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**January 14, 2014**

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

**CALIBRATION TEST PROCEDURE**  
for  
**Part 572 Subpart I, HII 6-Year-Old**  
**Child Test Dummy**



**ENFORCEMENT**  
**Office of Vehicle Safety Compliance**  
**Mail Code: NVS-220, W43-481**  
**1200 New Jersey Avenue, SE**  
**Washington, DC 20590**

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## **1. PURPOSE AND APPLICATION**

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

- A. HEAD IMPACT TEST
- B. HEAD-NECK PENDULUM TEST
- C. THORAXIC IMPACT TEST
- D. LUMBAR SPINE FLEXION TEST
- E. KNEE IMPACT

The performance criteria specified is intended to describe measuring tools with sufficient precision to give repetitive and correlative results under similar test conditions and to reflect adequately the protective performance of an item of motor vehicle equipment with respect to human occupants.

## **2. GENERAL REQUIREMENTS**

Each Part 572, Subpart I dummy used in a compliance test must meet the specifications and performance criteria of Part 572 before each test in order to be an acceptable compliance test tool. The COTR will determine when post-test calibrations are necessary.

The Part 572, Subpart I, 6-Year-Old Child Dummy consists of components and assemblies specified in the drawing and specifications package which is available for inspection from NHTSA's Docket/Technical Information Services department Docket No. 89-03

The Hybrid II 6-year-old Child Test Dummy (HII-6C) is defined by drawings and specifications containing the following materials:

- (1) The engineering drawings and specifications contained in drawing number SA 106 C001, the titles of the assemblies of which are listed in Table 1, and,
- (2) A user's manual entitled "Six-Year-Old Size Child Test Dummy SA106C," October 28, 1991.

TABLE 1. DRAWING PACKAGE INDEX

<b>Component assembly</b>	<b>Drawing No.</b>
Head Assembly	SA 106C 010
Neck Assembly	SA 106C 020
Thorax Assembly	SA 106C 030
Complete Arm Assembly—right	SA 106C 041
Complete Arm Assembly—left	SA 106C 042
Lumbar Spine Assembly	SA 106C 050
Pelvis Assembly	SA 106C 060
Complete Leg Assembly—left	SA 106C 071
Complete Leg Assembly—right	SA 106C 072

### 3. SECURITY

All NHTSA Part 572, Subpart I test dummies delivered to the contract laboratory as Government Furnished Property (GFP) will be stored in a safe and secure area such as the dummy calibration laboratory. The contractor is financially responsible for any acts of theft and/or vandalism that occur during the storage of GFP. Any security problems shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

The contractor is responsible for maintaining the NHTSA test dummies in good working order, and shall protect and segregate the data that evolves from conducting Part 572, Subpart P dummy calibration tests before and after each low risk deployment usage.

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

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

**4. GOOD HOUSEKEEPING**

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

**5. TEST SCHEDULING AND MONITORING**

The Part 572, Subpart I dummies are being calibrated as test tools to be used in tests to determine compliance with the requirements of federal motor vehicle safety standards. The schedule for these performance calibration tests must be correlated with that of the test schedule. All testing shall be coordinated to allow monitoring by the COTR.

**6. TEST DATA DISPOSITION**

The contractor shall make all dummy calibration data available to the COTR for review and analysis as required.

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

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

Part 572, Subpart I test dummies will be furnished to the contract laboratory by the OVSC. The dummies shall not be stored in a hanging position because there is no internal neck cable. 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 test and complete a dummy damage checklist that will be included with the posttest dummy calibration. The COTR will be kept informed of the dummies condition in order that replacement parts can be provided.

**8. CALIBRATION AND TEST INSTRUMENTATION**

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

- A. Standards for calibrating the measuring and test equipment shall be stored and used under appropriate environmental conditions to assure their accuracy and stability.

- B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 6 months for instruments and 12 months for calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.
- C. All measuring and test equipment and measuring standards shall be labeled with the following information:
  - (1) Date of calibration
  - (2) Date of next scheduled calibration
  - (3) Name of the technician who calibrated the equipment
- D. The contractor shall provide a written calibration procedure that includes, as a minimum, the following information for all measurement and test equipment:
  - (1) Type of equipment, manufacturer, model number, etc.
  - (2) Measurement range
  - (3) Accuracy
  - (4) Calibration interval
  - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
  - (6) The actual procedures and forms used to perform calibrations.
- E. The contractor shall keep records of calibrations for all test instrumentation in a manner that assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the written acceptance of the COTR before testing begins.
- F. Test equipment shall receive a calibration check immediately prior to each test. This check shall be recorded by the test technician(s) and made available if requested by the COTR.

## 9. DEFINITIONS

PADI- Procedures for Assembly, Disassembly, and Inspection

## 10. INSTRUMENTATION, TEST CONDITIONS, AND PROCEDURES

### 10.1 INSTRUMENTATION REQUIRED FOR QUALIFICATION TESTS (572.77)

The contractor shall provide and install the instrumentation to the GFP dummies for qualification testing and if required, for compliance testing. The instrumentation used during the compliance tests shall be those installed during qualification testing.

#### A. ACCELEROMETERS

The head and thorax assembly may be instrumented either with a Type A or Type B accelerometer. (572.77(a)(2))

- (i) Type A accelerometer is defined in drawing SA 572 S1.
- (ii) Type B accelerometer is defined in drawing SA 572 S2.

#### B. HEAD (572.77(b))

(1) Install accelerometers in the head as shown in drawing SA 106C 001 sheet 1 using suitable spacers or adaptors as needed to affix them to the horizontal transverse bulkhead so that the sensitive axes of the three accelerometers intersect at the point in the midsagittal plane located 0.4 inches below the intersection of a line connecting the longitudinal center lines of the roll pins in either side of the dummy's head with the head's midsagittal plane.

(2) The head has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is perpendicular to the horizontal bulkhead in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the horizontal bulkhead, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is parallel to the horizontal bulkhead in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches from the axial intersection point.

C. THORAX (572.77(c))

(1) Install accelerometers in the thoracic assembly as shown in drawing SA 106C 001, sheet 1, using suitable spacers and adaptors to affix them to the frontal surface of the spine assembly so that the sensitive axes of the three accelerometers intersect at a point in the midsagittal plane located 0.95 inches posterior of the spine mounting surface, and 0.55 inches below the horizontal centerline of the two upper accelerometer mount attachment hole centers.

(2) The sternum-thoracic assembly has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is parallel to the attachment surface in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the attachment surface, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is perpendicular to the attachment surface in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches of the axial intersection point.

D. FEMUR-SENSING DEVICE (572.77(d))

Install a force-sensing device SA 572-S10 axially in each femur shaft as shown in drawing SA 106C 072 and secure it to the femur assembly so that the distance measured between the center lines of two attachment bolts is 3.00 inches.

E. LIMB JOINTS (572.77(e))

Set the limb joints at 1g, barely restraining the limb's weight when the limb is extended horizontally, and ensure that the force required to move the limb segment does not exceed 2g throughout the limb's range of motion.

## 10.2 TRANSDUCER CONDITIONS (S572.77(f))

Record the outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified in this part, in individual channels that conform to the requirements of SAE Recommended Practice J211, October 1988, with channel classes as set out in the following table.

TABLE 2. CHANNEL CLASS

Device	Channel
Head acceleration	Class 1000
Pendulum acceleration	Class 60
Thorax acceleration	Class 180
Femur-force	Class 600

The mountings for sensing devices shall have no resonance frequency within a range of 3 times the frequency range of the applicable channel class.

## 10.3 TEST PROBES (572.77(a)(1))

For the head, thorax, and knee impact test, use a test probe that is rigid, of uniform density and weighs 10 pounds and 6 ounces, with a diameter of 3 inches; a length of 13.8 inches; and an impacting end that has a rigid flat right face and edge radius of 0.5 inches.

## 10.4 GENERAL TEST CONDITIONS

- A. Adjacent segments are joined in a manner such that throughout the range of motion and also under simulated crash-impact conditions, there is no contact between metallic elements except for contacts that exist under static conditions.
- B. Each Part 572, Subpart I dummy used in a compliance test must meet the specifications and performance criteria of Part 572 before each CRS test in order to be an acceptable compliance test tool. The COTR will determine when posttest calibrations are necessary
- C. Performance tests of the same component, segment, assembly or fully assembled dummy are separated in time by a period of not less than 20 minutes unless otherwise specified by this procedure or the COTR.

- D. Surfaces of the dummy components are not painted except as specified.
- E. Each 6-year-old child dummy will contain an identification serial number marked on the outer skin. This number shall be used throughout the verification test program. In preparation for the verification tests, each dummy will be partially disassembled and inspected for damaged areas or components showing impending failure, which might affect its performance in subsequent tests.

All defects will be noted in the verification test report along with a list of replacement components added to the child dummy.

After the initial inspection, clean the outer vinyl skin of the child dummy to remove any residues which remain from previous testing or usage. Reassemble the child dummy in preparation for the verification tests including instrumenting it with triaxial accelerometers in the head and chest.

- F. The dummy's dimensions are specified in drawings SA 106C 001, sheet 3, Revision A, July 11, 1997, and sheets 4 through 6.

## **11. CALIBRATION TEST EXECUTION**

### **11.1 HEAD CALIBRATION (572.72)**

#### **A. HEAD ASSEMBLY**

The head consists of the assembly designated as SA 106 010 on drawing No. SA 106C 001, sheet 2, and conforms to each drawing listed on SA 106C 001, sheet 8.

#### **B. REQUIREMENTS**

When the head is impacted by the test probe at 7 feet per second (fps), then the resultant head acceleration is 130g - 160g.

(1) The recorded acceleration-time curve for this test is unimodal at or above the 50g level, and lies at or above that level for an interval 1.0 - 2.0 milliseconds.

(2) The lateral acceleration vector does not exceed 5g.

C. PROCEDURE

(1) Soak the dummy for at least 4 hours and conduct performance tests at any temperature from 66 °F to 78 °F, and at any relative humidity from 10 percent to 70 percent.

(2) Ensure there has been at least 60 minutes since the prior head test.

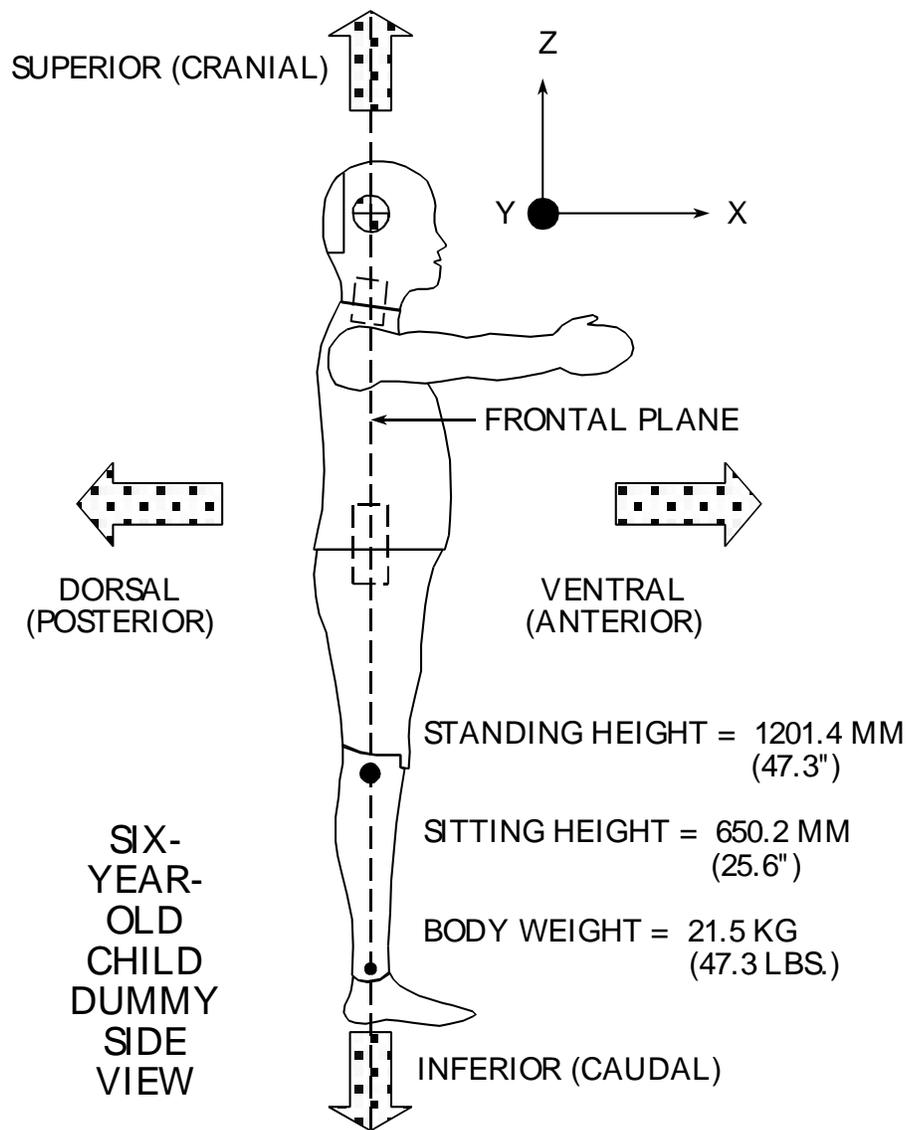


FIGURE 1. PLANES OF DIRECTION

(3) Seat and orient the dummy on a horizontal seating surface (at least 16 inches wide by 16 inches long) having a back a vertical back support whose top is  $12.4 \pm 0.2$  inches above the horizontal surface. The seating surface is flat, rigid, clean, and dry, with a smoothness not exceeding 40 microinches. The seating surface shall be covered in Teflon sheeting.

The dummy's midsagittal plane is vertical and centered on the test surface. Adjust the joints of the limbs to 1g - 2g. Position the dummy's arms and legs so that their center lines are in planes parallel to the midsagittal plane. Adjust each shoulder yoke so that with its upper surface horizontal, a yoke is at the midpoint of its anterior-posterior travel. Adjust the dummy so that the rear surfaces of the shoulders and buttocks are tangent to a transverse vertical plane.

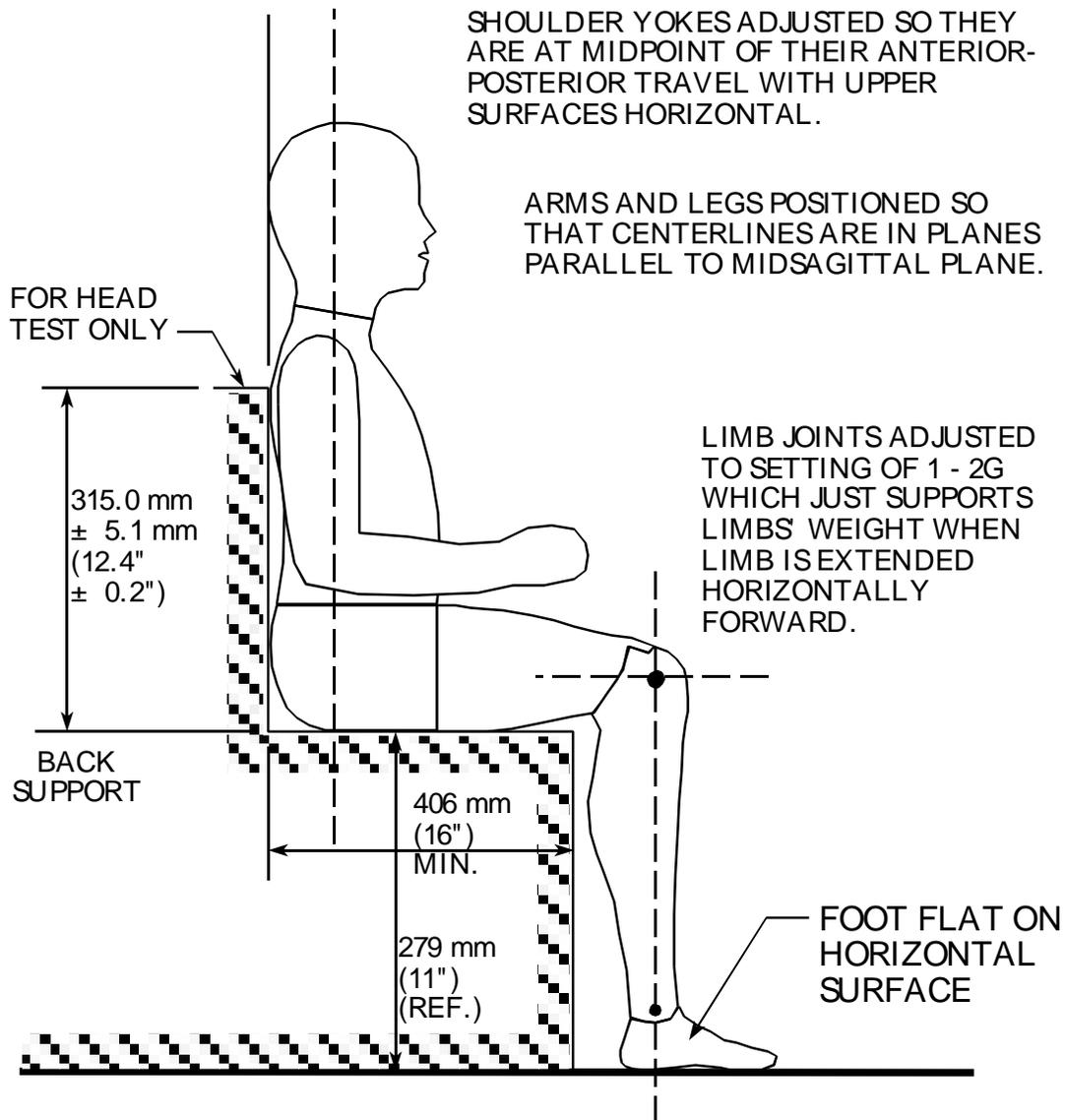
(4) Adjust the test probe so that its longitudinal center line is—

(i) At the forehead at the point of orthogonal intersection of the head midsagittal plane and the transverse plane which is perpendicular to the Z axis;

(ii) Located  $2.7 \pm 0.1$  inches below the top of the head measured along the Z axis, and;

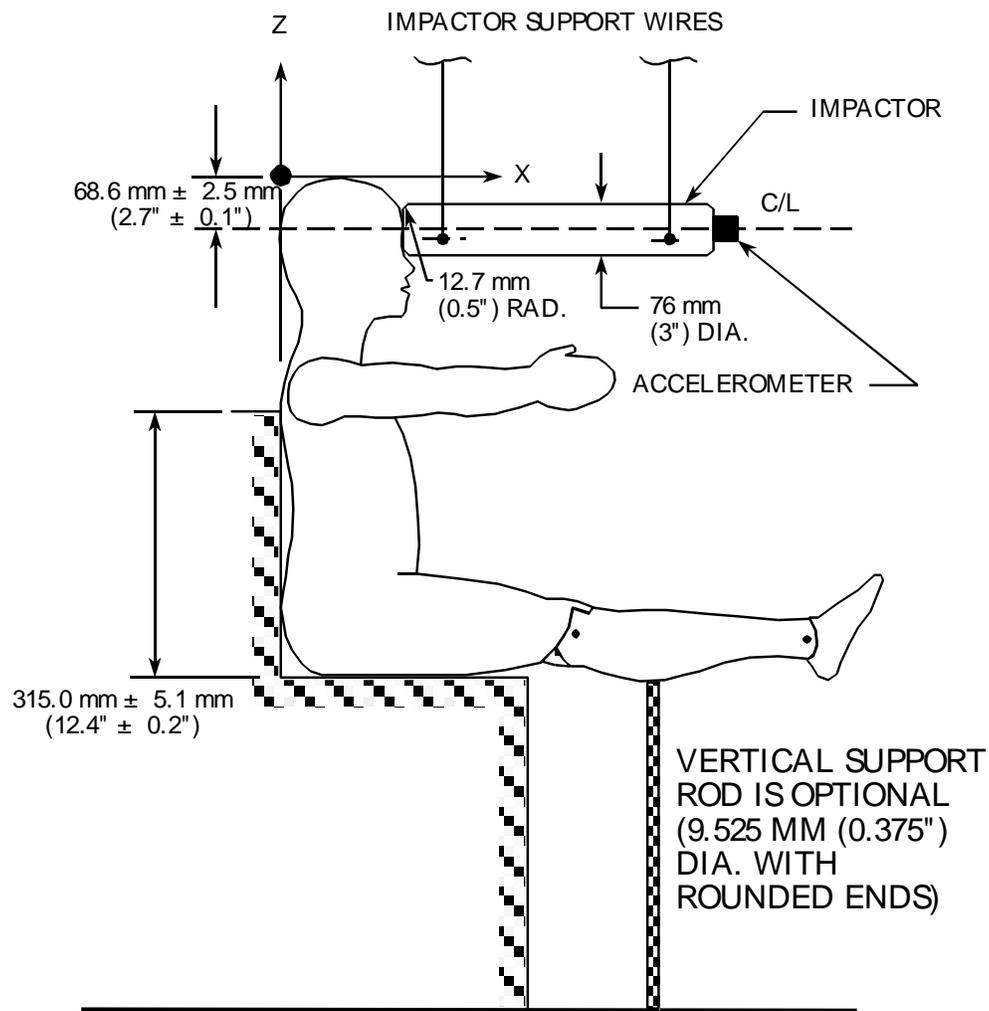
(iii) Coincides within 2 degrees with the line made by the intersection of the horizontal and midsagittal planes passing through this point.

(5) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement. Impact the head with the test probe so that at the moment of contact the probe's longitudinal center line falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.



CHILD DUMMY IS PLACED ON A FLAT, RIGID, CLEAN, DRY, HORIZONTAL SURFACE OF TEFLON SHEETING WITH A SMOOTHNESS OF 40 MICROINCHES AND WHOSE LENGTH AND WIDTH DIMENSIONS ARE 406 MM (16 INCHES) MINIMUM.

FIGURE 2. UPRIGHT SEATED POSITION



NOTES:

1. DUMMY IMPACT SENSORS NOT USED IN THIS TEST MAY BE REPLACED BY EQUIVALENT DEAD WEIGHTS.
2. NO EXTERNAL SUPPORTS ARE REQUIRED ON THE DUMMY TO MEET SETUP SPECIFICATIONS
3. THE MIDSAGITTAL PLANE OF THE DUMMY IS VERTICAL WITHIN  $\pm 1$  DEGREE
4. THE MIDSAGITTAL PLANE OF THE HEAD IS CENTERED WITH RESPECT TO THE LONGITUDINAL CENTERLINE OF THE PENDULUM WITHIN 3.04MM (0.12 INCHES).

FIGURE 3. HEAD IMPACT TEST SETUP

## 11.2 NECK CALIBRATION (572.73)

### A. NECK ASSEMBLY

The neck consists of the assembly designated as SA 106C 020 on drawing SA 106C 001, sheet 2, and conforms to each drawing listed on SA 106C 001, sheet 9.

### B. REQUIREMENTS

The head-neck assembly:

(1) Shall rotate, while translating in the direction of the pendulum preimpact flight, in reference to the pendulum's longitudinal center line a total of 78 degrees  $\pm 6$  degrees about the head's center of gravity; and

(2) Shall rotate to the extent specified in Table B at each indicated point in time, measured from time of impact, with the chordal displacement measured at the head's center of gravity.

(i) Chordal displacement at time "T" is defined as the straight line distance between the position relative to the pendulum arm of the head's center of gravity at time "zero;" and the position relative to the pendulum arm of the head's center of gravity at time T as illustrated by Figure 4.

(ii) The peak resultant acceleration shall not exceed 30g.

(3) The pendulum shall not reverse direction until the head's center of gravity returns to the original "zero" time position relative to the pendulum arm.

TABLE 3. NECK IMPACT ROTATION-TIME-DISPLACEMENT REQUIREMENTS

Rotation (degrees)	Time (ms) $\pm(2+.08T)$	Chordal displacement (in.) $\pm 0.8$
0	0	0
30	26	2.7
60	44	4.3
Maximum	68	5.8
60	101	4.4
30	121	2.4
0	140	0

C. PROCEDURE

(1) Soak the dummy for at least 4 hours and conduct performance tests at any temperature from 66 °F to 78 °F, and at any relative humidity from 10 percent to 70 percent.

(2) Ensure there has been at least 60 minutes since the prior test.

(3) Mount the head and neck assembly directly on a rigid pendulum (see Figure 15), so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal center line.

(4) Release the pendulum and allow it to fall freely from a height such that the velocity at impact is  $17.00 \pm 1.0$  fps, measured at the center of the accelerometer, see Figure 7.

(5) Decelerate the pendulum to a stop with an acceleration-time pulse described as follows:

(i) Establish 5g and 20g levels on the a-t curve.

(ii) Establish  $t_1$  at the point where the rising a-t curve first crosses the 5g level;  $t_2$  at the point where the rising a-t curve first crosses the 20g level;  $t_3$  at the point where the decaying a-t curve last crosses the 20g level; and  $t_4$  at the point where the decaying a-t curve first crosses the 5g level.

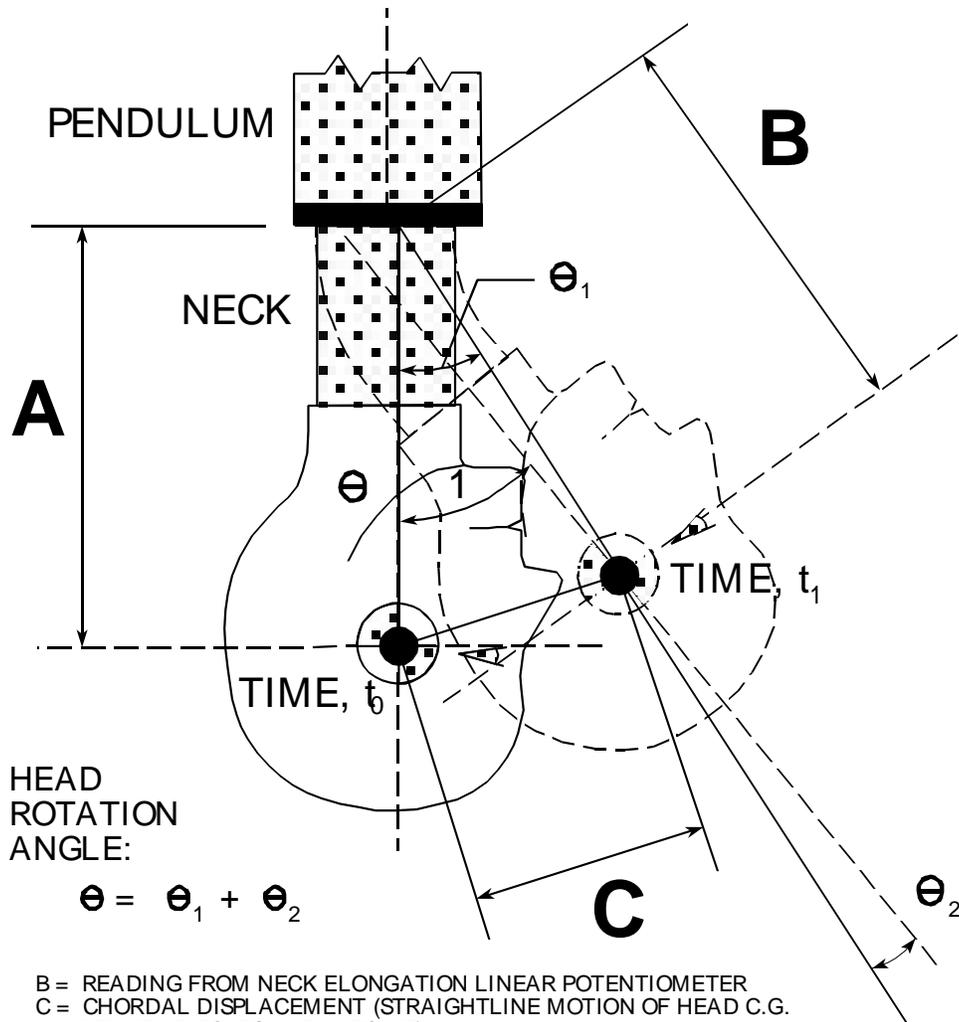
(iii)  $t_2 - t_1$  shall be  $\leq 3$  milliseconds.

(iv)  $t_3 - t_2$  shall be 19 - 22 milliseconds.

(v)  $t_4 - t_3$  shall be  $\leq 6$  milliseconds.

(vi) The average deceleration between  $t_2$  and  $t_3$  shall be 22- 26g.

(6) Allow the neck to flex without the head or neck contacting any object other than the pendulum arm.



B = READING FROM NECK ELONGATION LINEAR POTENTIOMETER

C = CHORDAL DISPLACEMENT (STRAIGHTLINE MOTION OF HEAD C.G. RELATIVE TO ITS INITIAL POINT)

$\theta_1$  = ANGLE READING FROM PENDULUM MOUNTED ROTARY POT.

$\theta_2$  = ANGLE READING FROM HEAD MOUNTED ROTARY POT.

COSINE LAW - THE SQUARE OF THE LENGTH OF ANY SIDE OF ANY TRIANGLE IS EQUAL TO THE SUM OF THE SQUARES OF THE LENGTHS OF THE OTHER TWO SIDES MINUS TWICE THEIR PRODUCT TIMES THE COSINE OF THE INCLUDED ANGLE.  $C^2 = A^2 + B^2 - 2AB\cos\theta$

B = A + e where e is the increase in A measured by the linear potentiometer

FIGURE 4. CALCULATION OF CHORDAL DISPLACEMENT

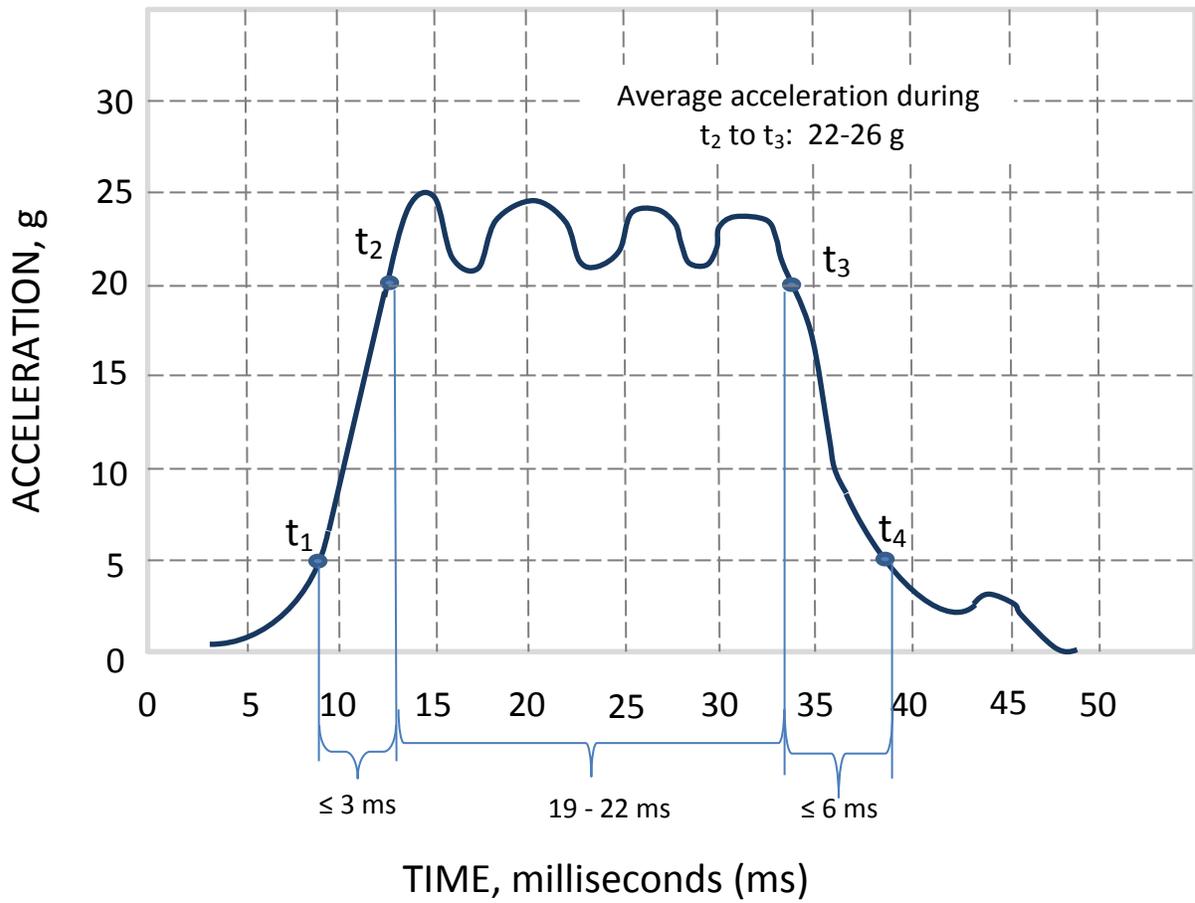


FIGURE 5. EXAMPLE TIME ACCELERATION CURVE FOR NECK TEST

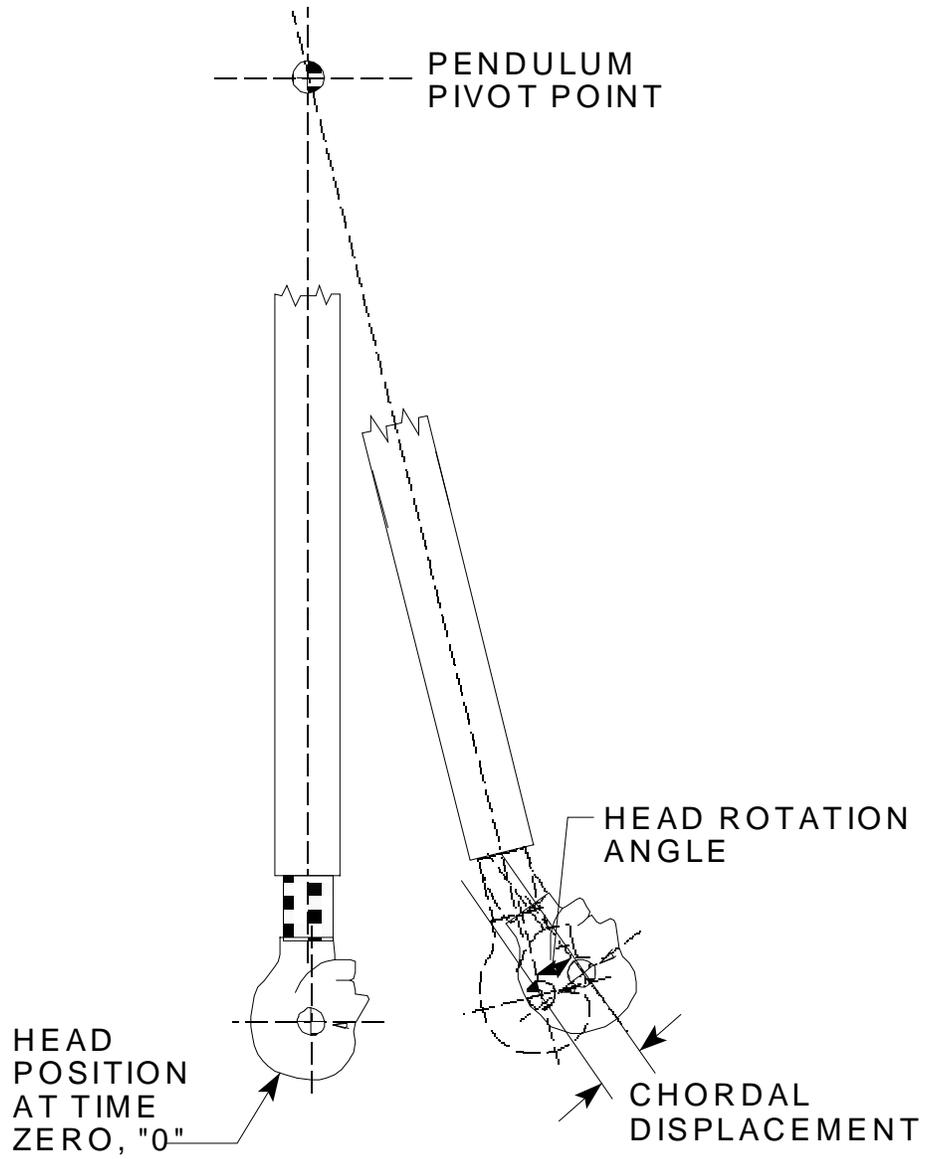


FIGURE 6. NECK COMPONENT TEST

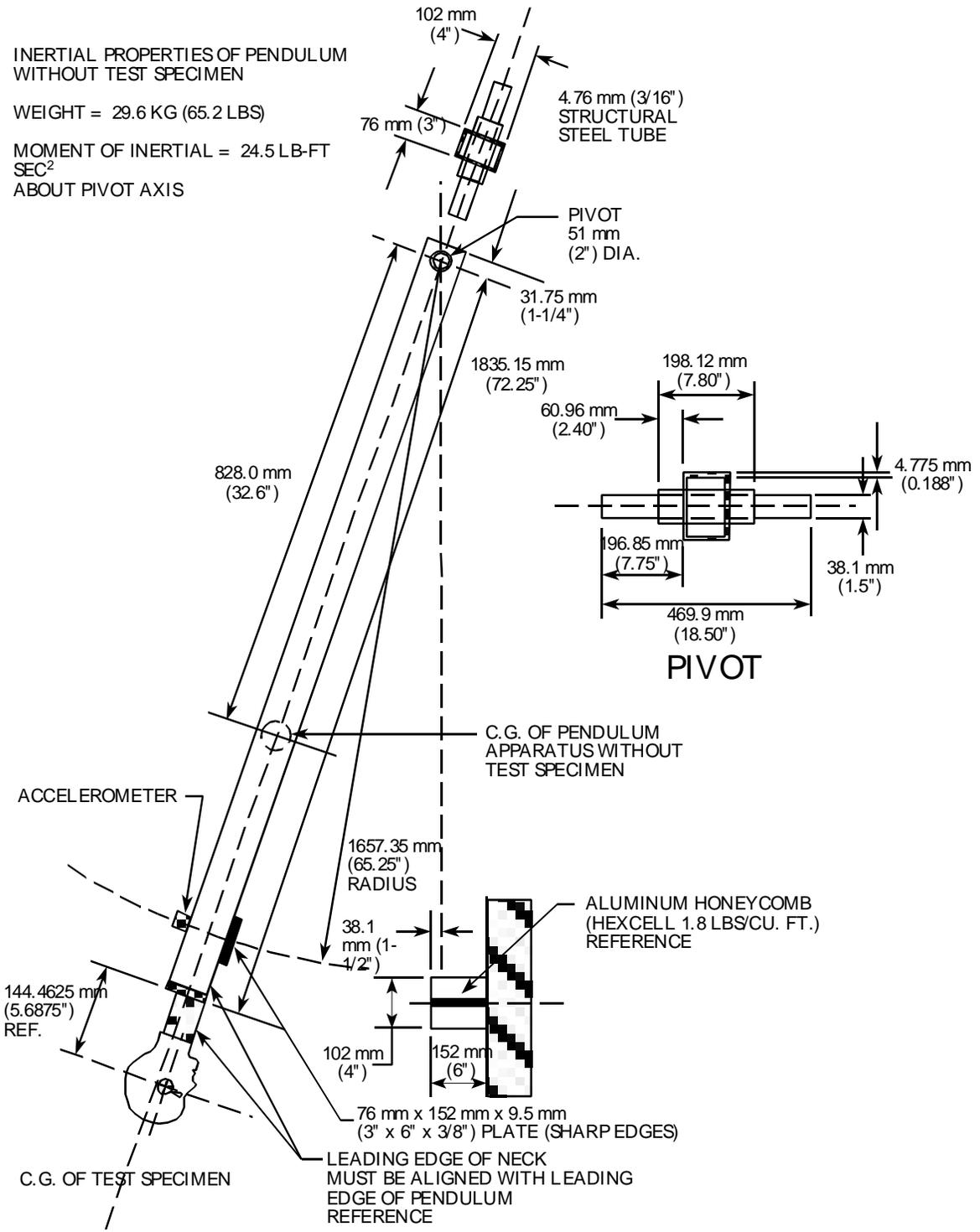


FIGURE 7. NECK COMPONENT TEST EXPANDED VIEW

### 11.3 THORAX CALIBRATION (572.74)

#### A. THORAX ASSEMBLY

The thorax consists of the part of the torso assembly designated as SA 106C 030 on drawing SA 106C 001, sheet 2, Revision A, and conforms to each applicable drawing on SA 106C 001 sheet 10, Revision C (including Drawing number 6C-1610-1 thru -4, Revision A, titled "Screw Button Head Socket", dated September 30, 1996, and Drawing number 6C-1021, Revision B, titled "Ballast, 6 Yr. Thorax (for 7267A)", dated September 24, 1996), and sheet 11, Revision D (including Drawing number SA 6C-909, Revision A, titled "Cover-chest Accelerometer", dated September 21, 1996, and Drawing number 6C-1000-1, Revision C, titled "Sternum Thoracic Weld Ass'y.", dated September 24, 1996).

#### B. REQUIREMENTS

When the thorax is impacted, the peak resultant accelerations shall be 43 - 53g.

(1) The recorded acceleration-time curve for this test shall be unimodal at or above the 30g level, and shall lie at or above that level for an interval not less than 4 milliseconds and not more than 6 milliseconds.

(2) The lateral accelerations shall not exceed 5g.

#### C. PROCEDURE

(1) Soak the dummy for at least 4 hours and conduct performance tests at any temperature from 66 °F to 78 °F, and at any relative humidity from 10 percent to 70 percent.

(2) Ensure there has been at least 30 minutes since the prior test.

(3) Seat and orient the dummy on a horizontal, flat, rigid, clean, and dry, seating surface having no back support and a minimum width of 16 inches, minimum length of 16 inches and a smoothness not exceeding 40 microinches. (see Figure 8)

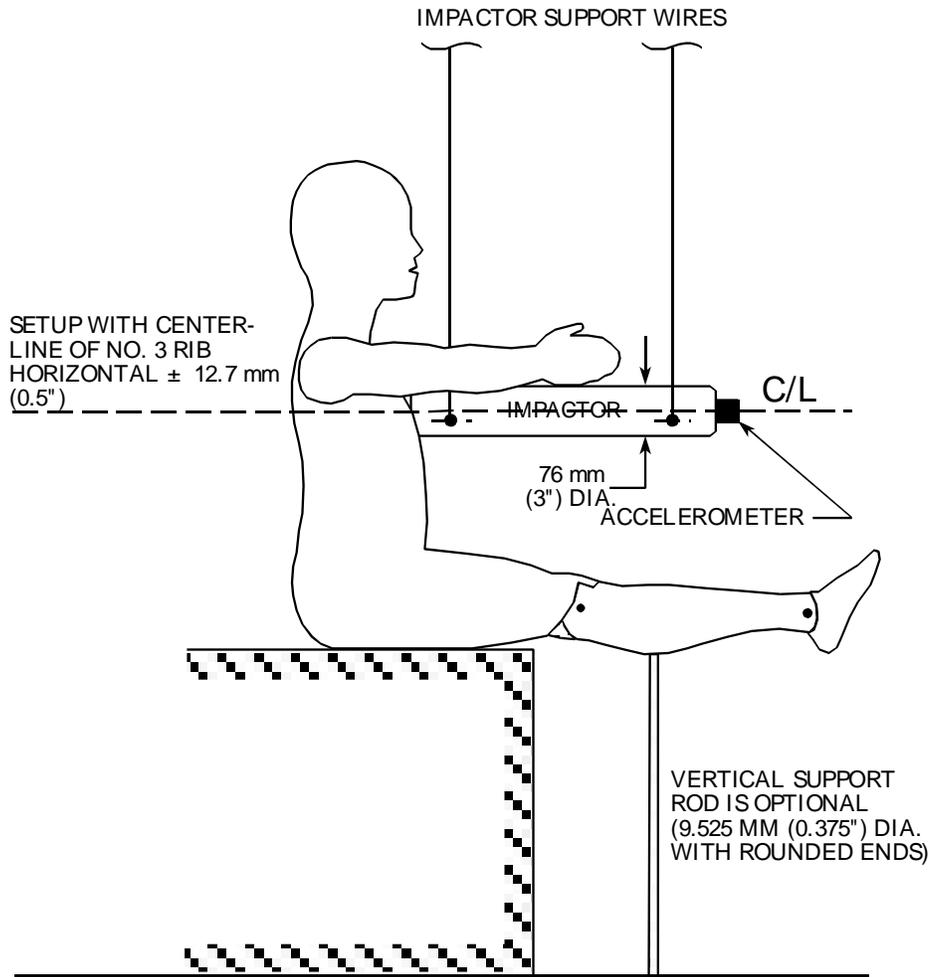
(4) Align the dummy's midsagittal plane vertically and center it on the test surface. Position the dummy's arms and legs so that their center lines are in planes parallel to the midsagittal plane. Adjust each shoulder yoke so that with its upper surface horizontal, a yoke

is at the midpoint of its anterior-posterior travel. Adjust the joints of the limbs to 1 - 2g.

(5) Establish the impact point at the chest midsagittal plane so that the impact point is 2.25 inches below the longitudinal center of the clavicle retainer screw, and adjust the dummy so that the plane that bisects the No. 3 rib into upper and lower halves is horizontal  $\pm 1$  degree.

(6) Place the longitudinal center line of the test probe so that it coincides with the designated impact point, and align the test probe so that at impact, the probe's longitudinal center line coincides (within 2 degrees) with the line formed at the intersection of the horizontal and midsagittal planes and passing through the designated impact point.

(7) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement. Impact the thorax with the test probe so that at the moment of contact the probe's longitudinal center line falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.



NOTES:

1. DUMMY IMPACT SENSORS NOT USED IN THIS TEST MAY BE REPLACED BY EQUIVALENT DEAD WEIGHTS.
2. NO EXTERNAL SUPPORTS ARE REQUIRED ON THE DUMMY TO MEET SETUP SPECIFICATIONS
3. THE MIDSAGITTAL PLANE OF THE DUMMY IS VERTICAL WITHIN  $\pm 1$  DEGREE
4. THE MIDSAGITTAL PLANE OF THE HEAD IS CENTERED WITH RESPECT TO THE LONGITUDINAL CENTERLINE OF THE PENDULUM WITHIN 3.05 MM (0.12 INCHES).

FIGURE 8. THORAX IMPACT TEST SETUP

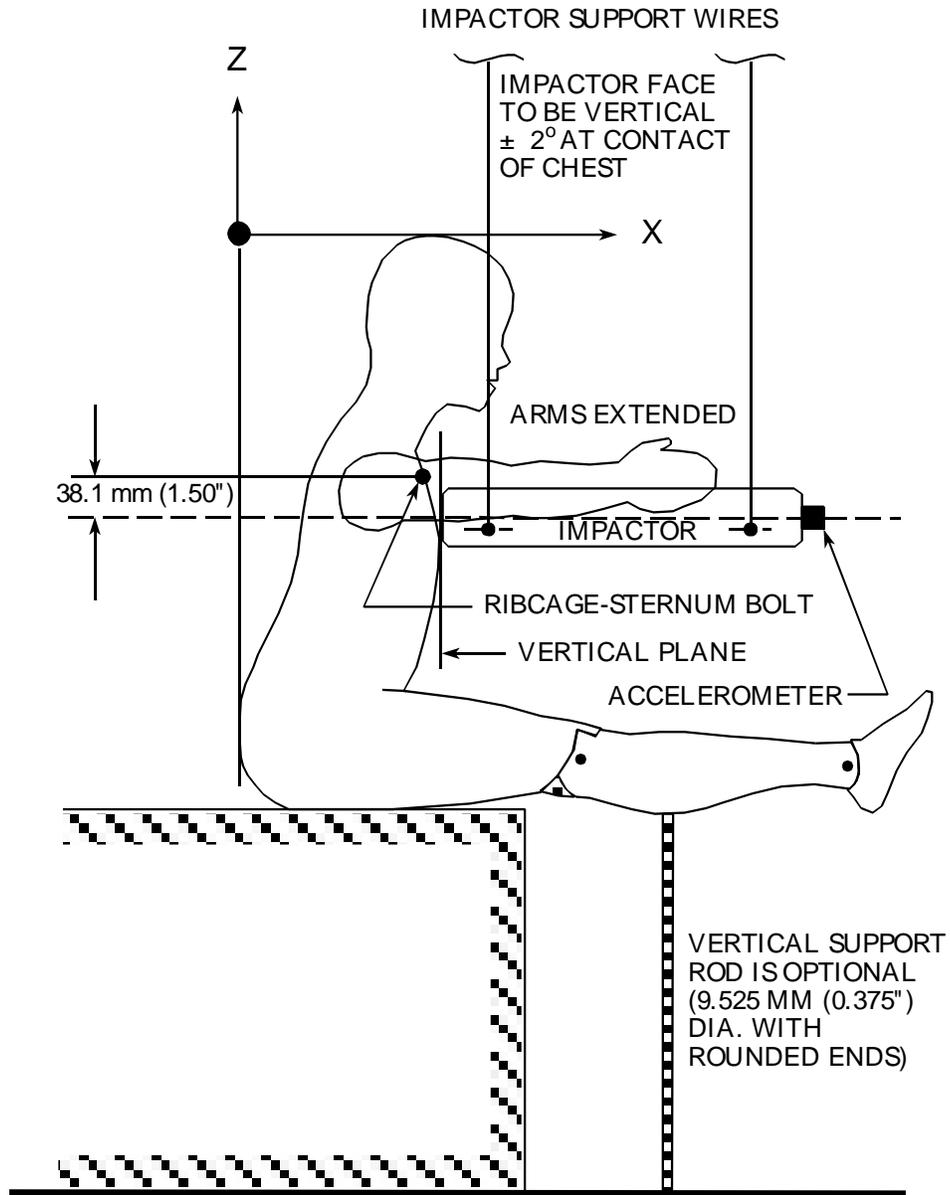


FIGURE 9. THORAX IMPACT TEST

#### 11.4 LUMBAR SPINE, ABDOMEN, AND PELVIS ASSEMBLY CALIBRATION (572.75)

##### A. LUMBAR SPINE, ABDOMEN, AND PELVIS ASSEMBLY

The lumbar spine, abdomen, and pelvis consist of the part of the torso assembly designated as SA 106C 50 and 60 on drawing SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 12 and 13.

B. REQUIREMENTS

When the lumbar spine is subjected to a continuously applied force, it shall—

- (1) Flex by an amount that permits the rigid thoracic spine to rotate from the torso's initial position by 40 degrees at a force level of 46 – 52 pounds, and
- (2) Straighten upon removal of the force to within 5 degrees of its initial position when the force is removed.

C. PROCEDURE

- (1) Soak the dummy for at least 4 hours and conduct performance tests at any temperature from 66 °F to 78 °F, and at any relative humidity from 10 percent to 70 percent.
- (2) Ensure at least 20 minutes has passed since the prior test.
- (3) Remove the dummy's head-neck assembly, arms, and lower legs, clean and dry all component surfaces
- (4) Seat the dummy upright on a horizontal, backless, flat, rigid, clean, and dry seating surface having dimensions at least 16 inches in width by 16 inches in length, a smoothness not exceeding 40 microinches, and covered by Teflon sheeting.
- (5) Align the dummy such that it's midsagittal plane is vertical and centered on the test surface and the rear surfaces of the shoulders and buttocks are tangent to a transverse vertical plane.
- (6) Adjust the dummy by—
  - (i) Tightening the femur ballflange screws at each hip socket joint to 50 inch-pounds torque;
  - (ii) Attaching the pelvis to the seating surface by a bolt D/605 as shown in Figure 10.
  - (iii) Attaching the upper legs at the knee joints by the attachments shown in drawing Figure 10.
  - (iv) Tightening the mountings so that the pelvis-lumbar joining surface is horizontal; and

(v) Removing the head and neck, and installing a cylindrical aluminum adapter (neck adapter) of 2.0 inches diameter and 2.60 inches length as shown in Figure 10.

(7) The initial position of the dummy's torso is defined by the plane formed by the rear surfaces of the shoulders and buttocks which is three to 7 degrees forward of the transverse vertical plane.

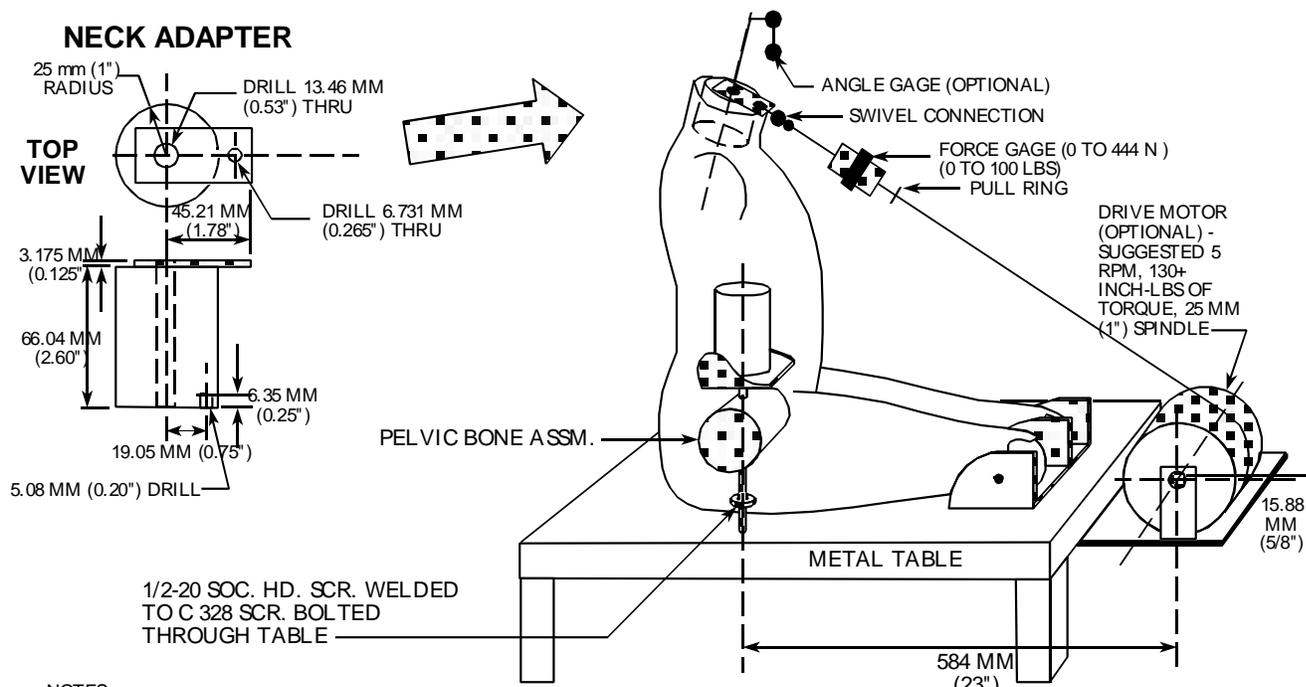
(8) Flex the thorax forward 50 degrees and then rearward as necessary to return the dummy to its initial torso position, unsupported by external means.

(9) Apply a forward pull force in the midsagittal plane at the top of the neck adapter so that when the lumbar spine flexion is 40 degrees, the applied force is perpendicular to the thoracic spine box.

(i) Apply the force at any torso deflection rate between 0.5 and 1.5 degrees per second, up to 40 degrees of flexion.

(ii) For 10 seconds, continue to apply a force sufficient to maintain 40 degrees of flexion, and record the highest applied force during the 10 second period.

(iii) Release all force as rapidly as possible, and measure the return angle 3 minutes after the release.



**NOTES:**

1. DUMMY IMPACT SENSORS NOT USED IN THIS TEST MAY BE REPLACED BY EQUIVALENT DEAD WEIGHTS.
2. NO EXTERNAL SUPPORTS ARE REQUIRED ON THE DUMMY TO MEET SETUP SPECIFICATIONS.
3. THE MIDSAGITTAL PLANE OF THE DUMMY IS VERTICAL WITHIN  $\pm 1$  DEGREE.
4. THE DUMMY IN THE SEATED POSITION IS FIRMLY AFFIXED TO THE TEST BENCH AT THE PELVIC BONE AND AT THE KNEES.
5. THE PULL-FLEXION FORCE APPLIED THROUGH A RIGID NECK ADAPTOR WHICH IS MOUNTED ON TOP OF THE THORACIC STERNUM ASSEMBLY (C/601), IS ALIGNED WITH THE MIDSAGITTAL PLANE OF THE DUMMY WITHIN  $\pm 1$  DEGREE.
6. THE SWIVEL FOR THE FORCE MEASURING SENSOR MUST NOT BIND OR BOTTOM OUT THROUGH THE ENTIRE LOADING CYCLE.

**FIGURE 10. LUMBAR-SPINE FLEXION TEST SETUP**

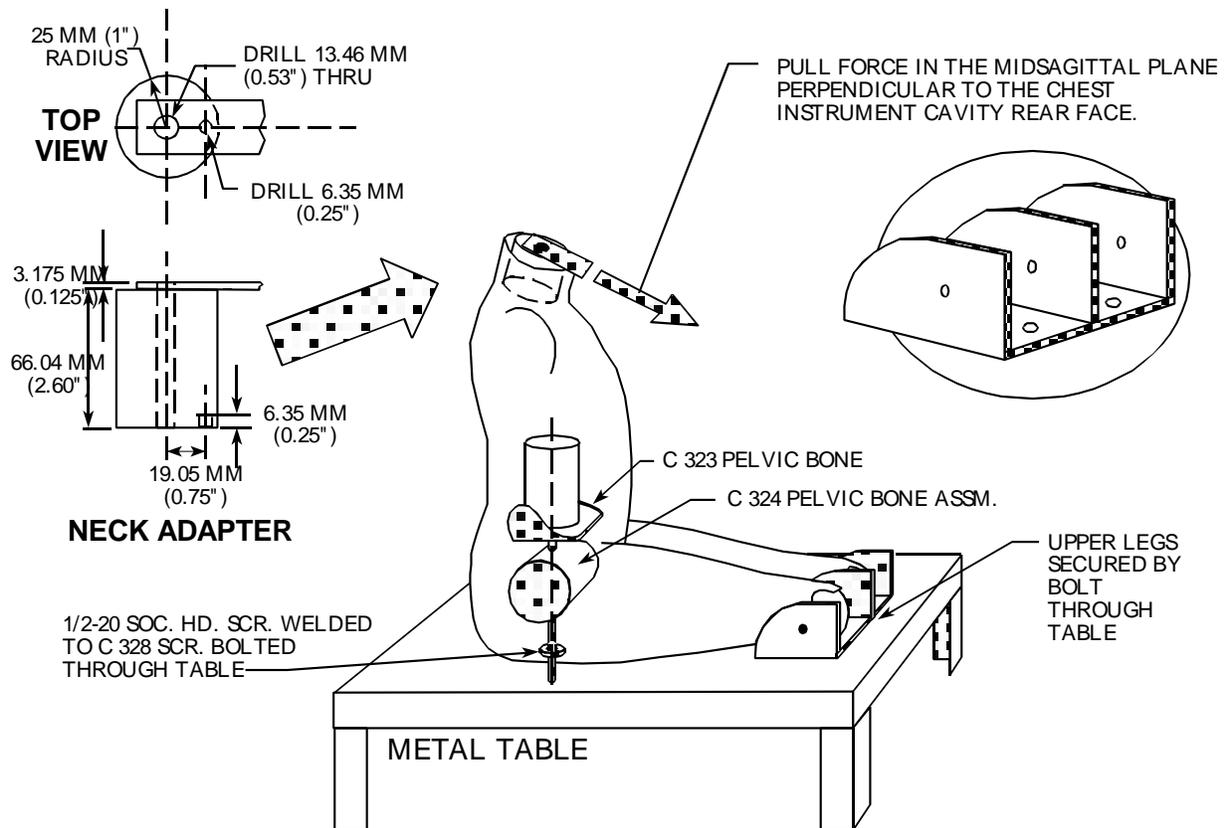


FIGURE 11. LUMBAR-SPINE FLEXION TEST

## 11.5 LIMBS ASSEMBLY (572.76)

### A. LIMBS ASSEMBLY

The limbs consist of the assemblies designated as SA 106C 041, SA 106C 042, SA 106C 071, and SA 106C 072, on drawing No. SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 14 through 17.

### B. REQUIREMENTS

When each knee is impacted at  $7.0 \pm 0.1$  fps, the maximum force on the femur shall be 780 - 1060 lbf, with a duration above 400 lbf of not less than 0.8 milliseconds.

## C. PROCEDURE

(1) Soak the dummy for at least 4 hours and conduct performance tests at any temperature from 66 °F to 78 °F, and at any relative humidity from 10 percent to 70 percent.

(2) Ensure at least 20 minutes has passed since the prior test.

(3) Seat and orient the dummy without back support on a seating surface that is  $11 \pm 0.2$  inches above a horizontal (floor) surface as specified in §572.78(c).

(i) Orient the dummy as specified in Figure 12 with the hip joint adjustment at 1 - 2g.

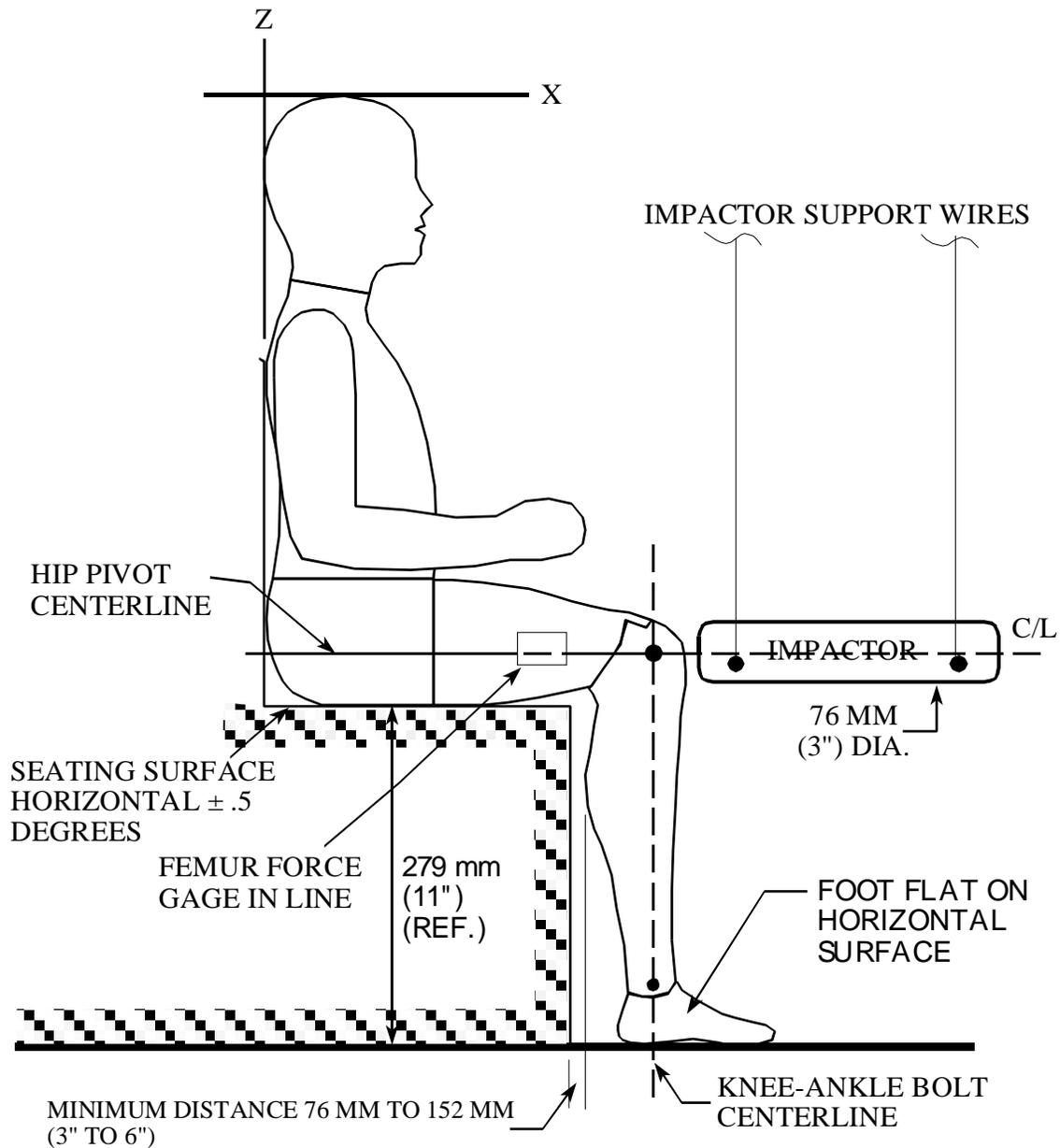
(ii) Place the dummy legs in a plane parallel to the dummy's midsagittal plane with the knee pivot center line perpendicular to the dummy's midsagittal plane, and with the feet flat on the horizontal (floor) surface.

(iii) Adjust the feet and lower legs until the line between the midpoint of each knee pivot and each ankle pivot is within 2 degrees of the vertical.

(4) If necessary, reposition the dummy so that at the level one inch below the seating surface, the rearmost point of the dummy's lower legs remains 3 – 6 inches forward of the forward edge of the seat.

(5) Align the test probe with the longitudinal center line of the femur force gauge, so that at impact, the probe's longitudinal center line coincides with the sensor's longitudinal center line within  $\pm 2$  degrees.

(6) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement and impact the knee with the test probe moving horizontally and parallel to the midsagittal plane at the specified velocity.



1. DUMMY IMPACT SENSORS NOT USED IN THIS TEST MAY BE REPLACED BY EQUIVALENT DEAD WEIGHTS.
2. NO EXTERNAL SUPPORTS ARE REQUIRED ON THE DUMMY TO MEET SET-UP SPECIFICATIONS.
3. THE MIDSAGITTAL PLANE OF THE DUMMY IS VERTICAL WITHIN  $\pm 1$  DEGREE.
4. CENTERLINE OF THE IMPACTED FEMUR IS ALIGNED WITH THE CENTERLINE OF THE IMPACTOR AND THE PLANE OF THE IMPACTOR MOTION WITHIN  $\pm 1$  DEGREE.

FIGURE 12. KNEE IMPACT TEST SET-UP

## **12. POST TEST REQUIREMENTS**

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

## **13. REPORTS**

### **13.1 APPARENT NONCONFORMANCE**

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

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

### **13.2 FINAL PERFORMANCE CALIBRATION REPORTS**

A report containing the pre-test calibration and posttest calibration verification data for each Part 572, Subpart P dummy used in the test shall be submitted with the compliance final test report if requested by the COTR. 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.

#### **13.2.1 REQUIREMENTS**

Performance calibration report Table of Contents shall include the following:

- A. Section 1 — Purpose of Calibration Test
- B. Section 2 — Calibration Data Summary
- C. Section 3 — Test Data
- D. Section 4 — Test Equipment List and Calibration Information

E. Section 5 — Photographs (if applicable)

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

### 13.2.2 REPORT COVER FORMAT

The information required on the cover follows:

A. Final Report Title and Subtitle such as

6-YEAR-OLD DUMMY CALIBRATION  
IN SUPPORT OF  
FMVSS 213 CHILD RESTRAINT SYSTEM DYNAMIC TESTS

B. DOT symbol, placed between items B and C



C. Contractor's Name and Address such as

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

D. Date of Final Performance Calibration Report completion

E. The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Enforcement  
Office of Vehicle Safety Compliance  
Mail Code: NVS-220, W43-481  
1200 New Jersey Avenue, SE  
Washington, DC 20590

**14. DATA SHEETS**

**DATA SHEET 1  
SUMMARY OF HEAD IMPACT TEST VERIFICATION DATA**

CHILD DUMMY I.D. NO.: \_\_\_\_\_

TEST MEASUREMENT	PRETEST DATA	POST TEST DATA	P572 REQUIREMENT
TEST DATES			
ROOM TEMPERATURE, , °C (°F)			19 - 26 °C (66 - 78 °F)
ROOM RELATIVE HUMIDITY, %			10 - 70%
TEST PROBE IMPACT VELOCITY, mps (fps)			2.1 to 2.2 mps (6.86 to 7.14 fps)
PEAK HEAD RESULTANT ACCEL., g			130-160 g
PEAK HEAD LATERAL ACCEL., g			≤ 5 g
Δ TIME (ms), acceleration ≥50g			1 - 2 ms

REMARKS:

Technician: \_\_\_\_\_

Date: \_\_\_\_\_

Project Manager: \_\_\_\_\_

DATA SHEET 2  
SUMMARY OF HEAD-NECK PENDULUM TEST DATA

CHILD DUMMY I.D. NO.: \_\_\_\_\_

TEST MEASUREMENT	PRETEST DATA	POST TEST DATA	P572 REQUIREMENT
TEST DATES			
TIME SINCE PRIOR TEST			≥60 MINUTES
ROOM TEMPERATURE, °C (°F)			19 - 26 °C (66 - 78 °F)
TIME SINCE PRIOR IMPACT			≥60 min.
ROOM RELATIVE HUMIDITY, %			10 - 70%
PENDULUM IMPACT VELOCITY, mps (fps)			4.9 to 5.5 mps (16 to 18 fps)
PENDULUM MIN./MAX. DECEL. OVER (t <sub>3</sub> - t <sub>2</sub> ), g			22 - 26 g
PEAK HEAD RESULTANT ACCEL., g			≤ 30g
PENDULUM DECEL. PULSE Δ TIME (t <sub>2</sub> - t <sub>1</sub> ), ms			≤ 3 ms
PENDULUM DECEL. PULSE Δ TIME (t <sub>3</sub> - t <sub>2</sub> ), ms			19 - 22 ms
PENDULUM DECEL. PULSE Δ TIME (t <sub>4</sub> - t <sub>3</sub> ), ms			≤ 6 ms
HEAD ZERO POSITION TIME/ PENDULUM REVERSAL TIME			- / -

HEAD MAX. ROTATION ANGLE, degrees			72 - 84 degrees
TIME (ms) @ HEAD ROT. ANGLE			
0°			-2 - +2 ms
30°			21.92 - 30.08 ms
60°			38.48 - 49.52 ms
Max.			60.56 - 75.44 ms
60°			90.92 - 111.08 ms
30°			109.32 - 132.68 ms
0°			126.8 - 153.2 ms

CHORD. DISPL. (in.) @ HEAD ANGLE OF-			
0°			-20 – 20 mm (-0.8 – 0.8 in.)
30°			48 – 89 mm (1.9 – 3.5 in.)
60°			89 – 129.5 mm (3.5 – 5.1 in.)
Max.			127 – 168 mm (5.0 – 6.6 in.)
60°			91 – 132 mm (3.6 – 5.2 in.)
30°			41 – 81 mm (1.6 – 3.2 in.)
0°			-20 – 20 mm (-0.8 – 0.8 in.)

ATTACH THE ACCELERATION TIME PULSES BELOW.

REMARKS

Technician: \_\_\_\_\_

Date: \_\_\_\_\_

Project Manager: \_\_\_\_\_

DATA SHEET 3  
SUMMARY OF THORAXIC IMPACT TEST DATA

CHILD DUMMY I.D. NO.: \_\_\_\_\_

TEST MEASUREMENT	PRETEST DATA	POST TEST DATA	P572 REQUIREMENT
TEST DATES			
TIME SINCE PRIOR IMPACT			≥30 MINUTES
ROOM TEMPERATURE, °C (°F)			19 - 26 °C (66 - 78 °F)
ROOM RELATIVE HUMIDITY, %			10 - 70%
TEST PROBE IMPACT VELOCITY, mps (fps)			5.4 to 6.2 mps (17.7 to 20.3 fps)
PEAK CHEST RESULTANT ACCEL., g			43 - 53g
PEAK CHEST LATERAL ACCEL., g			≤ 5g
Δ TIME (ms), acceleration ≥30g			2.5 - 4.0 ms

REMARKS:

Technician: \_\_\_\_\_

Date: \_\_\_\_\_

Project Manager: \_\_\_\_\_

DATA SHEET 4  
SUMMARY OF LUMBAR FLEXION TEST DATA

CHILD DUMMY I.D. NO.: \_\_\_\_\_

TEST MEASUREMENT	PRETEST DATA	POST TEST DATA	P572 REQUIREMENT
TEST DATES			
TIME SINCE PRIOR TEST			≥ 20 MINUTES
ROOM TEMPERATURE, °C (°F)			19 - 26 °C (66 - 78 °F)
ROOM RELATIVE HUMIDITY, %			10 - 70%
FORCE @ 40 DEG FLEXION ANGLE, kgf (lbf)			21 to 24 kgf (46 to 52 lbf)
SPINAL COLUMN ANGLE @ 3 MIN. POST TEST, DEGREES			≤ 5°

REMARKS:

Technician: \_\_\_\_\_

Date: \_\_\_\_\_

Project Manager: \_\_\_\_\_

DATA SHEET 5  
SUMMARY OF KNEE IMPACT TEST DATA

CHILD DUMMY I.D. NO.: \_\_\_\_\_

TEST MEASUREMENT	PRETEST DATA	POST TEST DATA	P572 REQUIREMENT
TEST DATES			
TIME SINCE PRIOR IMPACT			≥20 MINUTES
ROOM TEMPERATURE, °C (°F)			19 - 26 °C (66 – 78 °F)
ROOM RELATIVE HUMIDITY, %			10 - 70%
TEST PROBE IMPACT VELOCITY, mps (fps)			2.1 to 2.2 mps (6.9 to 7.1 fps)
MAXIMUM FEMUR FORCE, kgf (lbf)			354 – 481 kgf (780 – 1060 lbf)
Δ TIME (ms), acceleration ≥ 400 lb			≥0.8 ms

REMARKS:

Technician: \_\_\_\_\_

Date: \_\_\_\_\_

Project Manager: \_\_\_\_\_