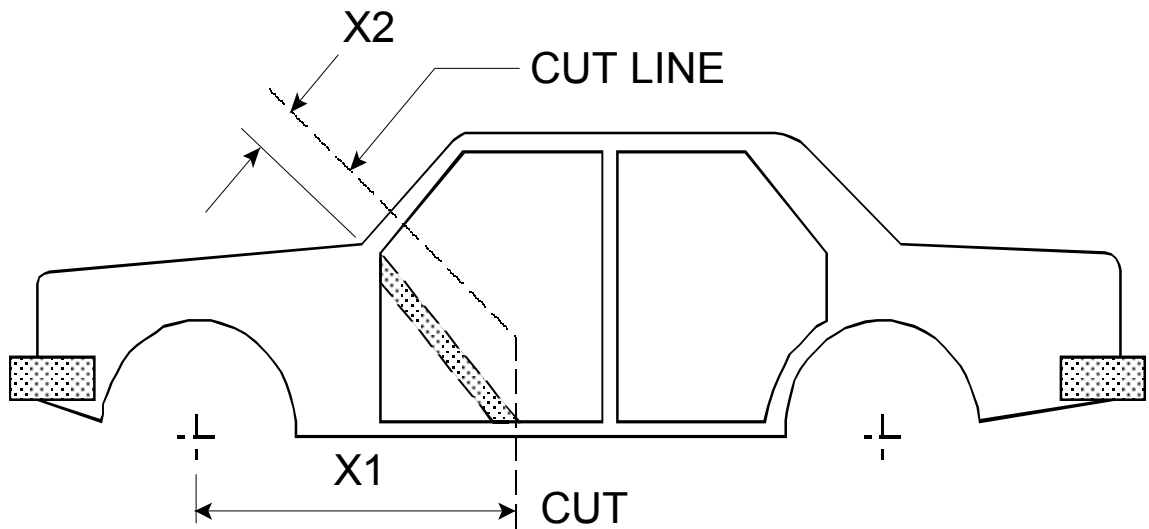
12. COMPLIANCE TEST EXECUTION....Continued

- M. After the reinforcement is installed, and the front and rear sections of the vehicle are supported, cut the vehicle in half along the cut lines chosen (see Figure 2).

NOTE: EXTREME CAUTION SHOULD BE EXERCISED WHEN CUTTING NEAR OR THROUGH BRAKE LINES, FUEL LINES IN AUTOMATIC TRANSMISSION FLUID LINES, ETC.

- N. Secure the reinforced test buck on a rigid, horizontal fixture so that it is adequately restrained at the vehicle underbody and "A" pillar to prevent translation and rotation of the test buck during the test. The vehicle shall be secured to the test fixture using wire rope, turnbuckles, strap plates, etc.

The buck must be positioned to maintain the installed design configuration of the steering control system and duplicate the measured steering column angle and vehicle attitude within $\pm 1^\circ$.



CUT LINES ACROSS "A" PILLAR AND FLOOR PAN

FIGURE 2

12. COMPLIANCE TEST EXECUTION....Continued

LOAD CELL INSTALLATION

A three (3) axis load cell having a force rating of at least 5,000 pounds force in the X-Axis and 2,500 pounds force in the Y-Axis and Z-Axis, must be installed into the steering control system between the steering wheel and the column as shown in Figure 3. This cell will be used to measure the force, in each of 3 mutually perpendicular axes, exerted on the steering control system by the impact dummy.

The added length to the steering column along the X-Axis shall be minimized as a result of the addition of the load cell. Also the diameter of the load cell shall be minimized as a result of the addition of the load cell, or an extensive increase in the length of the column could affect the validity of impact test results. A representative load cell suitable for this test is a Robert A. Denton, Inc. Model 1968 5-Axis Load Cell having a diameter of 4.5" and a length (along the X-Axis) of 2".

STEERING COLUMN LOAD CELL INSTALLATION

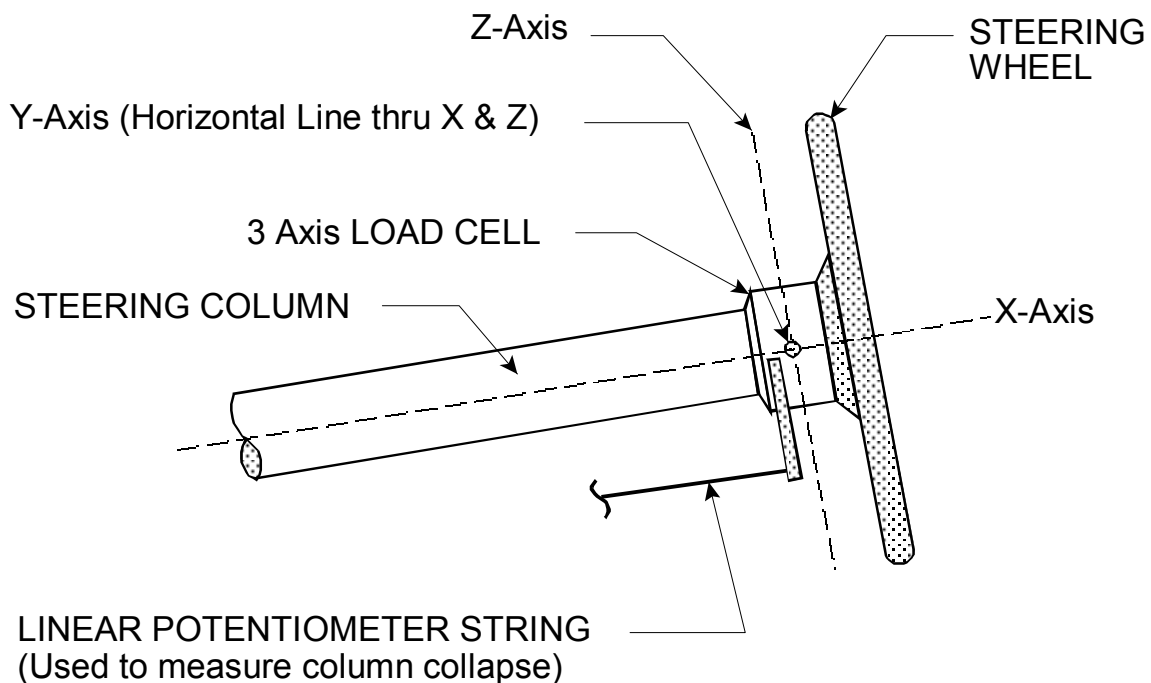


FIGURE 3

INSTALLATION OF THE DISPLACEMENT POTENTIOMETER

A suitable displacement transducer having a usable range of at least 10" shall be installed to measure the axial movement of the steering wheel hub during the test. A representative displacement transducer suitable for this test is a Celesco Model PT-101-0020 high "G" string potentiometer with a usable stroke of 20".

12. COMPLIANCE TEST EXECUTION....Continued

INSTALLATION OF TIME ZERO SWITCH

A suitable contact switch shall be mounted to the steering wheel at the point of impact time zero.

PRETEST PROCEDURE

Verify that the impact dummy (Body Block), complete with adapting hardware and instrumentation, satisfies the physical requirements as established in the test equipment section of this procedure.

The vertical relationship between the impact dummy and the steering wheel shall be established as shown in Figure 4.

Using Seating Reference Point (SRP) information obtained from the test vehicle manufacturer, determine the vertical dimension (H1) between the lower edge of the steering wheel and the SRP of the driver.

Determine the vertical increase (H2) caused by the installation of the load cell between the steering wheel and the steering column.

$$H2 = L \text{ (Load Cell Length)} \times \text{Sine of Angle } M \text{ (degrees)}$$

Calculate the vertical distance (H3) the impact dummy (Body Block) will drop during free flight (unrestrained in the vertical direction prior to impact).

Using Figure 3 as a reference, position the impact dummy in the propulsion device such that the top of the head is the following distance above the lower rim of the steering wheel as shown in Figure 4.

$$33.75" - H1 + H2 + H3$$

Center the impact dummy laterally about a vertical longitudinal plane (parallel to the vehicle centerline) intersecting the centerline of the steering wheel rim.

If the steering control system under test is equipped with adjustment features, the adjustments shall be at their midpoints for the purpose of locating the impact dummy (Body Block). The setting of these adjustments during the impact test will be selected by the test laboratory and confirmed by the COTR prior to testing. The configuration chosen shall constitute the most severe (rigid) condition likely to occur during normal driving. The impact dummy and the test specimen shall be stabilized at an ambient temperature between 70°F and 85°F for at least 4 hours prior to testing (Reference: SAE J944).

12. COMPLIANCE TEST EXECUTION....Continued

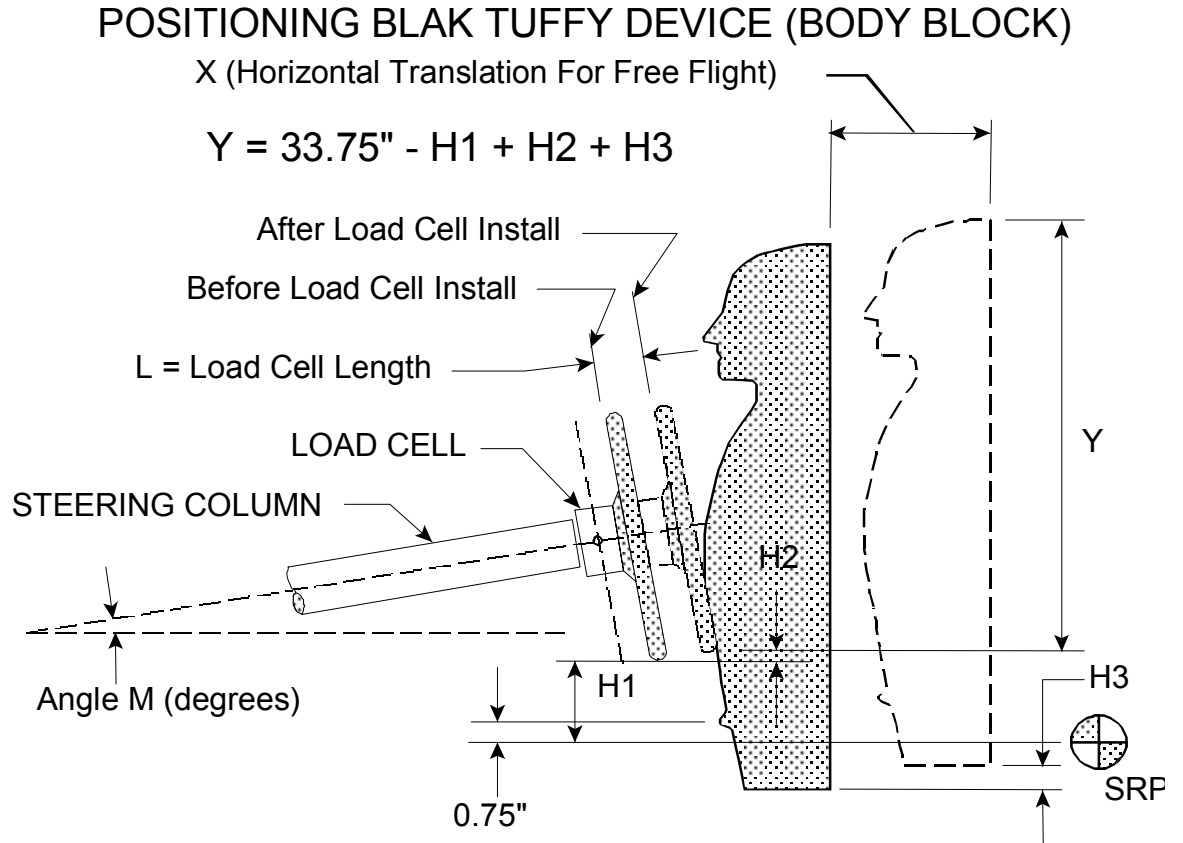


FIGURE 4

Connect all instrumentation to the data recording system and verify that all channels are functioning properly.

Take pretest photographs as described in section 8 and as necessary to document the setup and fixturing.

EXECUTION OF IMPACT TEST

Recheck all data channels to insure proper operation and set zero levels.

Enable the propulsion system and data recording system.

Activate the propulsion system and data system and data recording system.

TEST EQUIPMENT REQUIREMENTS

The test equipment requirements for S203 testing in terms of overall performance guidelines are outlined in this section. The information is broken down into two categories:

12. COMPLIANCE TEST EXECUTION....Continued

- A. The first addresses the overall impactor design as well as the required velocity measurement system
- B. The second covers all other test equipment items

IMPACTOR DESIGN AND VELOCITY MEASUREMENT

The impactor refers to the test apparatus used to fixture the steering column assembly as well as the mechanism employed to position and propel the impact dummy (Body Block or Blak Tuffy Device) into the steering column in the proper direction and at a speed of 14.75 mph plus or minus 0.15 mph. As noted in the previous section on "Preparation of Specimen", this test procedure requires that the steering column remain in the test vehicle as supplied by the manufacturer.

During vehicle preparation, the front portion of the test vehicle is separated from the rear portion and then secured to a test frame. The vehicle is cut in half in the area of the driver's seating area as appropriate to secure the front portion of the car to the test frame. The test frame must be of sufficient strength, weight, and rigidity to maintain the vehicle buck essentially stationary throughout the impact event.

The impact dummy (Body Block or Blak Tuffy Device) accelerator system is secured to the test fixture in the area directly behind the steering column, the test fixture should allow for convenient adjustment of the dummy in the fore/aft, vertical, and lateral directions with respect to the steering column.

The test fixture and impactor system is shown in Figure 5. The test frame utilizes two longitudinal rails on each side of the fixture that are used to mount the test vehicle body buck as well as a vertical frame that supports the impact dummy accelerator system.

The vehicle body buck is secured to the bed of the fixture and an electric motor driven winch controls the fore/aft position of the vertical frame. The vertical frame includes a crossbeam that can be raised and lowered by a motor driven lead screw. A platform on the cross beam is also motorized to allow the impact dummy accelerator to be adjusted laterally along the full width of the cross beam.

This system thereby provides an efficient method to fixture the test vehicle body buck on the horizontal frame rails and then independently position the Blak tuffy device or dummy in the required impact location. The impact dummy is propelled forward parallel to the longitudinal centerline of the vehicle laterally aligned on the center of the steering wheel hub. The height of the impact dummy is located with respect to the SRP of the vehicle and the preimpact distance between the steering column and the dummy is set to minimize free flight fall due to gravity.

12. COMPLIANCE TEST EXECUTION....Continued

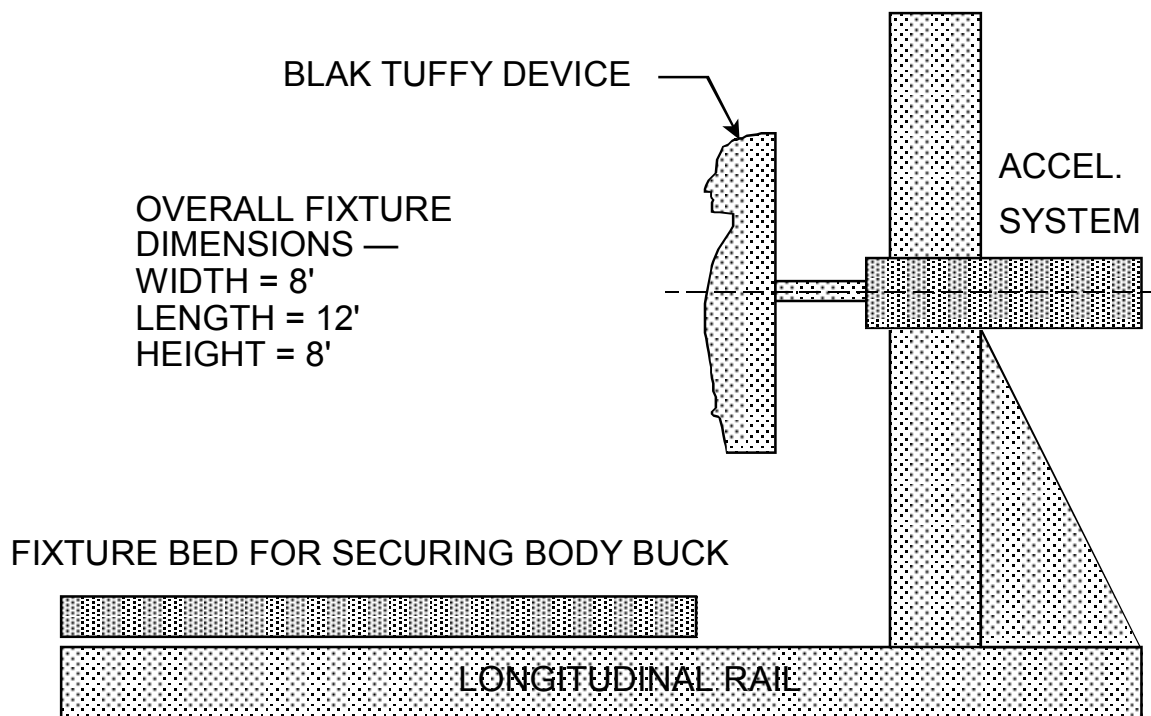
TYPICAL FMVSS 203 TEST FIXTURE AND
IMPACT DUMMY ACCELERATOR

FIGURE 5

The impact dummy accelerator should consist of a suitable apparatus to properly position the Blak Tuffy Device with respect to the steering control prior to the impact. The impact dummy must be maintained in a stable attitude throughout the acceleration phase and be in free-flight when striking the column at a speed of 14.75 mph plus or minus 0.15 mph.

Two independent methods shall be employed to measure the speed of the impact dummy.

- A. One measurement should be the speed of the accelerator system just prior to impact dummy separation
- B. The second system should measure the speed of the impact dummy in free flight within 3" prior to contacting the steering wheel.

The accelerator system must be capable of achieving a speed accuracy of 14.75 mph \pm 0.15 mph.

The speed of the impact dummy can be measured with a noncontacting optical system that is based on the measured time interval for the impact dummy to travel a distance of 1". Impact speed is then determined from the ratio of the known distance and the measured time interval.

12. COMPLIANCE TEST EXECUTION....Continued

The recorded speed is the average speed over a 1" travel distance within 3" of contact.

A representative impact dummy accelerator system proposed for S203 impact testing is shown in Figure 6. In this system, a hub on the back of the impact dummy slides into a low friction-mating hole on the impactor piston. The accelerator is pneumatically fired and includes an optical velocity sensor to measure impact dummy speed just prior to separation from the piston tube.

TYPICAL FMVSS 203 TEST SETUP

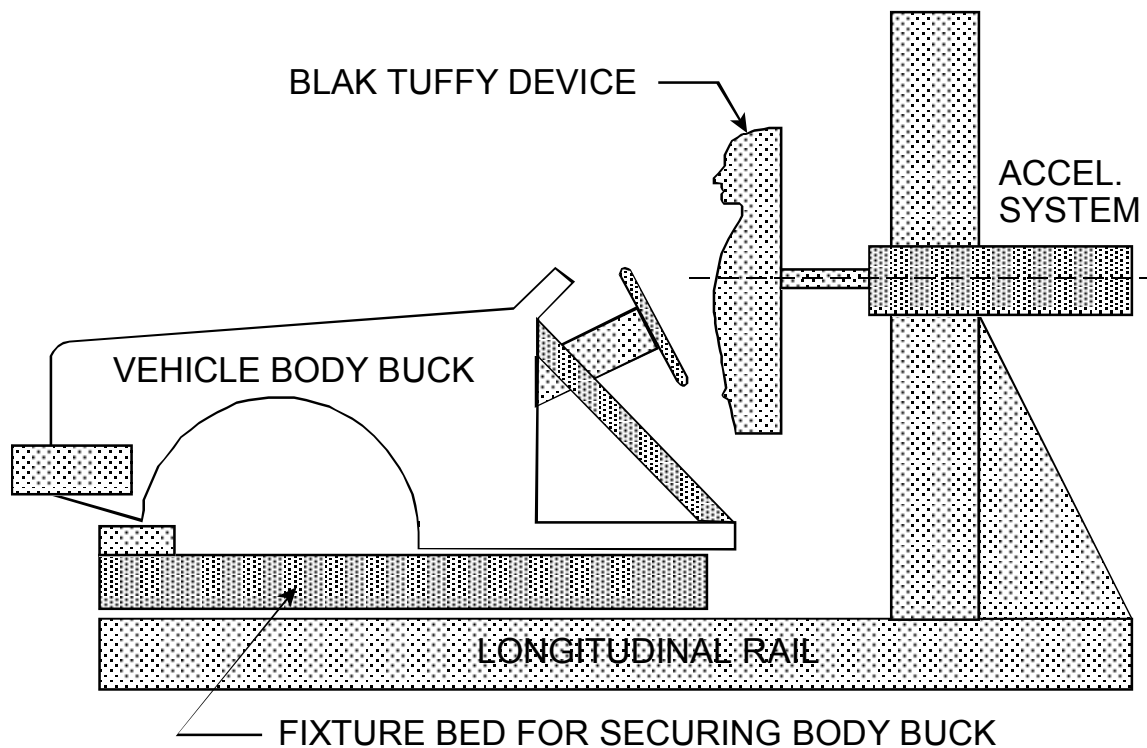


FIGURE 6

The impact dummy separates from the impactor and then travels in free flight until it strikes the steering column. Two eye hooks mounted on the back, topside of the impact dummy contain a small diameter cable attachment to prevent the dummy from falling on the floor after impact. Care should be used to allow sufficient cable length so that the cable does not restrain the impact dummy during the column collapse time of the impact.

A laser based velocity sensor is suitable for body block impact speed measurement. A 1" wide wand can be attached to the impact dummy which passes through the laser beam just prior to striking the steering column. The time interval for the 1" wide velocity wand to pass through the laser beam is recorded on the interval timer.

12. COMPLIANCE TEST EXECUTION....Continued

TEST EQUIPMENT

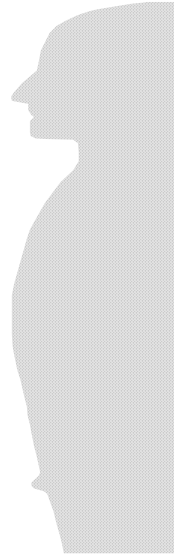
This subsection discusses the test equipment required to conduct an S203 test. The performance requirements for the equipment are summarized here along with the required accuracy and range for the equipment.

Test Frame and Impactor — a suitable test fixture and impactor system is required.

Blak Tuffy Device (Body Block) — the impact dummy shall conform to the requirements as outlined in the Society of Automotive Engineers Recommended Practice SAE J944, Jun 1980. A copy of this procedure is included as Appendix A.

Verification that the body block meets the SAE J944 Characteristics for the following must be included in the test report.

- A. Spring Rate — 107 to 143 kg/cm when chest is loaded by a 4" wide by 15" long beam, 90° to the longitudinal axis of the body block, and parallel to the backing plate
- B. Weight — 75 lbs + 5 lbs, - 0 lbs
- C. Center of Gravity (CG) — 21.7" \pm 0.25" from the top of the head
- D. Moment of Inertia — around the lateral axis through the CG of the body block shall be 20 in-lb second² \pm 2 in-lb second²)



DUMMY ACCELEROMETERS

A 3-axis or triaxial accelerometer shall be mounted on the back surface vertical center of gravity of the Blak Tuffy Device. The accelerometer shall be suitable for impact testing work, and must provide a frequency response from measured acceleration to final data channel class 180. See SAE J211, Jun80, for complete details on the data channel requirements. A full-scale range of at least 100 Gs is required for the impact dummy accelerometer.

12. COMPLIANCE TEST EXECUTION....Continued

STEERING COLUMN LOAD CELL

A 3-axis load cell is required to measure the impact load on the steering column. The load cell should be small as practical to minimize steering wheel location changes and should have full ranges as follows:

Along column axis	5,000 lbs
Perpendicular to column axis	2,500 lbs

The frequency response for the load data channels should also conform to channel class 600 as specified in SAE J211, Jun80.

COLUMN DISPLACEMENT

A displacement transducer suitable for measuring dynamic steering column collapse is required with a travel range of at least 10". A high G type string potentiometer is recommended for this purpose.

TIME ZERO CONTACT SWITCH

A low force constant switch is required to measure the time of initial contact of the impact dummy with the steering wheel rim. The switch should be mounted on the steering wheel rim at the first point of contact by the striking Blak Tuffy Device. The switch shall be flat and not affect the impact force.

VELOCITY SENSOR

Two (2) non-contacting optical velocity sensors are required to obtain a redundant measurement of the impact speed. The sensors should be capable of measuring the impact speed at a velocity of $14.75 \text{ mph} \pm 0.15 \text{ mph}$. The sensors should be operated from independent power supplies such that no single system failure results in a loss of both speed measurements.

INSTRUMENTATION AND RECORDING SYSTEM

Eight (8) data channels of instrumentation amplifiers, calibration circuitry, and recording equipment are required to record the test data. The data channels to be recorded are as shown on the next page.

Note that the complete end point to end point frequency response for each data channel must conform to channel Class data. If data are recorded at a higher frequency response, final results should be processed to obtain a final output corresponding to the data class requirements. All data must conform to all of the requirements of SAE J211, Jun80.

12. COMPLIANCE TEST EXECUTION....Continued

CHANNEL NO.	PARAMETER	CHANNEL	DATA CLASS
1	Dummy Acceleration	Ax	180
2	Dummy Acceleration	Ay	180
3	Dummy Acceleration	Az	180
4	Column load	Fc	600
5	Column load	Fy	600
6	Column load	Fz	600
7	Column Collapse	Lc	600
8	Time Zero	t(0)	600

13. POST TEST REQUIREMENTS

- A. Store all recorded data on hard storage such as magnetic tape or floppy disk.
- B. Obtain necessary post test photographs as described in paragraph 4.6.4 and as required to illustrate deformation in the steering control system and mounting.
- C. Process the test data to obtain the following:
 - (1) X-Axis Force vs. Time
 - (2) Y-Axis Force vs. Time
 - (3) Z-Axis Force vs. Time
 - (4) Resultant Force vs. Time (Column)
 - (5) X-Axis Acceleration vs. Time
 - (6) Y-Axis Acceleration vs. Time
 - (7) Z-Axis Acceleration vs. Time
 - (8) Resultant Acceleration vs. Time
 - (9) Resultant Force vs. Time (Body Block)
 - (10) Steering Column Deformation
 - (11) Time Zero Switch vs. Time
 - (12) Impact Velocity
 - (13) Determine if the Resultant Force (Column or Body Block) exceeds 2,500 pounds for any interval 3 ms duration or longer.

The contractor shall re-verify all instrumentation and check data sheets and photographs.

14. REPORTS

14.1 MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and a Vehicle Status Report to the COTR. The Vehicle Status Report shall be submitted until all vehicles are disposed of. Samples of the required Monthly Status Reports are contained in the report forms section.

14.2 APPARENT NONCOMPLIANCE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). A Notice of Test Failure (see report forms section) with a copy of the particular compliance 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 critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

14.3 FINAL TEST REPORTS

14.3.1 COPIES

In the case of a test failure, seven (7) copies of the Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. The Final Test Report format to be used by all contractors can be found in the "Report Section".

Where there has been no indication of a test failure, four (4) copies of each Final Test Report shall be submitted to the COTR within 3 weeks of test completion. Payment of contractor's invoices for completed compliance tests may be withheld until the Final Test Report is accepted by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within 2 weeks after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to **PROOF READ** all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for contractors. Reports containing a significant number of errors will be returned to the contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

14. REPORTS...Continued

14.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) is relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself. The contractor should use **detailed** descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much **detail** as possible in the report. Instructions for the preparation of the first three pages of the final test report are provided below for the purpose of standardization.

14.3.3 FIRST THREE PAGES

A. FRONT COVER —

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

- (1) Final Report Number such as 203-ABC-9X-001 where
 - 203 is the FMVSS tested
 - ABC are the initials for the laboratory
 - 9X is the Fiscal Year of the test program
 - 001 is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

- (2) Final Report Title And Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS 203
 Impact Protection for the Driver
 from the Steering Control System
 * * * * *
 World Motors Corporation
 199X XYZ 4-door sedan
 NHTSA No. CX0401

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

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

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (3) AND (4)

14. REPORTS....Continued

- (4) Date of Final Report completion
- (5) The words "FINAL REPORT"
- (6) The sponsoring agency's name and address as follows
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6115 (NSA-30)
Washington, DC 20590

14. REPORTS...Continued**B. FIRST PAGE AFTER FRONT COVER —**

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

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance Date: _____

14. REPORTS...Continued

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

Block 1 — REPORT NUMBER

203-ABC-9X-001

Block 2 — GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 — RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 — TITLE AND SUBTITLE

Final Report of FMVSS 203 Compliance Testing of 199X World XYZ 4-door sedan, NHTSA No. CX0401

Block 5 — REPORT DATE

March 1, 199X

Block 6 — PERFORMING ORGANIZATION CODE

ABC

Block 7 — AUTHOR(S)

John Smith, Project Manager / Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070

14. REPORTS...Continued**Block 10 — WORK UNIT NUMBER**

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

US Department of Transportation
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance (NSA-30)
400 Seventh Street, SW, Room 6115
Washington, DC 20590

Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 199X

Block 14 — SPONSORING AGENCY CODE

NSA-30

Block 15 — SUPPLEMENTARY NOTES

Leave blank

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 199X World XYZ 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-203-XX for the determination of FMVSS 203 compliance. Test failures identified were as follows:

None

Note: Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

14. REPORTS...Continued**Block 17 — KEY WORDS**

Compliance Testing
Safety Engineering
FMVSS 203

Block 18 — DISTRIBUTION STATEMENT

Copies of this report are available from —
NHTSA Technical Reference Division
Room 5108 (NAD-52)
400 Seventh St., SW
Washington, DC 20590
Telephone No.: 202-366-4946

Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 — NUMBER OF PAGES

Add appropriate number

Block 22 — PRICE

Leave blank

14. REPORTS...Continued

14.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

- A. Section 1 — Purpose of Compliance Test
- B. Section 2 — Compliance Test Data Summary
- C. Section 3 — Compliance Test Data
- D. Section 4 — Noncompliance Data (if applicable)
- E. Section 5 — Photographs

15. DATA SHEETS

TEST VEHICLE RECEIVING-INSPECTION

VEHICLE YEAR/MAKE/MODEL/STYLE: _____

VEHICLE NHTSA NO.: _____ VIN: _____

DATE OF MANUFACTURE: _____ (See Certification Label)

LABORATORY: _____ TEST DATE: _____

OBSERVERS: _____

UPON RECEIPT, THE VEHICLE WILL BE EXAMINED VISUALLY FOR COMPLETENESS, FUNCTION AND DAMAGE. INSPECT FOR ANY ABNORMAL CONDITION, ESPECIALLY RELATING TO THE STEERING CONTROL SYSTEM, WHICH MAY INFLUENCE TEST RESULTS.

RESULTS OF INSPECTION: _____

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

PRETEST PREPARATION

VEHICLE YEAR/MAKE/MODEL/STYLE: _____

VEHICLE NHTSA NO.: _____ VIN: _____

DATE OF MANUFACTURE: _____ (See Certification Label)

LABORATORY: _____ TEST DATE: _____

OBSERVERS: _____

PRIOR TO TESTING THE FOLLOWING WILL BE ACCOMPLISHED:

- (1) DETERMINE IF ANY COMPONENT OR ATTACHMENT HARDWARE, INCLUDING THE HORN ACTUATING MECHANISM OR TRIM HARDWARE CAN CATCH THE DRIVER'S CLOTHING OR JEWELRY DURING NORMAL DRIVING MANEUVERS.

RESULTS: _____

- (2) DETERMINE THE UNLOADED VEHICLE WEIGHT (UVW) AS RECEIVED:

_____ lbs.

- (3) ALL TIRE PRESSURES SHALL MEET MANUFACTURERS RECOMMENDATIONS:

LEFT FRONT = _____ psi RIGHT FRONT = _____ psi

LEFT REAR = _____ psi RIGHT REAR = _____ psi

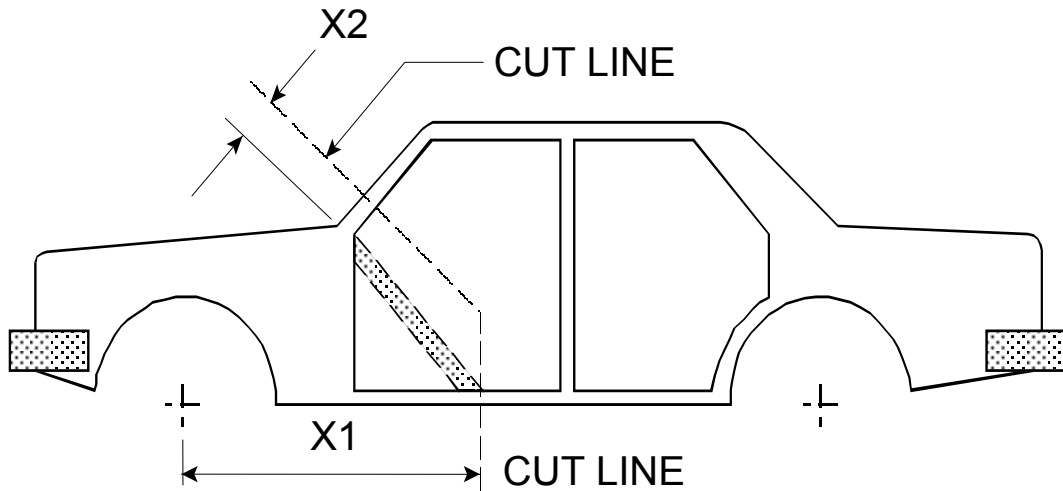
- (4) RECORD THE NORMAL VEHICLE RIDE ATTITUDE:

FRONT TO REAR = _____ inches

LEFT TO RIGHT = _____ inches

15. DATA SHEETS....Continued

(5) DETERMINE CUT LINES ACROSS A-PILLARS AND FLOOR PAN



CUT LINES ACROSS "A" PILLAR AND FLOOR PAN

X1 = _____ inches

X2 = _____ inches

(6) DESCRIBE STEERING COLUMN ATTACHMENT:

(7) IS STEERING CONTROL SYSTEM EQUIPPED WITH TILT STEERING WHEEL?

(8) DESCRIBE ANY OTHER STEERING ASSEMBLY DEVICES WHICH MAY AFFECT THE TEST:

15. DATA SHEETS....Continued

(9) DESCRIBE THE STEERING WHEEL CONSTRUCTION:

(10) DESCRIBE METHODOLOGY USED TO DETERMINE THE POSITION AND ROTATION OF THE STEERING WHEEL AS THE WORSE CASE TEST CONFIGURATION:

REMARKS:

RECORDED BY: _____

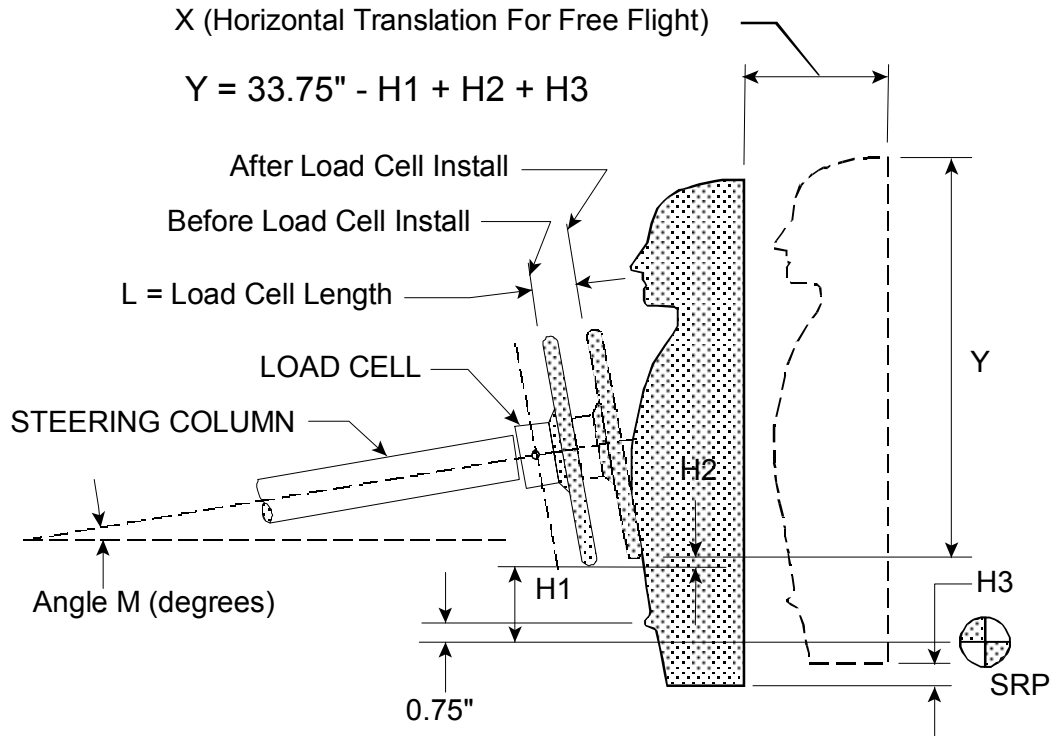
DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

FMVSS 203 IMPACT PROTECTION FOR THE DRIVER FROM THE STEERING CONTROL SYSTEM

POSITIONING BLAK TUFFY DEVICE (BODY BLOCK)



L (length of load cell) = ____ in

M (steering column angle) = ____ degrees

H1 (vertical dimension between the lower edge of the steering wheel and SRP of the driver) = ____ in

H2 (vertical increase caused by the load cell - $L \times \text{Sine } M$) = ____ in

H3 (vertical distance impact dummy will drop during free flight) = ____ in

Y (vertical relationship between the impact dummy and the steering wheel) = ____ in

15. DATA SHEETS....Continued

POST TEST INSPECTION

VEHICLE YEAR/MAKE/MODEL/STYLE: _____

VEHICLE NHTSA NO.: _____ VIN: _____

DATE OF MANUFACTURE: _____ (See Certification Label)

LABORATORY: _____ TEST DATE: _____

OBSERVERS: _____

UPON COMPLETION OF TESTING, A DETAILED VISUAL INSPECTION SHALL BE MADE.
DESCRIBE ALL DAMAGE AND DEFORMATION THAT OCCURRED DURING THE TEST

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

DATA REDUCTION SUMMARY SHEET

VEHICLE YEAR/MAKE/MODEL/STYLE: _____

VEHICLE NHTSA NO.: _____ VIN: _____

DATE OF MANUFACTURE: _____ (See Certification Label)

LABORATORY: _____ TEST DATE: _____

OBSERVERS: _____

DATA FROM THE PRIMARY DATA RECORDING SYSTEM ANALYZED AND THE PLOTS INCLUDED:

THE MAXIMUM RESULTANT FORCE:

_____ lbs at _____ milliseconds (ms)

MAXIMUM RESULTANT FORCE EXCLUDING MAXIMUMS WHOSE CUMULATIVE DURATION IS 3 MS OR LESS

_____ lbs at _____ milliseconds (ms)

DOES THE MAXIMUM RESULTANT FORCE EXCEED 2500 LBS FOR MORE THAN 3 MILLISECONDS?

_____ (Yes or No)

IF YES, GIVE THE DURATION: _____

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

16. FORMS

LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS NO.: 203 TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: DTNH22-_____ ; DELV. ORDER NO: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST VEHICLE MAKE/MODEL/BODY STYLE: _____

VEHICLE NHTSA NO.: _____; VIN: _____

VEHICLE MODEL YEAR _____; BUILD DATE: _____

TEST FAILURE DESCRIPTION: _____

S203 REQUIREMENT, PARAGRAPH _____ :

NOTIFICATION TO NHTSA (COTR): _____

DATE: _____ BY: _____

REMARKS: _____

16. FORMS...Continued

MONTHLY TEST STATUS REPORT

FMVSS 203

DATE OF REPORT: _____

NO.	VEHICLE NHTSA NO., MAKE & MODEL	COMPLIANCE TEST DATE	PASS/ FAIL	DATE REPORT SUBMITTED	DATE INVOICE SUBMITTED	INVOICE PAYMENT DATE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

16. FORMS...Continued

MONTHLY VEHICLE STATUS REPORT

FMVSS 203

DATE OF REPORT: _____

NO.	VEHICLE NHTSA NO., MAKE & MODEL	DATE OF DELIVERY	ODOMETER READING	TEST COMPLETE DATE	VEHICLE SHIPMENT DATE	ODOMETER READING
1						
2						
3						
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11						
12						
13						
14						

APPENDIX**STEERING CONTROL SYSTEM — PASSENGER CAR
LABORATORY TEST PROCEDURE
SAE J944 JUN80
SAE Recommended Practice****1. SCOPE**

This SAE Recommended Practice describes a laboratory test procedure for evaluating the characteristics of steering control systems under simulated driver impact conditions. The test procedure employs a torso-shaped body block which is impacted against the steering control system.

2. DEFINITION

For the purposes of this recommended practice, the steering control system is defined as that portion of the vehicle steering mechanism that may affect the occupant impact characteristics.

3. REFERENCE - - SAE J977**4. ITEMS TO BE DETERMINED**

- 4.1 Impact velocity of the body block.
- 4.2 Peak resultant force of the impact.

5. TEST EQUIPMENT AND INSTRUMENTATION**5.1 BODY BLOCK**

The complete body block shall have the following characteristics:

5.1.1 SPRING RATE

107 kg/cm to 143 kg/cm when the chest is loaded by a 4 inch wide by 15 inch long (10.0 cm by 38.0 cm) beam, 90 degrees to the longitudinal axis of the body block, and parallel to the backing plate (see Figure 1). The center of the beam is placed 18.0 ± 0.25 inches (45.7 cm \pm 0.63 cm) from the top of the head, centered laterally, and preloaded to 5 pounds (2.26 kg) including the weight of the beam to establish baseline penetration. Test speed is 10 ± 2 inches/minute (25.0 cm/minute \pm 5 cm/minute). The load is measured when the beam has moved 0.50 inches (12.7 cm) into the body block from the baseline and the spring rate is obtained by doubling this load.

TEST BEAM LOCATION

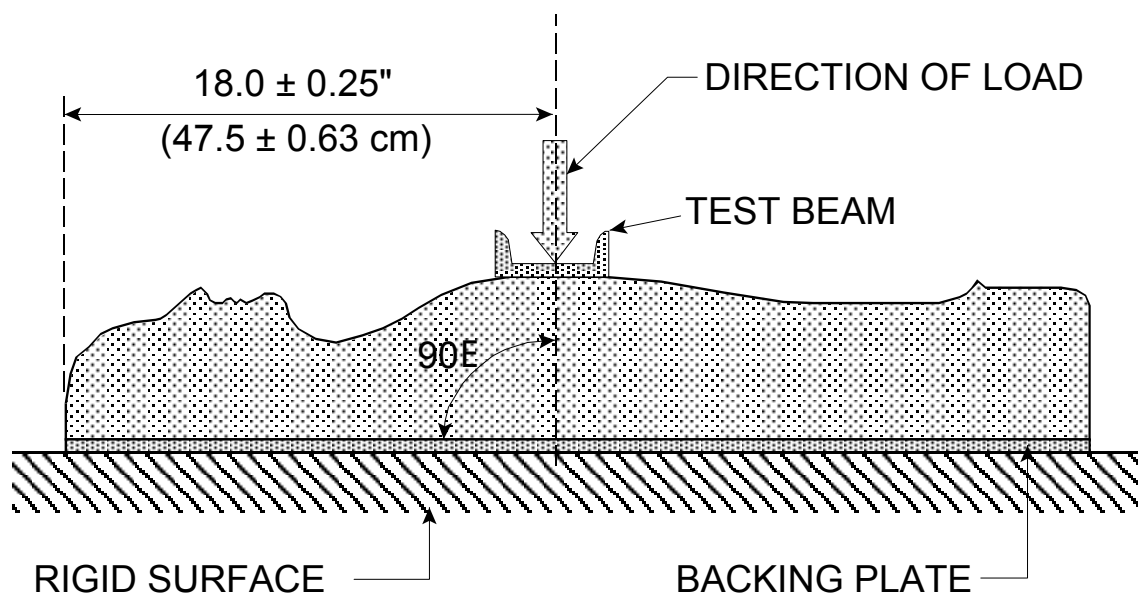


FIGURE 1

5.1.2 WEIGHT

The body block shall weigh 75 pounds, + 5 pounds, - 0 pounds (33.97 kg, + 2.26 kg, - 0 kg).

5.1.3 BODY BLOCK CENTER OF GRAVITY

The center of gravity of the complete body block shall be 21.7 ± 0.25 inches ($55.12 \text{ cm} \pm 0.63 \text{ cm}$) from the top of the head.

5.1.4 MOMENT OF INERTIA

The moment of inertia around the lateral axis through the center of gravity of the complete body block shall be 20 ± 2 in-lb sec² (23 ± 2.3 cm-kg sec²).

5.1.5 Configuration of the body block is shown in Figures 2 through 4.

APPENDIX...Continued

5.2 INSTRUMENTATION

Any system of instrumentation that will provide data from which the items in paragraph 4 can be determined and meet the performance requirements of SAE J977 is acceptable, with the following exception:

- 5.2.1 The force measuring channels shall have a frequency response flat to within ± 5 percent from 0.1 Hz to 500 Hz and shall be at least 3 db down at a maximum of 1500 Hz.
- 5.3 Any test equipment is satisfactory which can produce the desired body block-to-steering control system impact velocity and which insures that the body block is moving parallel to the vehicle horizontal reference, with translational (not rotational) motion, in side view at impact. (See Figure 5.) The direction of impact velocity, in the plan view, is parallel to the longitudinal vehicle axis.
- 5.4 The steering control system shall be mounted in the actual vehicle, vehicle buck, or on a fixture that is at least as rigid as the actual vehicle mounting.
- 5.5 If a load cell is used, it must be mounted between the column and the steering wheel (or equivalent).

6. TEST PROCEDURE

- 6.1 Vertical relationship between steering wheel and body block shall be established in the following manner:
 - 6.1.1 Using the package drawing of the particular vehicle in which the steering system is to be used, determine the vertical dimension between the lower edge of the wheel rim and a point 0.75 inches, (1.90 cm) vertically above the seating reference point of the driver. Seating reference point means the manufacturer's design reference point which:
 - A. Establishes the rearmost normal design driving or riding position of each designated seating position (DSP) in a vehicle.
 - B. Has coordinates established relative to the designed vehicle structure.
 - C. Simulates the position of the pivot center of the human torso and thigh.
 - D. Is the reference point employed to position the two-dimensional templates described in SAE J826.

MOLD INSERT

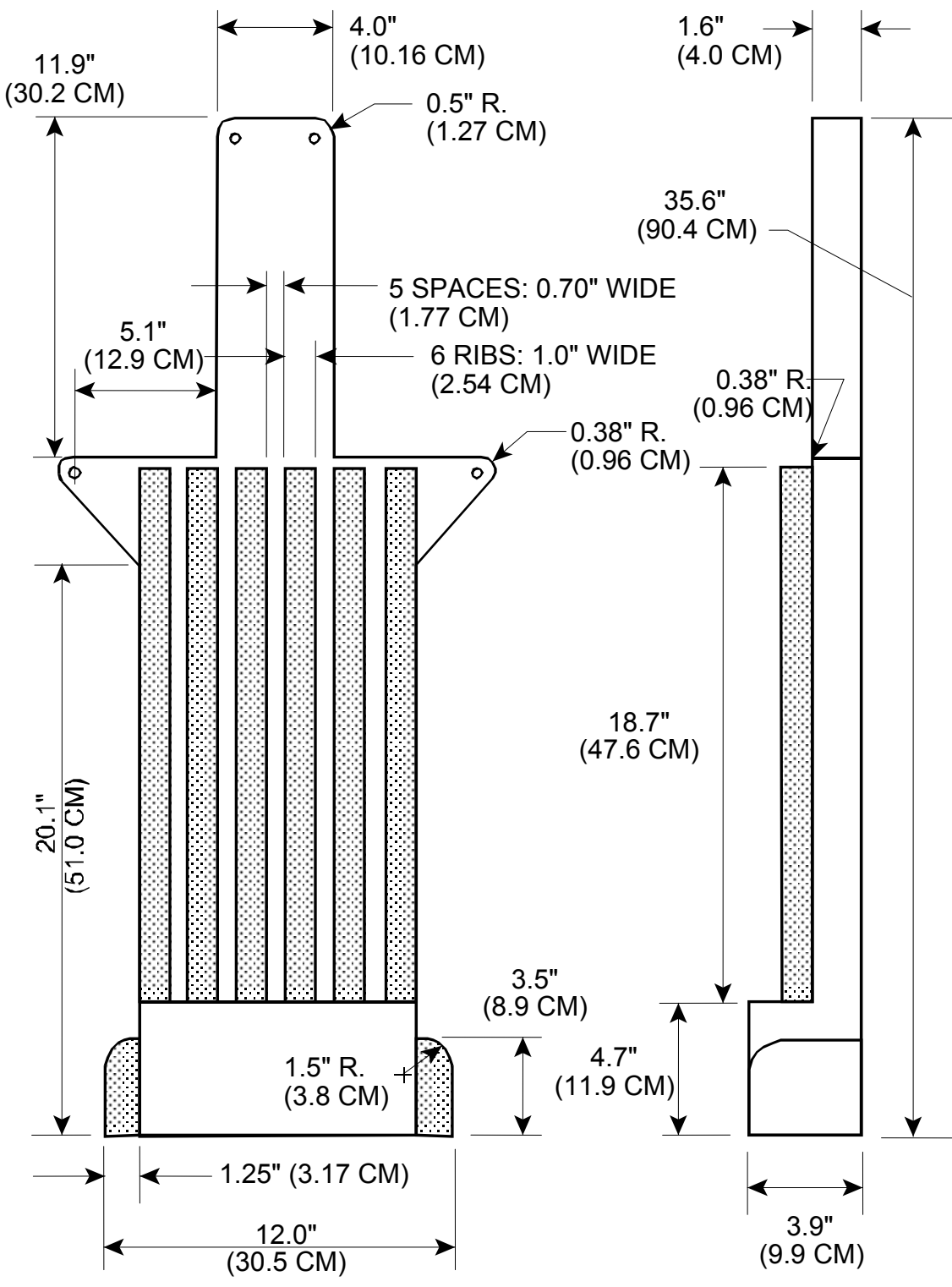


FIGURE 2

BACKBOARD AND BASE

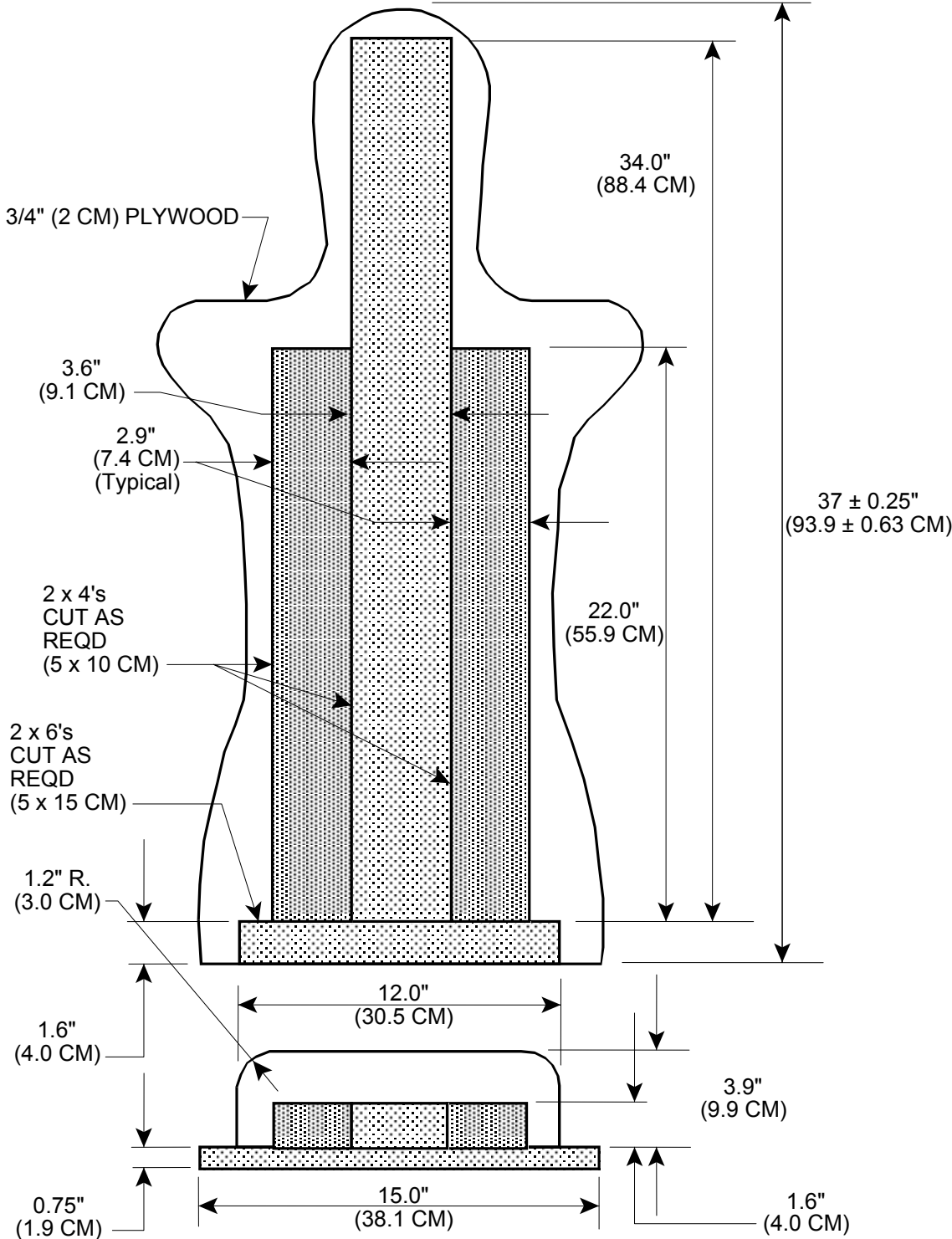
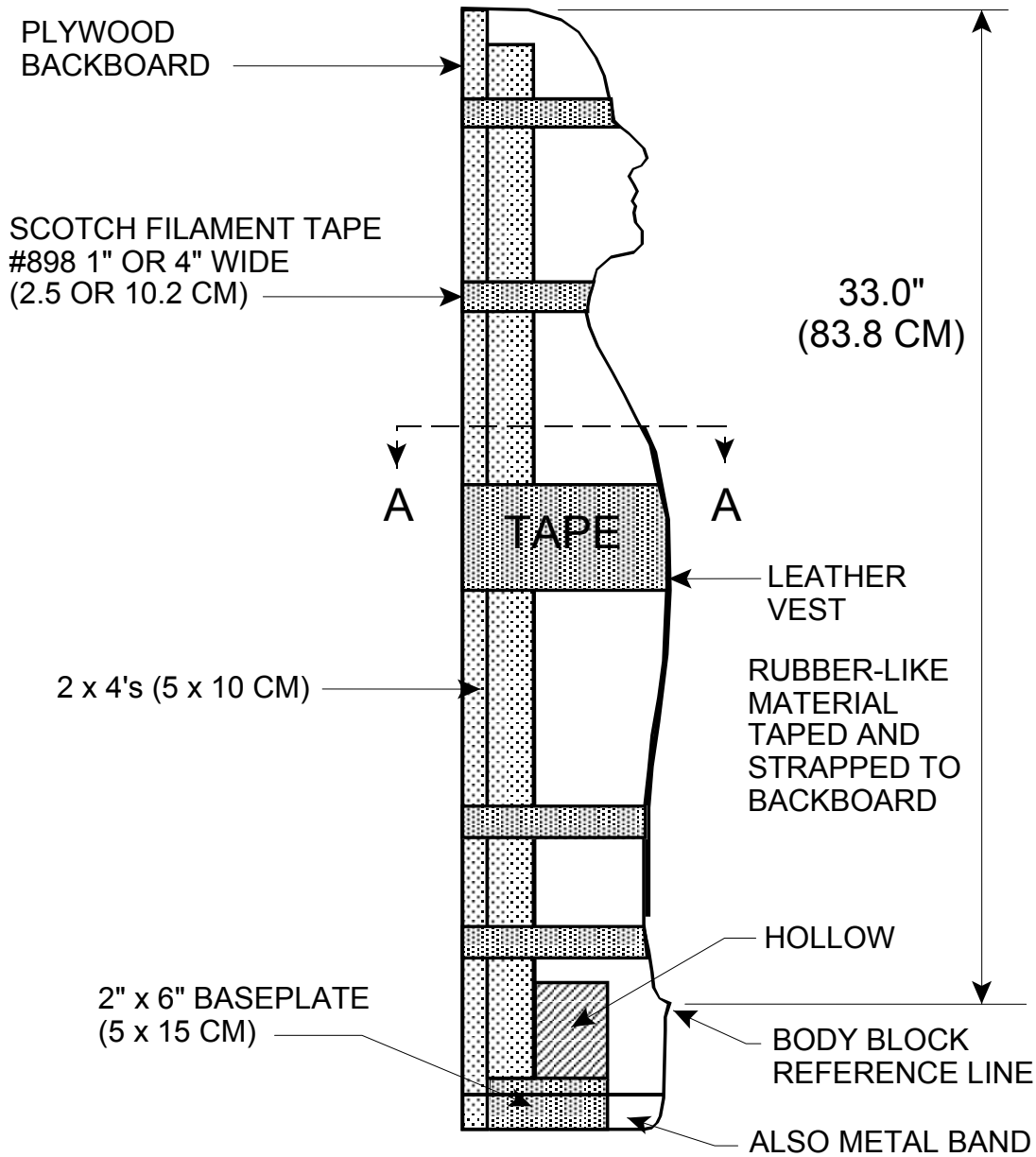
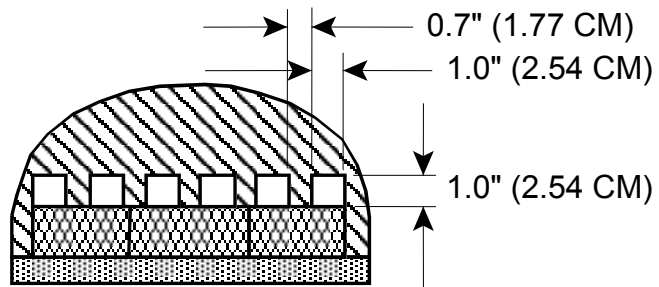


FIGURE 3

BODY BLOCK PROFILE



SECTION A-A
(SECTION ROTATED 90 DEGREES COUNTER-CLOCKWISE)



STEERING WHEEL--BODY BLOCK RELATIONSHIP

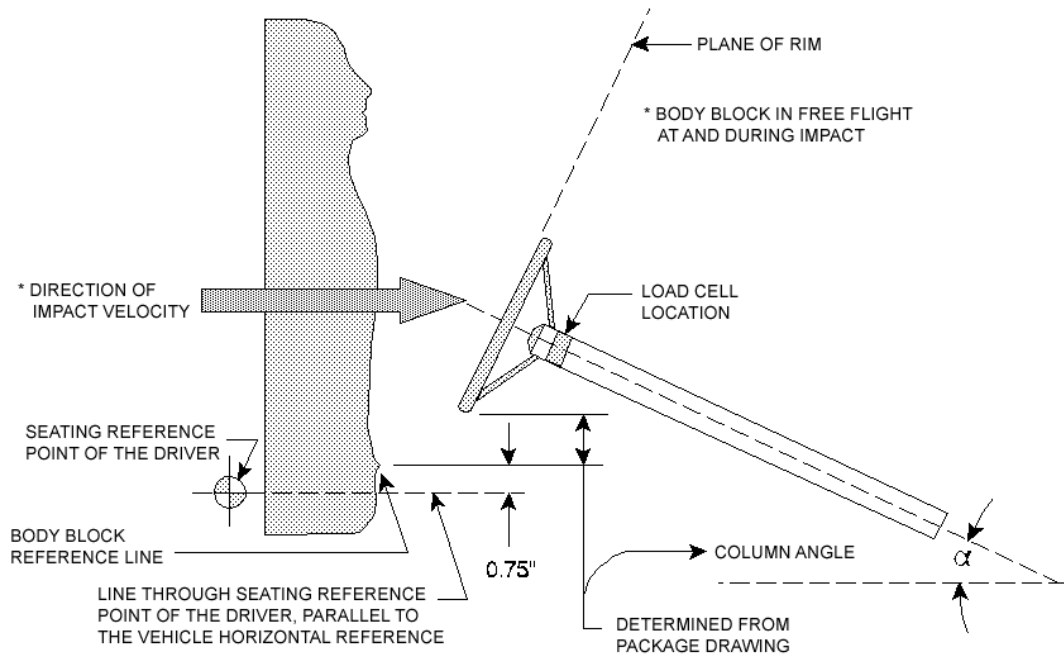


FIGURE 5

- 6.1.2 The body block at impact is positioned as shown in Figure 5. The body block is centered laterally in relation to the plane of the steering wheel rim. The vertical dimension, as defined in paragraph 6.1.1, is the relationship between the lower edge of the steering wheel and the reference line on the body block.
- 6.2 The steering wheel or steering wheel and column assembly to be tested is mounted at an angle within ± 1 degree in side and plan views.
- 6.3 All parts under test shall be installed using the design attachment points and production parts or simulations thereof torqued to the proper value.
- 6.4 All samples, and the body block, shall be stabilized at an ambient temperature ranging between 70EF and 85EF for 4 hours immediately prior to testing.