

# LABORATORY PROCEDURE FOR CHILD RESTRAINT SYSTEM TESTING

Federal Motor Vehicle Safety Standard No. 213



**U.S. DEPARTMENT OF TRANSPORTATION**  
**National Highway Traffic Safety Administration**  
**Enforcement**  
**Office of Safety Compliance**  
**Washington, D.C. 20590**



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LABORATORY PROCEDURE FOR TESTING CHILD RESTRAINT SYSTEMS  
FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

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16. Abstract  This laboratory procedure presents a uniform testing and data recording format for the Federal Motor Vehicle Safety Standard 213 enforcement program and clarifies some points not specifically covered in the standard. The procedure includes requirements for identification and storage of test specimens, instrument calibration, measurement accuracy, inspection and performance test procedures, data recording and reporting, and final report format.			
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## 1.0 Purpose, Application, and Scope

The purpose of this procedure is to present a uniform testing and data recording format for the Federal Motor Vehicle Safety Standard (FMVSS) 213 enforcement program and to clarify some points not specifically covered in the standard. This procedure is in no way intended to conflict with the requirements set forth in FMVSS 213, and it must be followed by the laboratory while conducting tests for the Office of Vehicle Safety Compliance (OVSC), National Highway Traffic Safety Administration (NHTSA). If the testing laboratory interprets any part of this procedure to be in conflict with FMVSS 213, it will advise the OVSC Contract Technical Manager (CTM) and resolve the discrepancy prior to testing.

Any interpretations and/or deviations from this Test Procedure shall be shown in Appendix A of the Final Test Report.

This procedure includes requirements for identification and storage of test specimens, instrument calibration, measurement accuracy, inspection and performance test procedures, data recording and reporting, and final report format.



## 2.0 General Test Requirements

### 2.1 Test Methods and Equipment

The test procedures, methods, and associated equipment are based on the requirements of the following documents to the extent referenced herein.

#### 2.1.1 49 Code of Federal Regulations (CFR) 571 Federal Motor Vehicle Safety Standards (FMVSS)

FMVSS 213 - Child Restraint Systems

FMVSS 209 - Seat Belt Assemblies

FMVSS 302 - Flammability of Interior Materials

#### 2.1.2 49 Code of Federal Regulations (CFR) 572 Anthropomorphic Test Dummies

Subpart C - Three-Year-Old Child

Subpart D - Six-Month-Old Infant

#### 2.1.3 Standard Bench Seat

Drawing Package SAS-100-1000, revised December 30, 1980

#### 2.1.4 American Society for Testing and Materials (ASTM)

ASTM B117-64 Standard Method for Salt Spray (Fog) Testing

ASTM D618-55 Methods of Conditioning Plastics and Electrical Insulating Materials for Testing

ASTM D756-56 Standard Methods of Test for Resistance of Plastics to Accelerated Service Conditions

ASTM D1056-73 Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber

ASTM D1564-71 Standard Methods of Testing Flexible Cellular Materials--Slab Urethane Foam

ASTM D1565-76 Standard Specifications for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)

- ASTM E4-64 Tentative Methods of Verification of Testing Machines
- ASTM E42-64 Recommended Practice for Operating Light-and-Water Exposure Apparatus (Carbon Arc Type) for Artificial Weathering Test

2.1.5 Society of Automotive Engineers (SAE)

SAE J211a Instrumentation for Impact Tests

2.1.6 American Association of Textile Chemists and Colorists (AATCC)

Standard Test Method 8-1961 - Colorfastness to Crocking (Rubbing)

Standard Test Method 107-1962 - Colorfastness to Water

Tentative Test Method 30-1957T - Fungicides, Evaluation of Textile; Mildew and Rot Resistance of Textiles

AATCC Geometric Gray Scale

AATCC Chart for Measuring Transference of Color

2.1.7 Military Standard

MIL-C-45662A Calibration System Requirements

2.2 Environmental Conditions

Unless otherwise specified, all tests and measurements shall be conducted under the following environmental conditions:

Temperature	66 to 78 degrees F
Relative Humidity	10% to 70%
Atmospheric Pressure	28 to 32 in. Hg

All data on environmental conditions required throughout this procedure shall be continuously and permanently recorded on strip charts, circular charts, or other acceptable printout media.



### 2.3 Test Sequence

Figure 2-1 shows the overall organization of this test procedure. The following three test series may be done simultaneously or sequentially in any order.

2.3.1 Materials Tests (See Figures 2-2 through 2-6.)

2.3.2 Inspection of Physical Features (See Figure 2-7.)

2.3.3 Dynamic Impact Test (See Figure 2-8.)

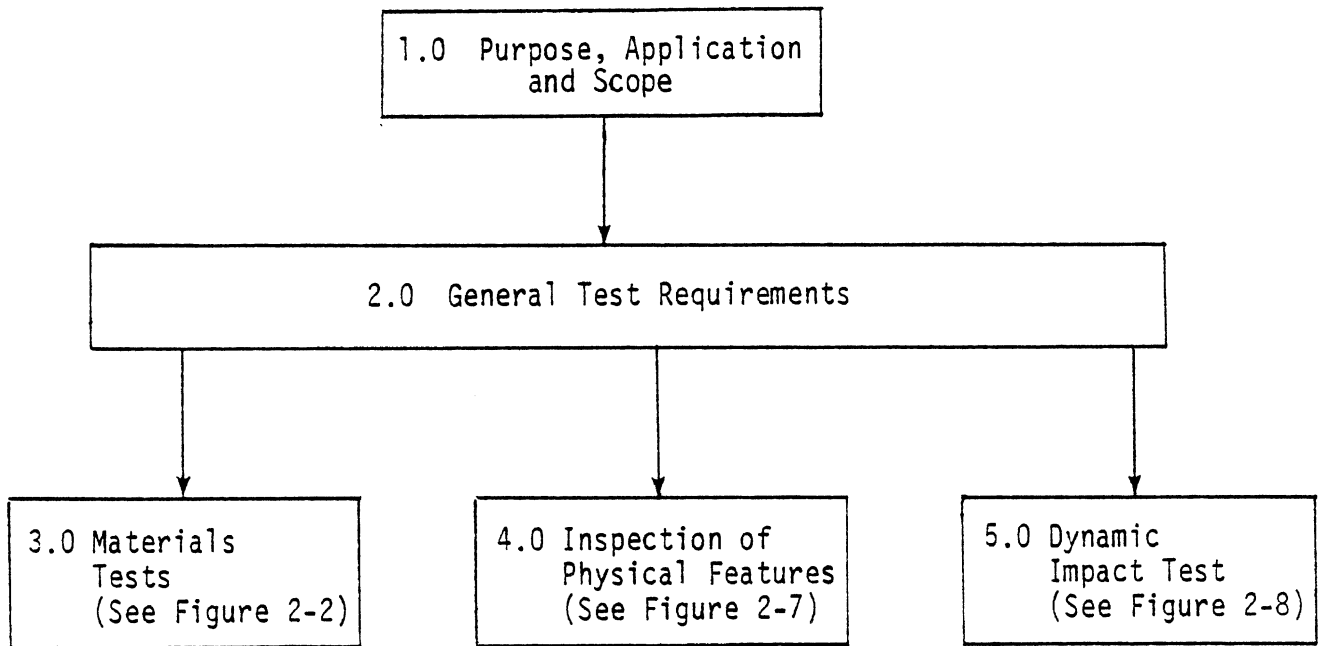


Figure 2-1 Test Procedure Organization

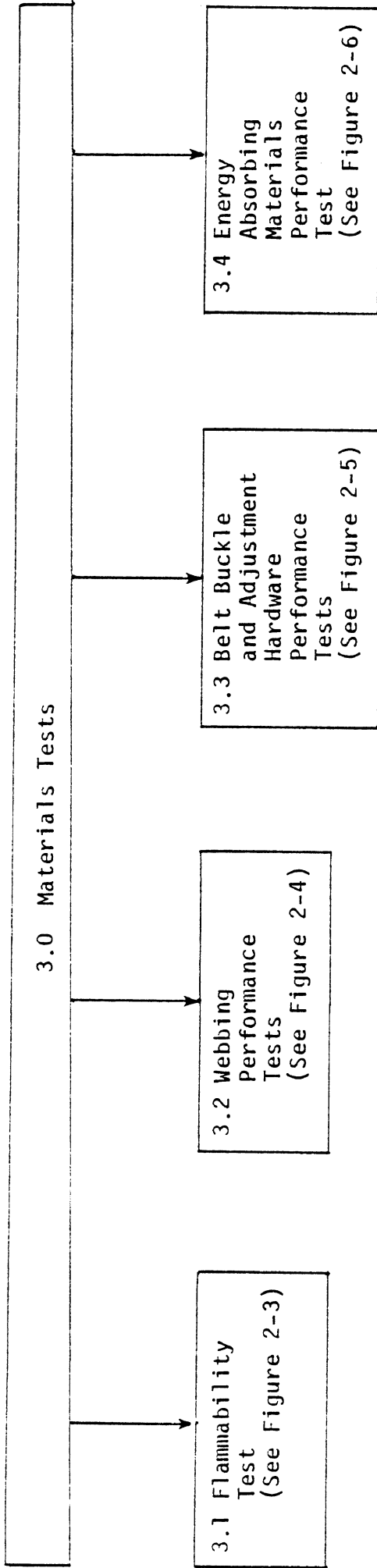


Figure 2-2 Materials Tests Flow Chart

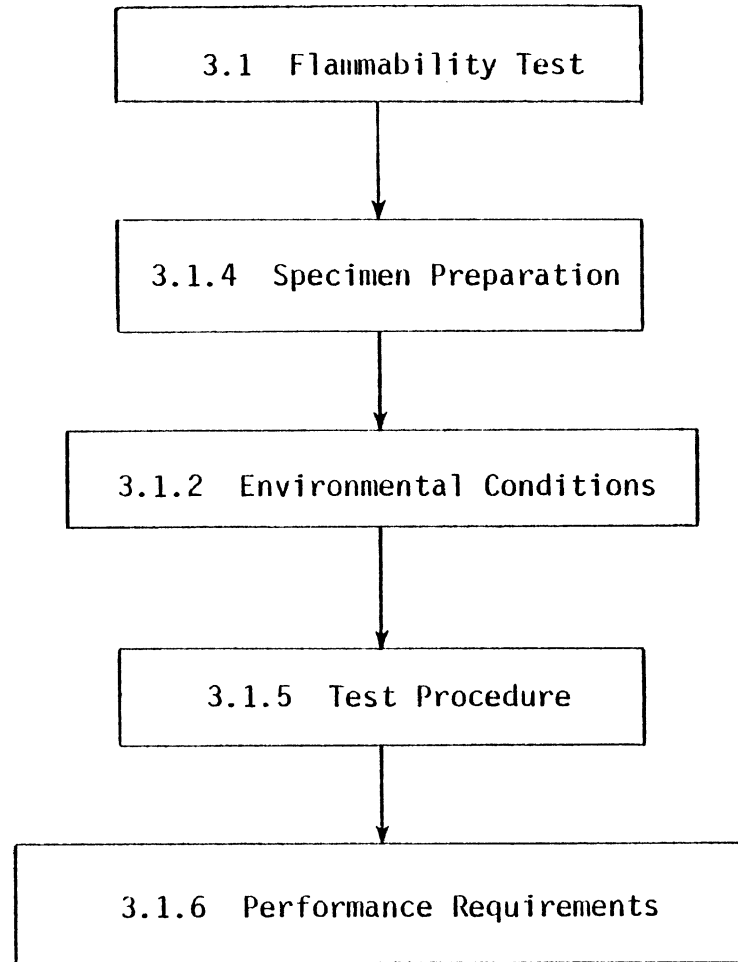


Figure 2-3 Flammability Test Flow Chart

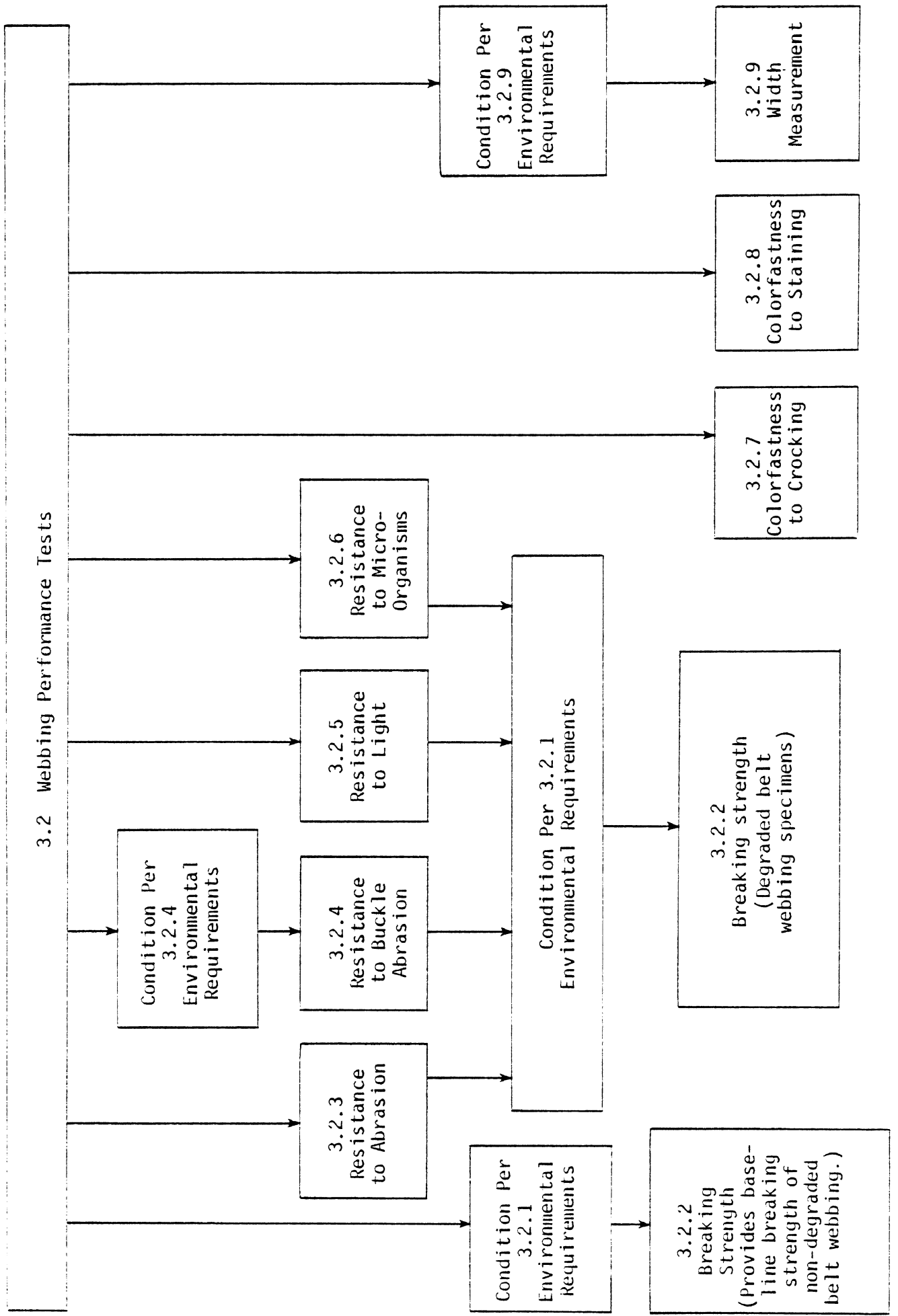


Figure 2-4 Webbing Performance Tests Flow Chart

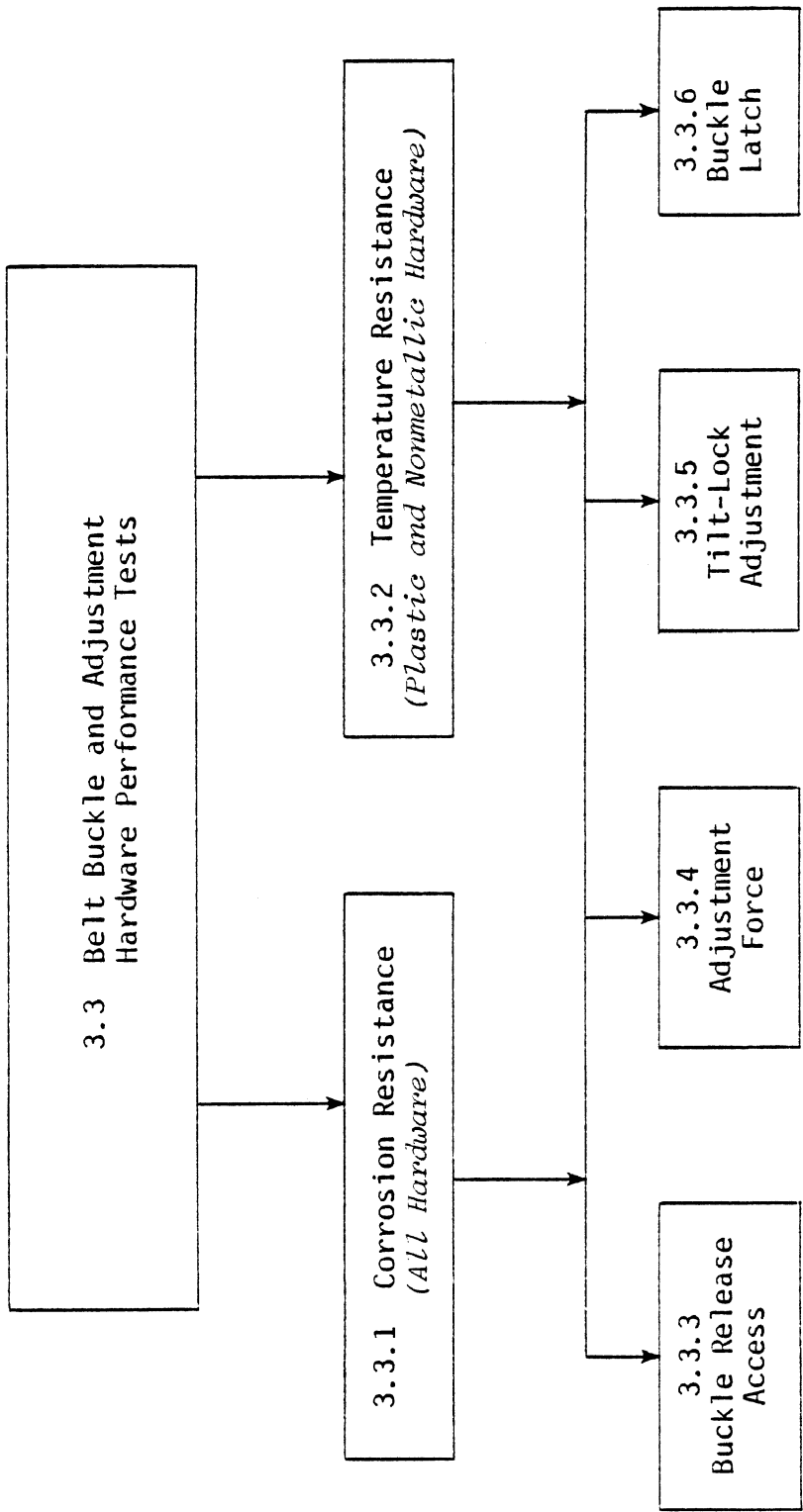


Figure 2-5 Belt Buckle Adjustment Hardware Performance Tests

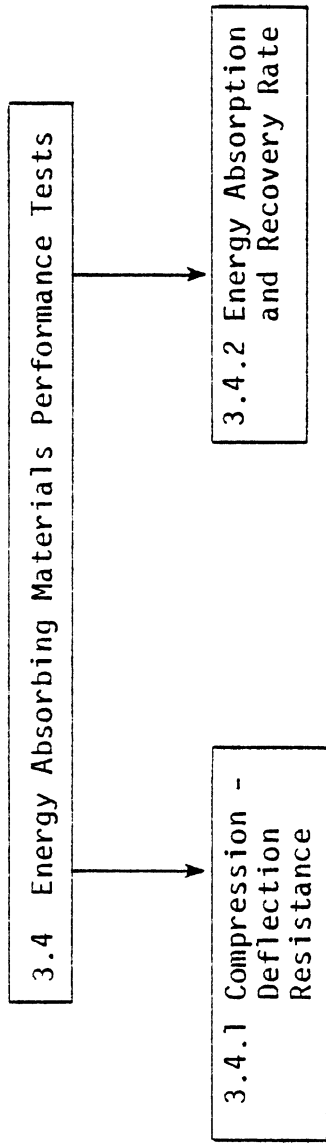


Figure 2-6 Energy Absorbing Materials Performance Tests Flow Chart

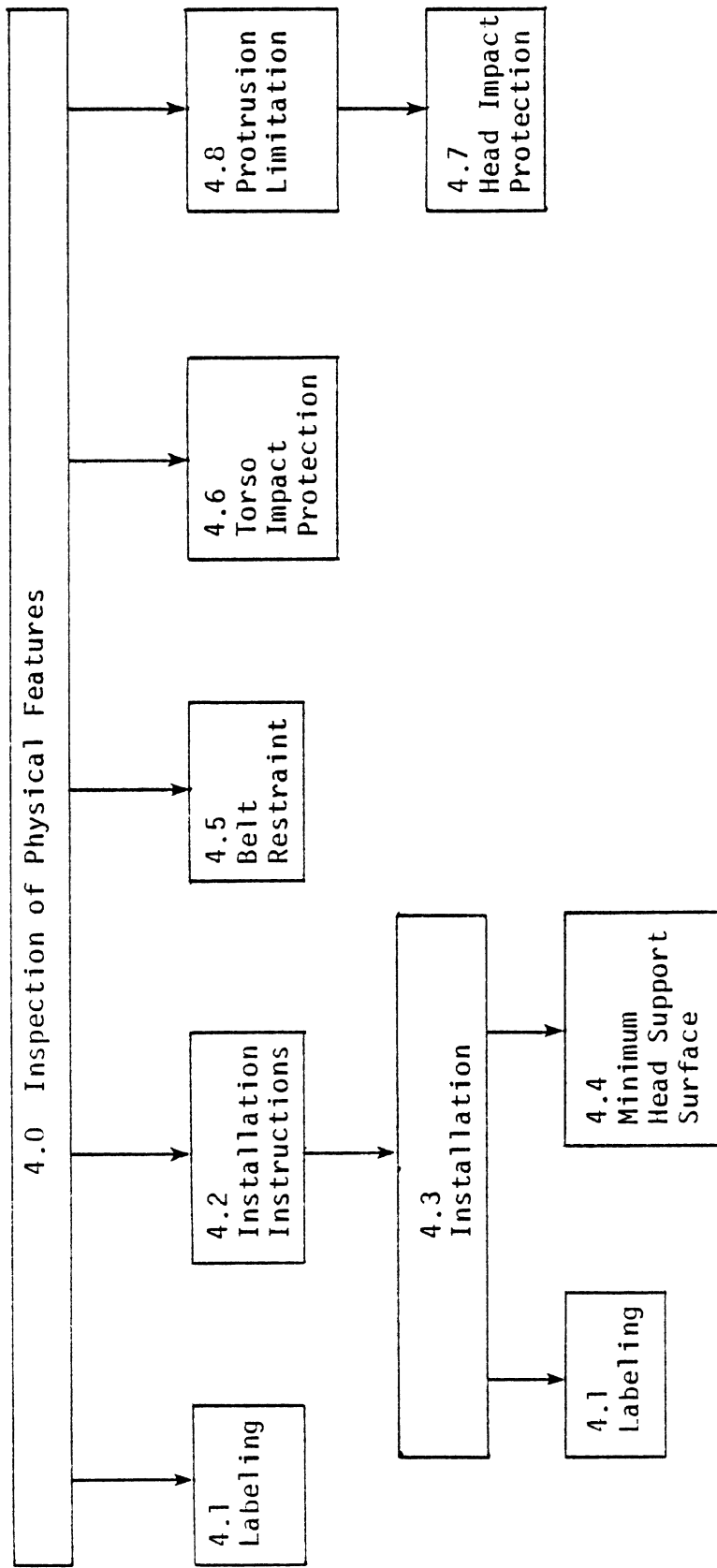


Figure 2-7 Inspection of Physical Features Flow Chart



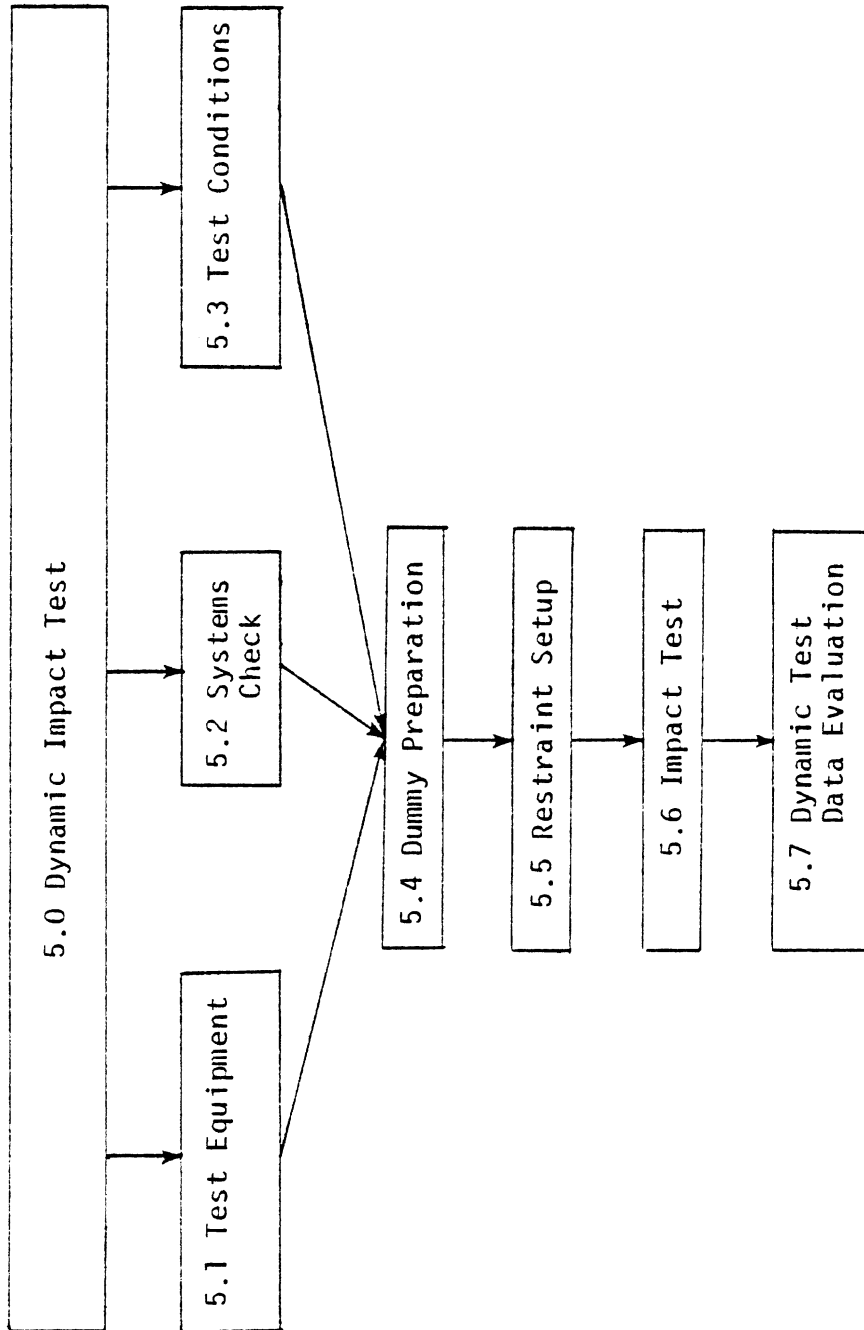


Figure 2-8 Dynamic Impact Test Flow Chart

## 2.4 Test Schedule

A test schedule shall be prepared and submitted to the CTM for approval prior to the start of the test program.

## 2.5 Operating Test Procedure

Before starting the test program, a written operating test procedure shall be submitted to the CTM for approval. The test procedure should include a step-by-step description of the test methodology to be employed in the program. When appropriate, the procedure shall include items such as safety precaution check-off lists, individual worksheets for each testing phase, and, if required, special procedures for dealing with a particular child restraint system.

## 2.6 Test Personnel Performance

Personnel supervising and/or performing the compliance test program shall be thoroughly familiar with the requirements, test conditions, and equipment for the tests to be conducted.

## 2.7 Test Sample Quantities

### 2.7.1 Materials Tests

Samples of all materials used in a given child restraint system shall be supplied by NHTSA in appropriate quantities for the materials tests in section 3.0 of this procedure and outlined in Figure 2-2.

(1) Flammability Tests - One sample 4 inches wide by 14 inches long, or the maximum available width or length if less, of each nonmetallic material is required for the flammability tests in section 3.1 of this procedure and outlined in Figure 2-3. The testing

laboratory may be required to cut specimens when necessary from an actual child restraint system.

(2) Webbing Performance Tests - Twenty-four samples, each 36 inches long, of each type of webbing used on the child restraint system are required for the webbing performance tests in section 3.2 of this procedure and outlined in Figure 2-4.

(3) Belt Buckle and Adjustment Hardware Performance Tests - Three sets of all buckle and adjustment hardware and an additional three sets of any plastic or nonmetallic buckle and adjustment hardware are required for the hardware performance tests in section 3.3 of this procedure and outlined in Figure 2-5.

(4) Energy Absorbing Materials Performance Tests - One complete set of padding is required for the energy absorbing materials performance tests in section 3.4 of this procedure and outlined in Figure 2-6. Additional larger samples may be required for certain types of materials.

#### 2.7.2 Inspection of Physical Features

One child restraint system shall be supplied by NHTSA for the inspection of physical features in section 4.0 of this procedure and outlined in Figure 2-7.

#### 2.7.3 Dynamic Impact Tests

Child restraint systems shall be supplied by NHTSA for the dynamic impact tests in section 5.0 of this procedure and outlined in Figure 2-8.

(1) Dynamic Impact Test Configuration 1 - One child restraint system is required for each test according to Dynamic Impact Test

Configuration I (FMVSS 213, S6.1.2.1.1). One test is required for each installation mode (i.e., forward- or rear-facing) in each adjustment position (i.e., upright or reclined) recommended by the manufacturer for actual use. For example, a child restraint system recommended for use in three forward-facing positions and one rear-facing position would require four Configuration I tests.

(2) Dynamic Impact Test Configuration II - One child restraint system is required for each test according to Dynamic Impact Test Configuration II (FMVSS 213, S6.1.2.1.2). One test is required for each forward-facing system, other than a child harness, that is equipped with an anchorage belt or a fixed or movable surface directly forward of the dummy (FMVSS 213, S5.2.2.2), in each adjustment position (i.e., upright or reclined) recommended by the manufacturer for actual use. Child restraint systems having both of the above features shall be tested with each feature "misused," i.e., with the tether or restraint belts not attached, both separately and simultaneously. For example, a child restraint system having both features and recommended for use in three forward-facing positions would require nine Configuration II tests.

(3) Retest - One child restraint system shall be available as a spare unit in the event that a retest is required.

## 2.8 Test Sample Inspection, Inventory, Identification, and Storage

All child restraint systems and associated extra materials and parts shall be stored upon receipt in a clean, dry, secure storage area to prevent any damage or deterioration that might affect test results. Within one week of receipt, all samples shall be inspected, and the date of receipt and the condition of the samples shall be recorded. Each

sample shall also be marked or labeled with a systematic item coding scheme to indicate the following:

Sequential number for entire sample set

Child restraint manufacturer and model

Sequential sample number within set

Type of test to be conducted with sample

Example: 001-XYZ-03-MW

This Item Code shall be recorded on all Compliance Datasheets applicable to the test sample.

## 2.9 Housekeeping

The laboratory shall maintain all test areas, calibration areas, test fixtures, and instrumentation in a neat, clean, and painted condition with test instruments set up in an orderly manner consistent with good laboratory housekeeping practices.

## 2.10 Calibration of Measurement and Test Equipment

Before starting the test program, the laboratory shall implement and maintain a measurement and test equipment calibration system in accordance with established calibration practices. Guidelines for setting up and maintaining such systems are described in MIL-C-45662A, "Calibration System Requirements." The calibration system shall be approved by the CTM before testing commences.

### 2.10.1 Implementation and Maintenance

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

(2) 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. Records showing the calibration traceability to the National Bureau of Standards shall be maintained for all measuring and test equipment.

(3) All measuring and test equipment and measuring standards shall be labeled with the following information:

- (a) Date of calibration
- (b) Date of next scheduled calibration
- (c) Name of the person who calibrated the equipment

(4) A written calibration procedure shall be provided by the contractor which includes the following information for all measuring and test equipment:

- (a) Type of equipment
- (b) Manufacturer
- (c) Model
- (d) Serial number
- (e) Measurement range
- (f) Accuracy
- (g) Calibration standard
- (h) Frequency of calibration
- (i) Date of last calibration
- (j) Date of next calibration
- (k) Person performing calibration

(5) Records of calibrations for all measuring and test equipment 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 by the CTM or authorized representatives of OVSC. The equipment list and calibration schedules shall be included in the Final Test Report as Appendix B.

#### 2.10.2 Worst Case Analysis

The laboratory shall prepare a worst case error analysis of the Dynamic Impact Test instrumentation to show the ability of the instrumentation to determine whether a restraint system complies with the standard. This analysis shall include all potential measurement variables.

#### 2.11 Government Furnished Equipment (GFE)

The three-year-old dummy (49 CFR 572, Subpart C) and the six-month-old dummy (49 CFR 572, Subpart D) will be provided to the laboratory by OVSC. The three-year-old dummy shall be calibrated by the laboratory before the start of the test program, after an apparent noncompliance with the Dynamic Impact Test requirements (unless waived by the CTM), and six months after the previous official calibration. The dummy calibration procedure is attached as Appendix I.

#### 2.12 Photographs of Equipment

The test setup and equipment used in all tests are to be photographed for the record and the photographs included in the Final Test Report as Appendix C. Normally one photograph of each test setup and associated equipment will suffice unless the setup is complicated and/or spread out, thereby requiring two or more photographs. The equipment in the photographs must agree with those items noted in Appendix B of the Final Test Report. Each photograph must be accompanied by a suitable caption.

### 2.13 Test Data

Test data shall be recorded in standard engineering units, when applicable, on Compliance Datasheets specifically prepared for this purpose, as shown in section 6.0 of this procedure. The Datasheets are coded to reflect their applicable test series:

M - Materials Tests

F - Inspection of Physical Features

D - Dynamic Impact Tests

For each FMVSS requirement indicated on the Datasheets, determine compliance, and record Pass, Fail, NA (not applicable), or See Remarks in the space provided. Any noncompliance should be explained under Remarks.

The full set of Compliance Datasheets shall be included in the Final Test Report.

### 2.14 Interim Failure Reports

When an apparent noncompliance is encountered during a test, the CTM shall be notified of the failure by telephone within 24 hours. Three copies of the appropriate Compliance Datasheet(s) with complete explanatory comments shall be mailed to the CTM within 2 working days. These may be hand-written.

### 2.15 Final Test Report

The Final Test Report shall be submitted to the CTM within 2 weeks of completion of all phases of compliance testing of each restraint system. Six copies are required in the case of a noncompliance; four copies are required if the restraint system has complied.



Format and preparation of the Final Test Report as well as specifications for film submitted with the report are outlined in section 7.0 of this procedure.



### 3.0 Materials Tests

#### 3.1 Flammability Test (FMVSS 213, S5.7; FMVSS 302)

##### 3.1.1 Application (FMVSS 302, S4.1, S4.2)

All nonmetallic materials of a child restraint system shall meet the flammability requirements of FMVSS 302 as outlined in this procedure. Any material that does not adhere to other material(s) at every point of contact shall meet the requirements given in section 3.1.6 of this procedure when tested separately. Any material that adheres to other material(s) at every point of contact shall meet these same requirements when tested as a composite with the other materials. Indicate on Compliance Datasheet M-1 the type of material being tested and the specimen's function on the restraint system (i.e., padding, buckle, shell, etc.).

##### 3.1.2 Environmental Conditions (FMVSS 302, S5.1.2)

Flammability tests shall be conducted under the following environmental conditions:

Temperature	60 to 70 degrees F
Relative Humidity	50% to 60%
Atmospheric Pressure	28 to 32 in. Hg

Each specimen shall be conditioned for a minimum of 24 hours under these environmental conditions before subjecting it to the flammability test.

### 3.1.3 Equipment Requirements

#### 3.1.3.1 Enclosure Cabinet (FMVSS 302, S5.1.1)

Conduct the test in a metal cabinet for protecting the test specimens from drafts, as shown in Figure 3-1. The interior of the cabinet is 15 inches long, 8 inches deep, and 14 inches high. It has a glass observation window in the front, a closable opening to permit insertion of the specimen holder, and a hole to accommodate tubing for a gas burner. For ventilation, it has a 1/2-inch clearance space around the top of the cabinet, ten 3/4-inch-diameter holes in the base of the cabinet, and legs to elevate the bottom of the cabinet by three-eighths of an inch, all located as shown in the figure.

#### 3.1.3.2 Specimen Support Frame (FMVSS 302, S5.1.3)

Insert the test specimen between two matching U-shaped frames of metal stock 1 inch wide and 3/8 inch high. The interior dimensions of the U-shaped frames are 2 inches wide by 13 inches long. A specimen that softens and bends at the flaming end so as to cause erratic burning is kept horizontal by supports consisting of thin, heat resistant wires, spanning the width of the U-shaped frame under the specimen at 1-inch intervals. A device that may be used for supporting this type of material is an additional U-shaped frame, wider than the U-shaped frame containing the specimen, spanned by 10-mil wires of heat-resistant composition at 1-inch intervals, inserted over the bottom U-shaped frame.

#### 3.1.3.3 Flame Source (FMVSS 302, S5.1.4 and S5.1.5)

Use a bunsen burner with a tube of 3/8-inch inside diameter. Set the gas adjusting valve to provide a flame, with the tube vertical, of

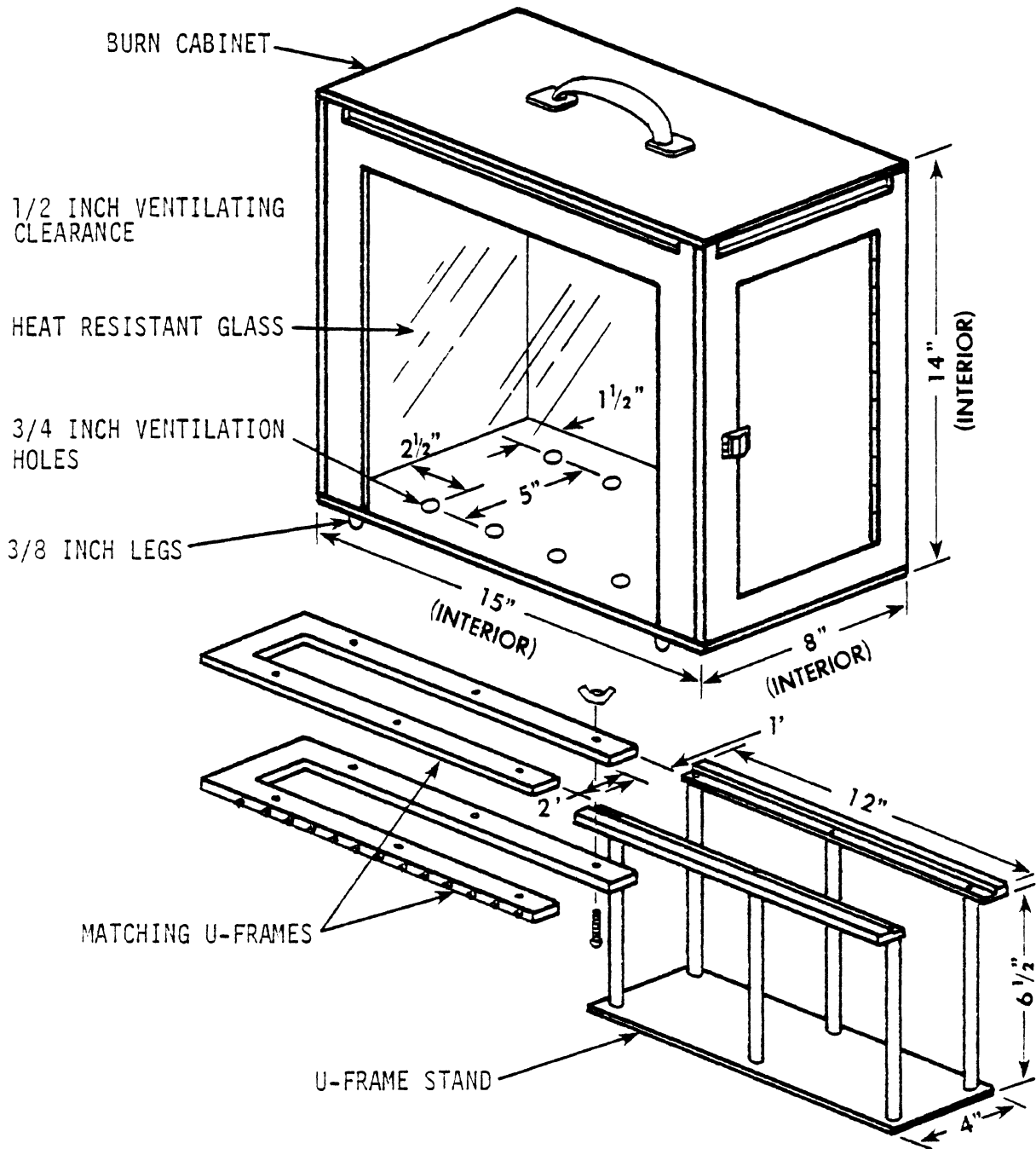


Figure 3-1 Enclosure Cabinet

1-1/2 ±1/16 inches in height. Close the air inlet to the burner. The gas supplied to the burner should have a flame temperature equivalent to that of natural gas.

3.1.4 Specimen Preparation  
(FMVSS 302, S5.2.1, S5.2.2, S5.2.3)

Each specimen of material to be tested shall be a rectangle 4 inches wide by 14 inches long, whenever possible. The thickness of the specimen is that of the single or composite material used in the child restraint system, except that if the material's thickness exceeds 1/2 inch, cut the specimen down to that thickness. When it is not possible to obtain a flat specimen because of surface curvature, cut the specimen to not more than 1/2 inch in thickness at any point. Use the maximum available length or width of a specimen when either dimension is less than 14 inches or 4 inches, respectively.

For homogeneous material, prepare a single specimen. For material with directional structure, cut and test two specimens, one oriented parallel to and the other oriented perpendicular to this structure. If, during a test, a diagonal direction appears to yield a more adverse result, prepare and test a third specimen oriented diagonally.

Place material with a napped or tufted surface on a flat surface and comb twice against the nap with a comb having seven to eight smooth, rounded teeth per inch.

3.1.5 Test Procedure  
(FMVSS 302, S5.3)

Orient the specimen so that the surface closest to the child restraint occupant faces downward on the test frame. Mount the specimen so that both sides and one end are held by the U-shaped frame, and one

end is even with the open end of the frame. When the maximum available width of a specimen is not more than 2 inches, so that the sides of the specimen cannot be held in the U-shaped frame, place the specimen in position on wire supports as described in section 3.1.3.2 of this procedure, with one end held by the closed end of the U-shaped frame.

Place the mounted specimen in a horizontal position, in the center of the cabinet. With the flame adjusted according to section 3.1.3.3 of this procedure, position the bunsen burner and specimen so that the center of the burner tip is 3/4-inch below the center of the bottom edge of the open end of the specimen. Expose the specimen to the flame for 15 (+0,-1) seconds. Turn off the gas supply to the burner and reset the timer to zero.

Begin timing (without reference to the period of application of the burner flame) when the flame from the burning specimen reaches a point  $1\text{-}1/2 \pm 1/16$  inches from the open end of the specimen. Use the forward-most point of visible flame as a reference point. Measure the time that it takes the flame to progress to a point 1-1/2 inches from the clamped end of the specimen. If the flame does not reach the specified end point, time its progress to the point where flaming stops.

Calculate the burn rate from the formula

$$B = 60 \times D/T$$

where B = burn rate in inches per minute,  
D = length the flame travels in inches, and  
T = time in seconds for the flame to travel D inches.

Record the burn rate data on Compliance Datasheet M-1 along with any observations on burn characteristics.

3.1.6 Performance Requirements  
(FMVSS 302, S4.3)

When tested in accordance with section 3.1.5 of this procedure, the material shall not burn, nor transmit a flame front across its surface, at a rate of more than 4 inches per minute. However, the requirement concerning transmission of a flame front shall not apply to a surface created by the cutting of a test specimen for purposes of testing pursuant to sections 3.1.4 and 3.1.5 of this procedure.

If a material stops burning before it has burned for 60 seconds from the start of timing, and has not burned more than 2 inches from the point where timing was started, it shall be considered to meet the burn-rate requirement.

Record the results on Compliance Datasheet M-1.

3.2 Webbing Performance Tests  
(FMVSS 213, S5.4.1)

This section applies to the webbing of belts provided with a child restraint system and used to attach the system to the vehicle or to restrain the child within the system. Three specimens of each type of webbing are to be subjected to each of the following webbing performance tests. Twenty-four belt webbing specimens, 36 inches in length, of each type of webbing used in the child restraint system are required to determine compliance.

3.2.1 Environmental Conditioning  
(FMVSS 209, S5.1(a))

When specified below for particular tests, webbing samples shall be conditioned for at least 24 hours under the following environmental conditions:



Temperature 69.8 to 77 degrees F  
Relative Humidity 48% to 67%

3.2.2 Breaking Strength  
(FMVSS 213, S5.4.1(a); FMVSS 209, S5.1(b))

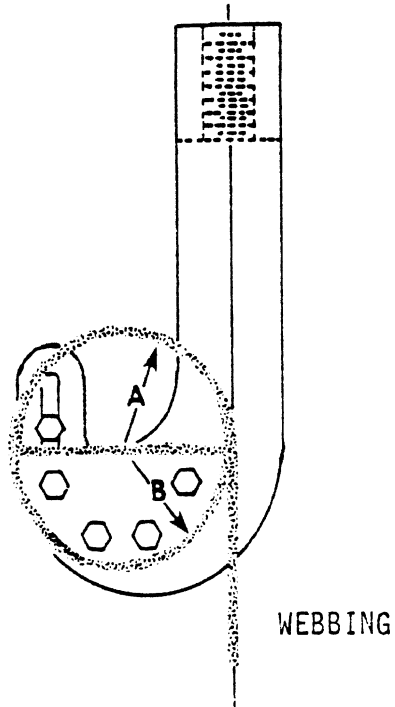
Subject three specimens of each type of belt webbing used in the child restraint system to the environmental conditioning given in section 3.2.1 of this procedure.

Test the webbing for breaking strength in a testing machine having a load-generating capacity of approximately 5000 pounds and verified to have an error of not more than 1% in the range of the breaking strength of the tested webbing by ASTM E4-64, Tentative Methods of Verification of Testing Machines. The machine shall be equipped with split drum grips illustrated in Figure 3-2, having a diameter between 2 and 4 inches or 5 and 10 centimeters. The rate of grip separation shall be between 2 and 4 inches per minute or 5 and 10 centimeters per minute. The distance between the centers of the grips at the start of the test shall be between 4 and 10 inches or 10 and 25 centimeters. After placing the specimen in the grips, stretch the webbing continuously at a uniform rate to failure. Record the breaking strength for each specimen on Compliance Datasheet M-2, and calculate a median breaking strength to be used as a baseline for comparison with the results of other tests.

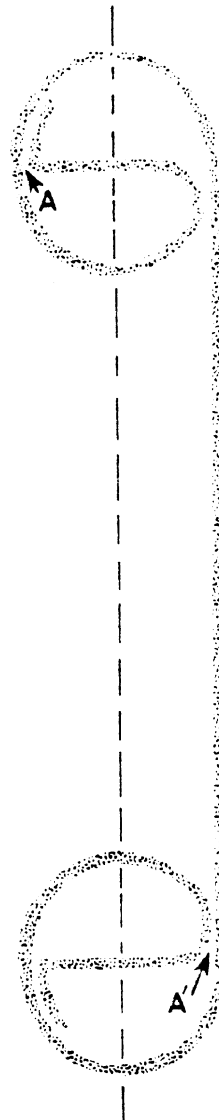
3.2.3 Resistance to Abrasion  
(FMVSS 209, S5.1(d))

Test three specimens for resistance to abrasion by rubbing over the hexagon bar illustrated in Figure 3-3 in the following manner. Mount the webbing in the apparatus as shown schematically in the figure. Attach one end of the webbing (A) to a weight (B) which has a mass of  $3.3 \pm 0.1$  pounds or  $1.50 \pm 0.05$  kilograms, except that a mass of  $5.2 \pm 0.1$

WEBBING GRIP  
WITH WEBBING



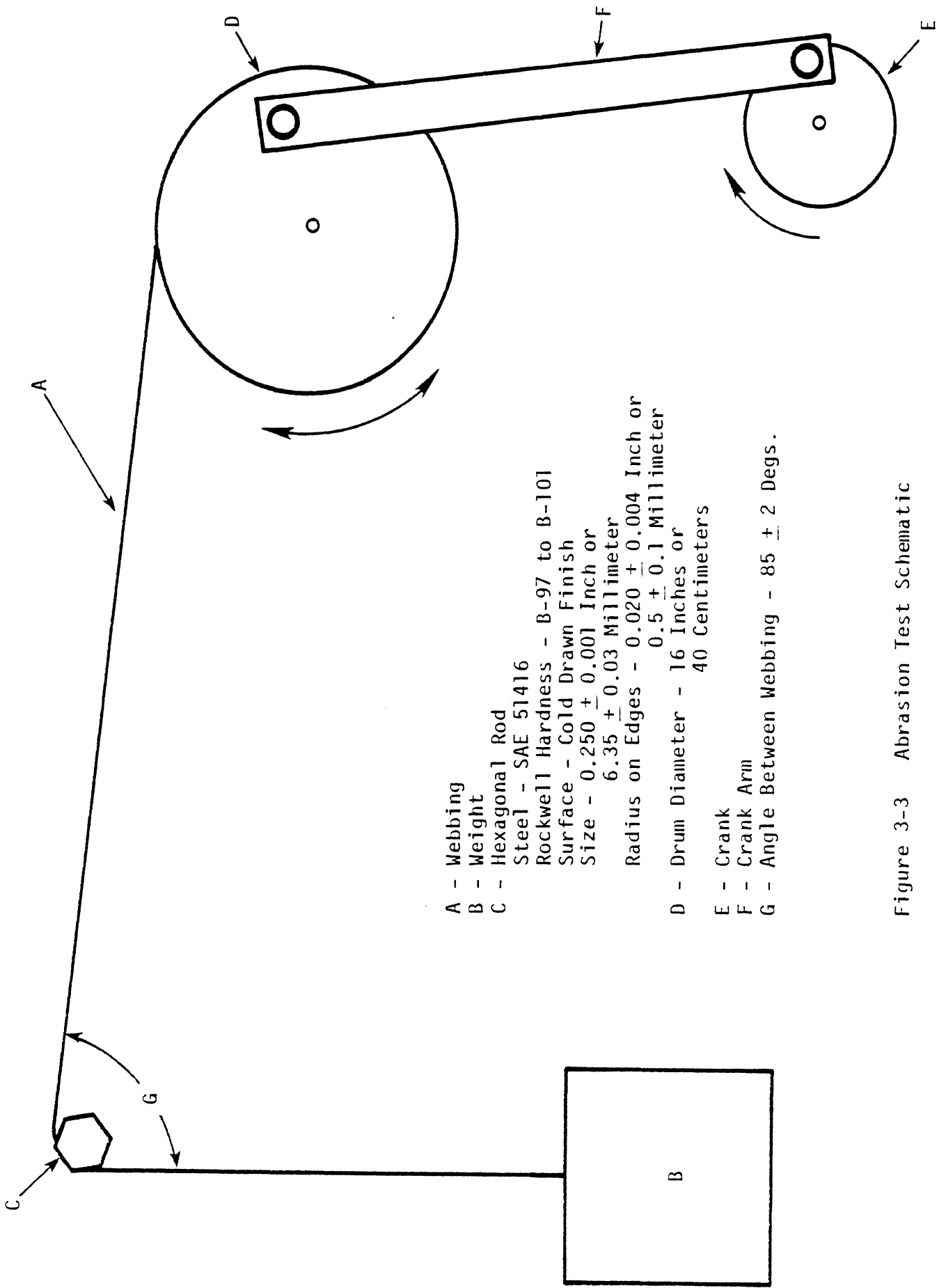
METHOD OF WRAPPING  
WEBBING GRIP



A: 1 to 2 Inches or 2.5 to 5 Centimeters  
B: A Minus 0.06 Inch or 0.15 Centimeter

A' & A: NO WEBBING -  
TO-WEBBING CONTACT

Figure 3-2 Breaking Strength Test Device



- A - Webbing
- B - Weight
- C - Hexagonal Rod
  - Steel - SAE 51416
  - Rockwell Hardness - B-97 to B-101
  - Surface - Cold Drawn Finish
  - Size -  $0.250 \pm 0.001$  Inch or  $6.35 \pm 0.03$  Millimeter
  - Radius on Edges -  $0.020 \pm 0.004$  Inch or  $0.5 \pm 0.1$  Millimeter
- D - Drum Diameter - 16 Inches or 40 Centimeters
- E - Crank
- F - Crank Arm
- G - Angle Between Webbing -  $85 \pm 2$  Degs.

Figure 3-3 Abrasion Test Schematic

pounds or  $2.35 \pm 0.03$  kilograms shall be used for webbing in an anchorage belt (tether) provided with the child restraint system. Pass the webbing over the two new abrading edges of the hexagon bar (C), and attach the other end to an oscillating drum (D) that has a stroke of 13 inches or 33 centimeters. Use suitable guides to prevent movement of the webbing along the axis of hexagonal bar C. Oscillate drum D for 5,000 strokes or 2,500 cycles at a rate of  $60 \pm 2$  strokes per minute or  $30 \pm 1$  cycles per minute.

Upon completion of the webbing abrasion, conduct a breaking strength test on the three belt webbing specimens as outlined in section 3.2.2 of this procedure, including the required environmental conditioning. Record the breaking strength for each abraded specimen on Compliance Datasheet M-2, calculate the median breaking strength for the three specimens, and record this value on the Datasheet. The median breaking strength of the abraded samples shall be at least 75% of the median breaking strength of the non-abraded belt webbing specimens of the same type.

#### 3.2.4 Resistance to Buckle Abrasion (FMVSS 209, S5.3(c))

Test three specimens of each type of belt webbing used in a child restraint system for resistance to abrasion by each buckle or manual adjusting device normally used to adjust the size of the assembly. Expose the webbing for 4 hours (+0,-5 minutes) to an atmosphere having relative humidity of  $65 \pm 5$  percent and temperature of  $70 (+10,-0)$  degrees F. Pull the webbing back and forth through the buckle or manual adjusting device as shown schematically in Figure 3-4. Attach the anchor end of the webbing (A) to a weight (B) of 3 pounds. Pass the

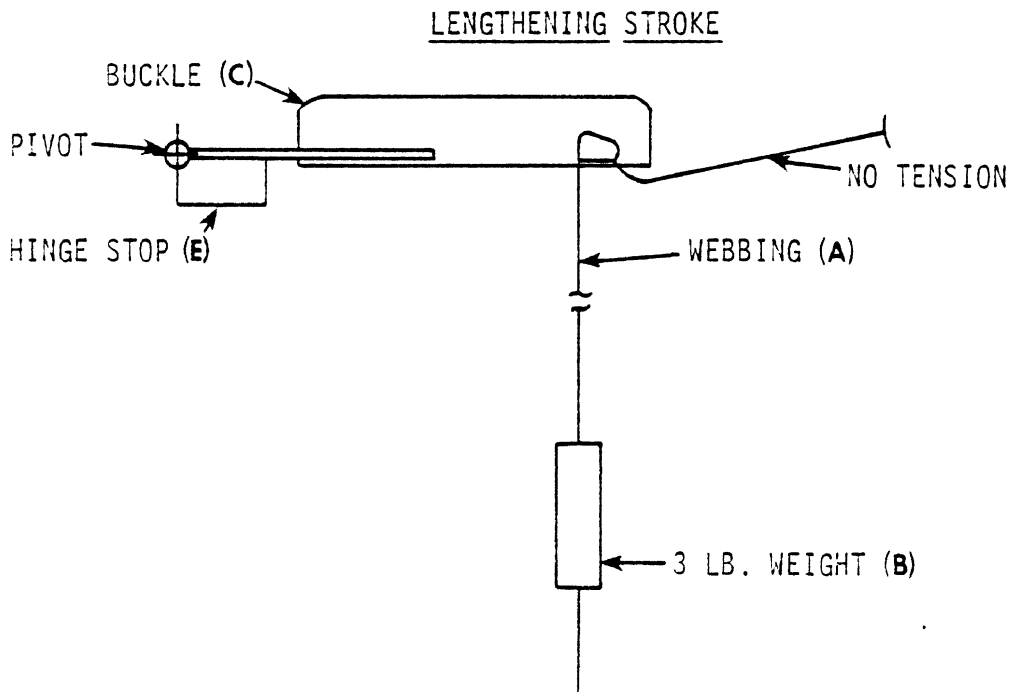
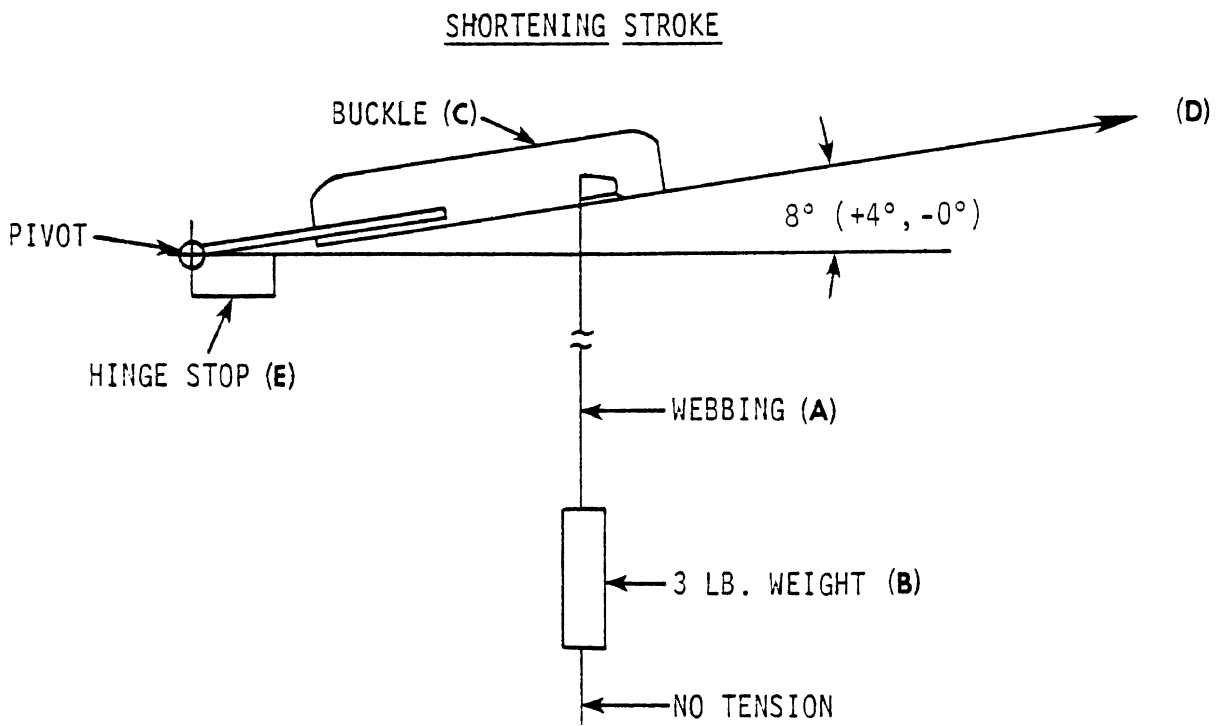


Figure 3-4 Buckle Abrasion Test Schematic

webbing through the buckle (C), and attach the other end (D) to a reciprocating device so that the webbing forms an angle of  $8 (+4,-0)$  degrees with the hinge stop (E). Operate the reciprocating device for 2,500 cycles at a rate of 18 cycles per minute with a stroke length of  $8 (+0,-.5)$  inches.

Upon completion of the webbing buckle abrasion, conduct a breaking strength test on the three belt webbing specimens as outlined in section 3.2.2 of this procedure, including the required environmental conditioning. Record the breaking strength for each buckle-abraded specimen on Compliance Datasheet M-2, calculate the median breaking strength for the three specimens, and record this value on the Datasheet. The median breaking strength of the buckle-abraded samples shall be at least 75% of the median breaking strength of the non-abraded belt webbing specimens of the same type.

#### 3.2.5 Resistance to Light (FMVSS 209, S4.2(e), S5.1(e))

Test three specimens of each type of belt webbing used in the child restraint system for resistance to light. Webbing specimens shall be at least 20 inches or 50 centimeters in length. Suspend these specimens vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in ASTM E42-64, Recommended Practice for Operation of Light and Water-Exposure Apparatus (Carbon-Arc Type) for Artificial Weathering Test. Operate the apparatus without water spray at an air temperature of  $140 \pm 3.6$  degrees F or  $60 \pm 2$  degrees C measured at a point  $1.0 \pm 0.2$  inch or  $25 \pm 5$  millimeters outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. Expose the specimens to the light

from the carbon arc for 100 (+0,-.5) hours, and then condition the specimens under the environmental conditions given in section 3.2.1 of this procedure.

Determine the colorfastness of the exposed and conditioned specimens on the AATCC Geometric Gray Scale. The webbing shall have a color retention not less than No. 2 on this scale. Record the results for each specimen on Compliance Datasheet M-2.

Conduct a breaking strength test on the three light-exposed and conditioned belt webbing specimens as outlined in section 3.2.2 of this procedure without repeating the environmental conditioning. Record the breaking strength of each carbon-arc-exposed belt webbing specimen on Compliance Datasheet M-2, calculate the median breaking strength for the three specimens, and record this value on the Datasheet. The median breaking strength of the carbon-arc-exposed samples shall be at least 60% of the median breaking strength of specimens of the same type of belt webbing without any exposure to the carbon arc.

#### 3.2.6 Resistance to Micro-Organisms (FMVSS 209, S4.2(f), S5.1(f))

Test three specimens of each type of belt webbing used in the child restraint system for resistance to micro-organisms, unless the webbing is made from material inherently resistant to micro-organisms. Webbing specimens shall be at least 20 inches or 50 centimeters in length. Subject these specimens successively to the procedures prescribed in AATCC Tentative Test Method 30-1957T, Fungicides, Evaluation of Textiles; Mildew and Rot Resistance of Textiles, Section 1C1--Water Leaching, Section 1C2--Volatilization, and Section 1B3--Soil Burial Test. After soil-burial for a period of 2 weeks, wash the specimens in

water, allow them to dry and condition them under the environmental conditions given in section 3.2.1 of this procedure.

Upon completion of exposure to micro-organisms, conduct a breaking strength test on the three belt webbing specimens as outlined in section 3.2.2 of this procedure, without repeating the environmental conditioning. Record the breaking strength of each micro-organism-exposed belt webbing specimen on Compliance Datasheet M-2, calculate the median breaking strength for the three specimens, and record this value on the Datasheet. The median breaking strength of the micro-organism-exposed samples shall be at least 85% of the median breaking strength of specimens of the same type of belt webbing without any exposure to micro-organisms.

3.2.7 Colorfastness to Crocking  
(FMVSS 209, S4.2(g), S5.1(g))

Test three specimens of each type of belt webbing used in a child restraint system for colorfastness to crocking (rubbing) in accordance with AATCC Standard Test Method 8-1961. The belt webbing shall not transfer color to a crock cloth either wet or dry to a greater degree than class 3 on the AATCC Chart for Measuring Transference of Color. Record the degree of color transference on Compliance Datasheet M-2.

3.2.8 Colorfastness to Staining  
(FMVSS 209, S4.2(h), S5.1(h))

Test three specimens of each type of belt webbing used in a child restraint system for colorfastness to staining in accordance with the water-immersion procedures of AATCC Standard Test Method 107-1962, with the following modifications. Use distilled water, use a perspiration tester, use a drying time in paragraph 4 of the procedures of 4 hours,



and use the section entitled "Evaluation Method for Staining (3)" to determine colorfastness to staining. The belt webbing shall not stain to a greater degree than class 3 on the AATCC Chart for Measuring Transference of Color. Record the degree of staining on Compliance Datasheet M-2.

3.2.9 Width  
(FMVSS 213, S5.4.1(c), S5.4.1.1)

Subject three specimens of each type of belt webbing used in a child restraint system and contactable by the test dummy torso during the Dynamic Impact Test (see section 5.0 of this procedure) to width measurement. Condition the webbing for 24 hours under the following environmental conditions:

Temperature	70 to 77 degrees F
Relative Humidity	48% to 67%

Measure belt webbing width under a tension of 5 pounds applied lengthwise. The measured width of the belt webbing shall not be less than 1-1/2 inches. Record the results for each specimen on Compliance Datasheet M-2.

3.3 Belt Buckle and Adjustment Hardware Performance Tests  
(FMVSS 213, S5.4.2)

3.3.1 Corrosion Resistance  
(FMVSS 209, S4.3(a)(2), S5.2(a))

Subject three specimens of all buckle and adjustment hardware to the salt spray test, according to ASTM B117-64, for a period not to exceed 25 hours, consisting of 24 (+0,-.25) hours of salt spray exposure followed by 1 (+0,-.1) hour of drying. Each specimen among a set of three should be oriented differently in the salt spray chamber. During the test, the temperature in the salt spray chamber shall be

continuously and permanently recorded, and the test-condition records specified in ASTM B117-64, section 13, shall be maintained.

After the test, wash the hardware thoroughly with water to remove the salt, and allow the specimens to dry for 24 hours under standard laboratory environmental conditions as given in section 3.2.1 of this procedure. The hardware shall be free of ferrous or nonferrous corrosion that may be transferred, either directly or indirectly by means of webbing, to the restraint system's occupant or his/her clothing. Examine the hardware for such corrosion, and record the results on Compliance Datasheet M-3.

The three hardware specimens used in this test shall also be tested according to applicable hardware tests outlined in sections 3.3.3 through 3.3.6 of this procedure.

3.3.2 Temperature Resistance  
(FMVSS 209, S4.3(b), S5.2(b))

Subject three new specimens of all plastic or other nonmetallic buckle and adjustment hardware to the accelerated service conditions test in accordance with ASTM D756-56, Procedure IV, omitting the weight and dimension measurements. Unlatch buckles, and condition the specimens as indicated in ASTM D756-56, section 5, prior to and at the end of the test.

The hardware specimens shall not warp or otherwise deteriorate to cause the buckle or other assembly to operate improperly. Examine the specimens for such deterioration, and record the results on Compliance Datasheet M-3.

The three hardware specimens used in this test shall also be tested according to applicable hardware tests outlined in sections 3.3.3 through 3.3.6 of this procedure.

3.3.3 Buckle Release Access  
(FMVSS 209, S4.3(d) (2), S5.2(d) (2))

Follow the procedure given below for the appropriate buckle design, and record the results on Compliance Datasheet M-3.

3.3.3.1 Pushbutton Buckles

Measure the linear dimensions of the surface designed for applying the release force, and calculate the area of this surface to the nearest 0.05 square inch or 0.3 square centimeter. This surface shall have a minimum area of 0.7 square inch or 4.5 square centimeters, with a minimum linear dimension of 0.4 inch or 10 millimeters.

3.3.3.2 Lever-Release Buckles

Insert a cylinder  $0.4 \pm 0.02$  inch or  $10 \pm 0.5$  millimeters in diameter and  $1.5 \pm 0.02$  inches or  $38 \pm 0.5$  millimeters long in the actuation portion of the buckle release. The buckle shall permit insertion of this cylinder to at least the midpoint of the cylinder along the cylinder's entire length.

3.3.3.3 Other Buckle Designs

Attempt to actuate the buckle release using two adult fingers. The buckle shall have adequate access for two or more fingers.

3.3.4 Adjustment Force  
(FMVSS 209, S4.3(e), S5.2(e))

Test three sets of adjustment hardware and webbing for the force necessary to decrease the effective length of the assembly. The hardware previously used for the Corrosion Resistance or Temperature

Resistance tests shall also be used for this test. With no load on the anchor end of the webbing, draw the webbing through the adjustment device at a rate of  $20 \pm 2$  inches per minute or  $50 \pm 5$  centimeters per minute. Precycle the webbing 10 times in the above manner, and then measure the maximum force to the nearest 0.25 pound or 0.1 kilogram after the first 1.0 inch or 25 millimeters of webbing movement. The force required to decrease the effective length of this assembly shall not exceed 11 pounds or 5 kilograms. Record the results on Compliance Datasheet M-3.

3.3.5 Tilt-Lock Adjustment  
(FMVSS 209, S4.3(f), S5.2(f))

If the adjustment device is of a "tilt-lock" design, test three such devices for lock angle. The hardware previously used for the Corrosion Resistance or Temperature Resistance tests shall also be used for this test. Orient the base of the adjustment mechanism and the anchor-end of the webbing in planes normal to each other. Draw the webbing through the adjustment mechanism in a direction to increase belt length at a rate of  $20 \pm 2$  inches per minute or  $50 \pm 5$  centimeters per minute while the plane of the base is slowly rotated in a direction to lock the webbing. When the webbing locks, stop the rotation, but continue pulling on the webbing until there is a resistance of at least 20 pounds or 9 kilograms. Measure the angle between the anchor-end of the webbing and the base of the adjustment mechanism to the nearest degree. The lock angle shall be not less than 30 degrees. Record the results on Compliance Datasheet M-3.

3.3.6 Buckle Latch  
(FMVSS 209, S4.3(g), S5.2(g))

Test three buckle assemblies, previously used in the Corrosion Resistance or Temperature Resistance tests, for latch wear and partial-engagement separation force. Clamp or firmly hold the buckles against a flat surface, so as to permit normal movement of buckle parts, but with the metal mating plate (for metal-to-metal buckles) or the webbing end (for metal-to-webbing buckles) withdrawn. Move the release mechanism 200 times through its maximum travel with a force of  $30 \pm 3$  pounds or  $14 \pm 1$  kilograms at a rate not to exceed 30 cycles per minute. The buckle latch shall not fail, nor gall or wear to an extent that normal latching or unlatching is impaired. Examine the buckle for such degradation, and record the results on Compliance Datasheet M-3.

For metal-to-metal buckles that can be partially engaged by means of any technique representative of actual use, measure the maximum force necessary to separate the buckle parts when in such partial engagement. The buckle shall separate when in any such position of partial engagement by a force not more than 5 pounds or 2.3 kilograms. Record the results on Compliance Datasheet M-3.

3.4 Energy Absorbing Materials Performance Tests  
(FMVSS 213, S5.2.3, S6.3)

This section applies to padding located in the head impact area of child restraint systems recommended for children weighing less than 20 pounds. (See section 4.7 of this procedure for the definition of head impact area.) The specific test method depends on the type of base material used in the padding:

Sponge or expanded rubber: ASTM D1056-73

Slab urethane foam: ASTM D1564-71

Vinyl chloride polymers and copolymers (open-cell foam):  
ASTM D1565-76

For materials which do not fall into the above three categories, analogous test procedures appropriate for the particular material should be used, identified, and recorded on Compliance Datasheet M-4. If more than one type of material is used in the head impact area, each material shall be tested according to the procedures appropriate for that material.

#### 3.4.1 Compression-Deflection Resistance (FMVSS 213, S6.3.1)

Determine the base material of the padding, select the appropriate test procedures from the following sections, and measure the load necessary to produce a 25% deflection or indentation of the padding material. Record the base material type on Compliance Datasheet M-4.

##### 3.4.1.1 Test Apparatus

A padding consisting of a rubber base material requires a compression testing machine (ASTM D1056-73, section 17) capable of compressing a test specimen at a rate of 0.5 to 2 inches per minute gently without impact. The machine may be motor- or hand-driven and shall be equipped with a gage (graduated in 0.001 inch) to measure deflection. The machine must also be capable of measuring the load produced by deflecting the specimen. The machine must have parallel metal loading plates 1.5 (+.1, -0) inches in diameter.

For padding consisting of urethane base material or polyvinyl chloride polymer and copolymer base materials, a different test fixture in the compression testing machine is required as are different ranges of deflection speeds. For urethane base foams (ASTM D1564-71, section 20), the machine must be capable of deflecting the specimen at a speed

of 1.0 to 15 inches per minute. For vinyl base foams (ASTM D1565-76, section 13), the machine must be capable of deflecting the specimen at a speed of 0.5 to 20 inches per minute. Both base material types require the same loading fixture which consists of a flat circular indenter foot,  $50 \pm 5$  square inches in area, connected by means of a swivel joint to a load-measuring device and mounted in such a manner that the specimen can be deflected at the specified speeds. The apparatus shall be arranged to support the specimen on a level horizontal plate that is perforated with 0.24 to 0.26 inch holes on 0.75 inch centers to allow for rapid escape of air during the test.

#### 3.4.1.2 Test Specimens

Test specimens for rubber base materials shall be cylinders  $1.129 \pm 0.06$  inches or  $2.868 \pm 1.5$  centimeters in diameter, cut from the finished product, from standard test slabs, or from flat sheets (ASTM D1056-73, Figure 1). The specimen thickness shall be at least 1/4 inch. Measure the thickness using a dial-type gage having a maximum stem and foot mass of 25 g and a foot 1-1/4 inches in diameter and exerting a pressure of  $.0045 \pm .00045$  psi.

Test specimens for urethane base materials shall consist of the entire product sample or a portion of it. The specimen shall have dimensions not less than 15 by 15 by 0.75 inches. Specimens less than 0.75 inch thick shall be made up of plies, without the use of cement, to a minimum thickness of 0.75 inch. Measure the thickness of the specimens using a dial-type gage with a minimum foot area of 1 square inch exerting a pressure of  $0.028 \pm 0.007$  psi.

The test specimens for vinyl base materials shall consist of a complete article or a portion thereof, with a surface for indentation

not less than 12 by 12 inches. If the thickness of the material is less than 1 inch, the specimen shall be made up of plies to a minimum thickness of 1 inch. Measure the thickness of the specimen with a dial gage graduated in divisions not larger than 0.001 inch. The gage shall have a circular foot between 1.0 and 1.5 square inches in area exerting a pressure of  $0.0150 \pm 0.0015$  psi.

#### 3.4.1.3 Environmental Conditions

Tests shall be conducted under the following environmental conditions:

Temperature	69.8 to 77 degrees F
Relative Humidity	48% to 52%

Condition the specimens for at least 12 hours under these conditions before testing.

#### 3.4.1.4 Test Procedures

For rubber base materials, compress the standard test specimen between the parallel metal plates of the machine until the thickness has been reduced 25 percent, and take a reading of the load immediately. Repeat the test with the same specimen until the load readings do not change more than 5 percent.

For urethane base materials, place the specimen such that the indentation will be made at the center of the sample. Preflex the area to be tested by lowering the indenter foot twice to 75 to 80 percent of the full part thickness at a rate of 1 to 15 inches per minute. Mark the location of the test area with a pen by circumscribing the indenter foot while under a 1-pound load. Allow the specimen to rest  $6 \pm 1$  minutes after preflex. Bring the indenter foot into contact with the specimen and determine the thickness, after applying a preload of 1 pound, of the area under the indenter foot. Compress the specimen 25



percent of this thickness at 2 inches per minute, and observe and record the final load in pounds after 1 minute.

For vinyl base materials place the specimen such that the indentation will be made at the center of the sample. Bring the indenter foot into contact with the specimen and determine the original height under a load of 1 pound. Indent the specimen 25 percent of this original height. Maintain the deflection and record the load 1 minute after the 25 percent indentation is reached.

Normalize the load value determined in any of the above procedures by dividing it by the area of the loading surface. Record the resulting value in pounds per square inch on Compliance Datasheet M-4. The results of this test are used to determine compliance with the Head Impact Protection requirements outlined in section 4.7 of this procedure.

3.4.2 Energy Absorption and Recovery Rate  
(FMVSS 213, S5.2.3.2)

There are currently no test criteria specified for determining the energy-absorption and recovery-rate characteristics of materials in the head impact area. Questionable cases should be indicated, however, under Remarks on Compliance Datasheet M-4 for evaluation by the CTM.



#### 4.0 Inspection of Physical Features

##### 4.1 Labeling (FMVSS 213, S5.5)

Inspect the labels attached to the child restraint system and compare them with the requirements of FMVSS 213, S5.5, listed on Compliance Datasheet F-1. After the child restraint is installed (see section 4.3 of this procedure), check whether certain required labels are visible in all recommended installation modes.

Provide photographs of all labels on the child restraint system to show availability, legibility, and location. Include these photographs as part of Compliance Datasheet F-1.

##### 4.2 Installation Instructions (FMVSS 213, S5.6)

Review the manufacturer's instructions for installation and use of the child restraint system to verify that they include the information specified by FMVSS 213, S5.6, and listed on Compliance Datasheet F-2. Verify that storage provisions are available for these instructions on the child restraint itself.

##### 4.3 Installation (FMVSS 213, S5.3)

Install the child restraint system on the standard seat according to the manufacturer's instructions.

The child restraint shall have no means designed for attaching the system to the vehicle seat cushion or the vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back. Except for child harnesses, the system shall also be capable of being restrained against forward

movement solely by means of a Type I seat belt assembly (lap belt) or by means of a lap belt plus one additional anchorage strap (tether) that is supplied with the system.

For car beds, the system shall be designed to be installed on a vehicle seat so that the car bed's longitudinal axis is perpendicular to a vertical longitudinal plane through the longitudinal axis of the vehicle.

Indicate compliance and record any difficulties encountered during installation on Compliance Datasheet F-3.

4.4 Minimum Head Support Surface  
(FMVSS 213, S5.2.1)

This section does not apply to car beds or to forward-facing child restraints whose seating surface, when installed on the standard seat, is low enough that the target point on either side of the appropriate dummy's head, when properly positioned in the restraint, is below the top of the standard seat assembly. Indicate exemption, if appropriate, on Compliance Datasheet F-4.

Other child restraint systems shall have a minimum back height, as specified below, based on the manufacturer's recommended maximum weight for children using the restraint:

<u>Maximum Weight</u>	<u>Back Height</u>
Under 20 lb.	18 in.
20 lb.-40 lb.	20 in.
Over 40 lb.	22 in.

Measure the height of the restraint back surface along the vertical centerline from the seating surface to the top of the back surface. The padding on the seating surface may be depressed by the weight of the

appropriate dummy in the seated position. Record the results on Compliance Datasheet F-4.

The width of the back surface, at the height specified above, shall be at least 8 inches, or at least 6 inches if side wings at least 4 inches deep are also provided. Measure the depth of these side wings, if any, along a line perpendicular to the restraint back surface at the appropriate height from the seating surface as specified above. Record the results on Compliance Datasheet F-4.

#### 4.5 Belt Restraint (FMVSS 213, S5.4.3)

##### 4.5.1 Snug Fit of Belts (FMVSS 213, S5.4.3.1)

Each belt that is designed to restrain a child using the system shall be adjustable to snugly fit any properly positioned child whose height and weight are within the ranges recommended by the manufacturer. Using the appropriate dummy, fasten and adjust the system's harness to fit properly around the dummy. If there is insufficient webbing to do so, the restraint system fails. If webbing is sufficient, note how much additional webbing is available to further lengthen and secure each harness segment. Record this information on Compliance Datasheet F-5.

There is currently no test criterion for "snug fit" at the lower end of the size range. Questionable cases should be indicated, however, under Remarks on Datasheet F-5 for evaluation by the CTM.

##### 4.5.2 Direct Restraint Belts (FMVSS 213, S5.4.3.2)

No belt that is designed both to restrain the child and to attach the restraint to the vehicle shall impose a load on the dummy resulting

from the mass of either the child restraint system or the back of the standard seat assembly during the Dynamic Impact Test. To determine compliance with this requirement, verify whether the following conditions are met:

(1) The belt in question contacts the dummy for the purpose of restraint; and

(2) The child restraint includes any rigid structure between the dummy and the back of the standard seat assembly; and

(3) The child restraint can slip such that the belt in question contacts the dummy for the purpose of restraint.

If all three conditions apply, the restraint fails. If any one condition is not met, the restraint passes. Record the results on Compliance Datasheet F-5.

#### 4.5.3 Seating System Belts and/or Shields

These requirements apply to child restraints that are designed for use by a child in a seated position and that include belt restraints, with the specific exception of child harnesses. Restraint systems intended for use by infants (i.e., when the manufacturer's maximum recommended weight for children using the restraint is under 20 pounds), are not considered to be "seating systems" and are thus also excluded. For applicable seating systems, the following restraining systems shall be provided:

(1) Upper torso--either belts passing over each shoulder of the child or a shield-type system subject to further requirements (see sections 4.6.3 and 4.6.4 of this procedure).

(2) Lower torso--either a lap belt (angle with seating surface at anchorage point to be between 45 degrees and 90 degrees) or a shield-

type system subject to further requirements (see sections 4.6.3 and 4.6.4 of this procedure).

(3) Crotch restraint--for child restraints recommended for children over 20 pounds, either a crotch belt connectable to the lower torso restraint or a shield-type system subject to further requirements (see sections 4.6.3 and 4.6.4 of this procedure).

Verify the existence of the above systems, and record the results on Compliance Datasheet F-5.

#### 4.5.4 Child Harness Belts

For child harnesses, the following restraining belts shall be provided:

- (1) Upper torso--belts passing over each shoulder of the child.
- (2) Lower torso--lap and crotch belts.
- (3) Belts to prevent any properly restrained child, whose height is within the range recommended by the manufacturer, from standing on the vehicle seat.

Verify the existence of the above belts, and record the results on Compliance Datasheet F-5.

#### 4.6 Torso Impact Protection (FMVSS 213, S5.2.2)

These requirements do not apply to car beds and are also not applicable to child harnesses consisting entirely of belt restraints. For other child restraint systems, the following surface area and curvature requirements apply. Remove padding for all curvature determinations, noting any difficulties on Compliance Datasheet F-6.

For measurements that refer to dummy "shoulder height" or "torso depth," use the following dimensions for the appropriate dummy, based on

the manufacturer's recommended maximum weight for children using the restraint:

<u>Maximum Weight</u>	<u>Dummy</u>	<u>Shoulder Height</u>	<u>Torso Depth</u>
Under 20 lb.	6-mo.	9.5 in.	3.75 in.
20 lb. or more	3-yr.	14.5 in.	5.25 in.

4.6.1 Back Support Surface  
(FMVSS 213, S5.2.2.1(a))

The surface provided for the support of the child's back shall be flat or concave and have a continuous surface area of not less than 85 square inches. The area to be considered is the entire width of the restraint back surface below a height above the seating surface indicated above as "shoulder height" for the appropriate dummy. Measure this area, and record the results on Compliance Datasheet F-6.

4.6.2 Side Support Surface  
(FMVSS 213, S5.2.2.1(b))

Each surface provided for support of the side of the child's torso shall be flat or concave and have a continuous surface of not less than 24 square inches for systems recommended for children weighing 20 pounds or more, or 48 square inches for systems recommended for children weighing less than 20 pounds. "Torso" is defined as "the portion of the body of a seated anthropomorphic test dummy, excluding the thighs, that lies between the top of the child restraint system seating surface and the top of the shoulders of the test dummy." The area to be considered is (1) below a line perpendicular to the restraint back surface at a height above the seating surface indicated above as "shoulder height" for the appropriate dummy, and (2) rearward of a line perpendicular to the seating surface at a distance forward of the restraint back surface



indicated above as "torso depth" for the appropriate dummy. Measure this area, and record the results on Compliance Datasheet F-6.

4.6.3 Forward Restraining Surface  
(FMVSS 213, S5.2.2.1(c))

Each horizontal cross section of each surface designed to restrain forward movement of the child's torso shall be flat or concave, and each vertical longitudinal cross section shall be flat or convex with a radius of curvature of the underlying structure of not less than 2 inches. Determine the curvatures, and record the results on Compliance Datasheet F-6.

4.6.4 Forward Fixed or Movable Surfaces  
(FMVSS 213, S5.2.2.2)

For forward-facing child restraint systems, there shall be no fixed or movable surface directly in front of the appropriate test dummy, when properly positioned in the restraint, and intersected by a horizontal line parallel to the Seat Orientation Reference Line (SORL) and passing through any portion of that dummy, except for surfaces that restrain the dummy when tested according to Dynamic Impact Test Configuration II (FMVSS 213, S6.1.2.1.2). For a definition of SORL, see section 5.1.1 of this procedure.

If such a surface exists, determination of compliance must be deferred pending results of the Dynamic Impact Test. If no such surface exists, the system complies. Indicate Pass or Deferred on Compliance Datasheet F-6.

4.7 Head Impact Protection  
(FMVSS 213, S5.2.3)

For child restraint systems recommended for children weighing less than 20 pounds, with the exception of child harnesses, each surface that is contactable by the dummy head during the Dynamic Impact Test shall be covered with slow recovery, energy absorbing material with a 25% compression-deflection resistance of 0.5 to 10 pounds per square inch. Unpadded protrusions that meet the requirements defined in section 4.8 of this procedure are exempt from the Head Impact Protection requirement.

For rear-facing infant restraints, the head impact area is any surface directly forward or rearward of the dummy and above its shoulders. For car beds or other laterally-positioned restraints, the head impact area includes any surface forward, rearward, or to either side of the dummy head and above its shoulders. For a car bed that does not have positioning devices within the restraint, the entire interior surface should be included. If films of the Dynamic Impact Test disclose that surfaces not expected to be within the head impact area are being impacted by the dummy head, make a notation under Remarks on Compliance Datasheet F-7.

Verify that padding materials tested for performance characteristics at section 3.4 of this procedure do cover the head impact area as defined above. Refer to the measured compression-deflection resistance value on Compliance Datasheet M-4 to determine compliance with the compression-deflection requirement and to determine the required padding thickness as indicated below:

<u>Resistance Value</u>	<u>Minimum Thickness</u>
0.5 psi- 1.79 psi	3/4 in.
1.8 psi-10.00 psi	1/2 in.

Remove the padding in the head impact area and measure its thickness using the methods outlined in section 3.4.1.2 of this procedure. Record the results on Compliance Datasheet F-7.

4.8 Protrusion Limitation  
(FMVSS 213, S5.2.4)

Any protrusion, padded or unpadded, on a rigid structure, other than belts or belt hardware, that is contactable by any part of the appropriate dummy head or torso during the Dynamic Impact Test shall have a height above the immediately adjacent restraint system surface of not more than 3/8 inch and no exposed edge with a radius of less than 1/4 inch. The areas to be considered include those identified in the sections on Torso Impact Protection (see section 4.6 of this procedure) and Head Impact Protection (see section 4.7 of this procedure), with the addition of the surfaces directly forward of the 3-year-old dummy or directly rearward of the dummy and above its shoulders for restraints recommended for children weighing 20 pounds or more. This requirement does not apply to child harnesses consisting entirely of belt restraints.

Remove any padding in the applicable areas to make the measurements, and record the maximum values encountered on Compliance Datasheet F-8.



## 5.0 Dynamic Impact Test

Test a new specimen of the child restraint system according to the procedures below in each possible combination of installation mode, adjustment position, and proper-use/"misuse" mode. For details, see section 2.7.3 of this procedure. Record the particular combination to be tested as well as the test configuration to be used on Compliance Datasheet D-1.

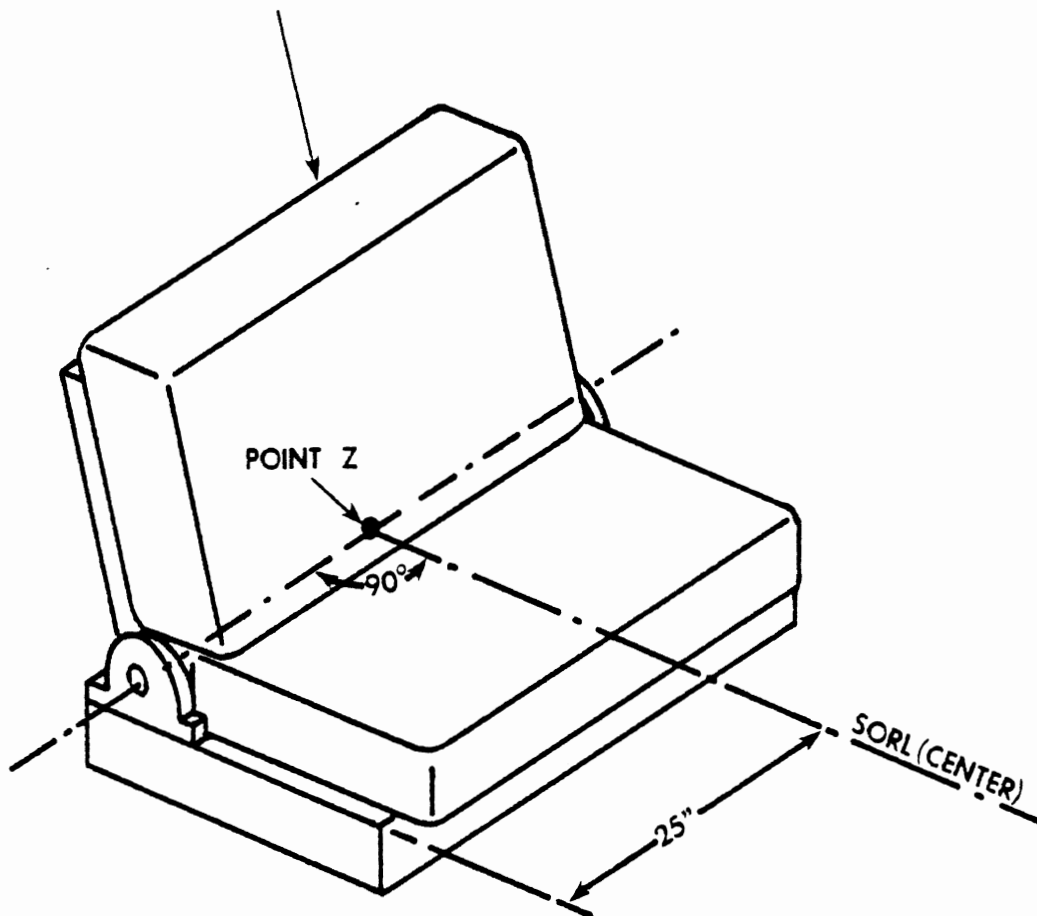
### 5.1 Test Equipment

#### 5.1.1 Test Device (FMVSS 213, S6.1.1.1, S6.1.1.3)

The test device used to evaluate the dynamic performance of the child restraint is the standard seat assembly securely attached to a dynamic test platform or impact sled. The standard seat assembly is described in Drawing Package SAS-100-1000 (revised December 30, 1980). The orientation should simulate a vehicle frontal impact. The standard seat has three seating positions of which the center position shall be used for all child restraint testing. The forward direction of the standard seat is defined by the Seat Orientation Reference Line (SORL), which is the horizontal line through point Z as illustrated in Figure 5-1.

Attach a new Type I seat belt assembly (lap belt) to the center seating position anchor points of the standard seat assembly before each Dynamic Impact Test. These anchor points are shown in Drawing Package SAS-100-1000 (revised December 30, 1980). Additional belt anchor points and forward dummy excursion limits for dynamic test compliance are illustrated in Figure 5-2. A transducer to measure initial belt webbing tension in the Type I belt is required. A belt webbing load cell on

Ref. NHTSA Drawing  
No. SAS-1000



SORL = Seat Orientation Reference Line (horizontal)

Figure 5-1 Standard Seat SORL

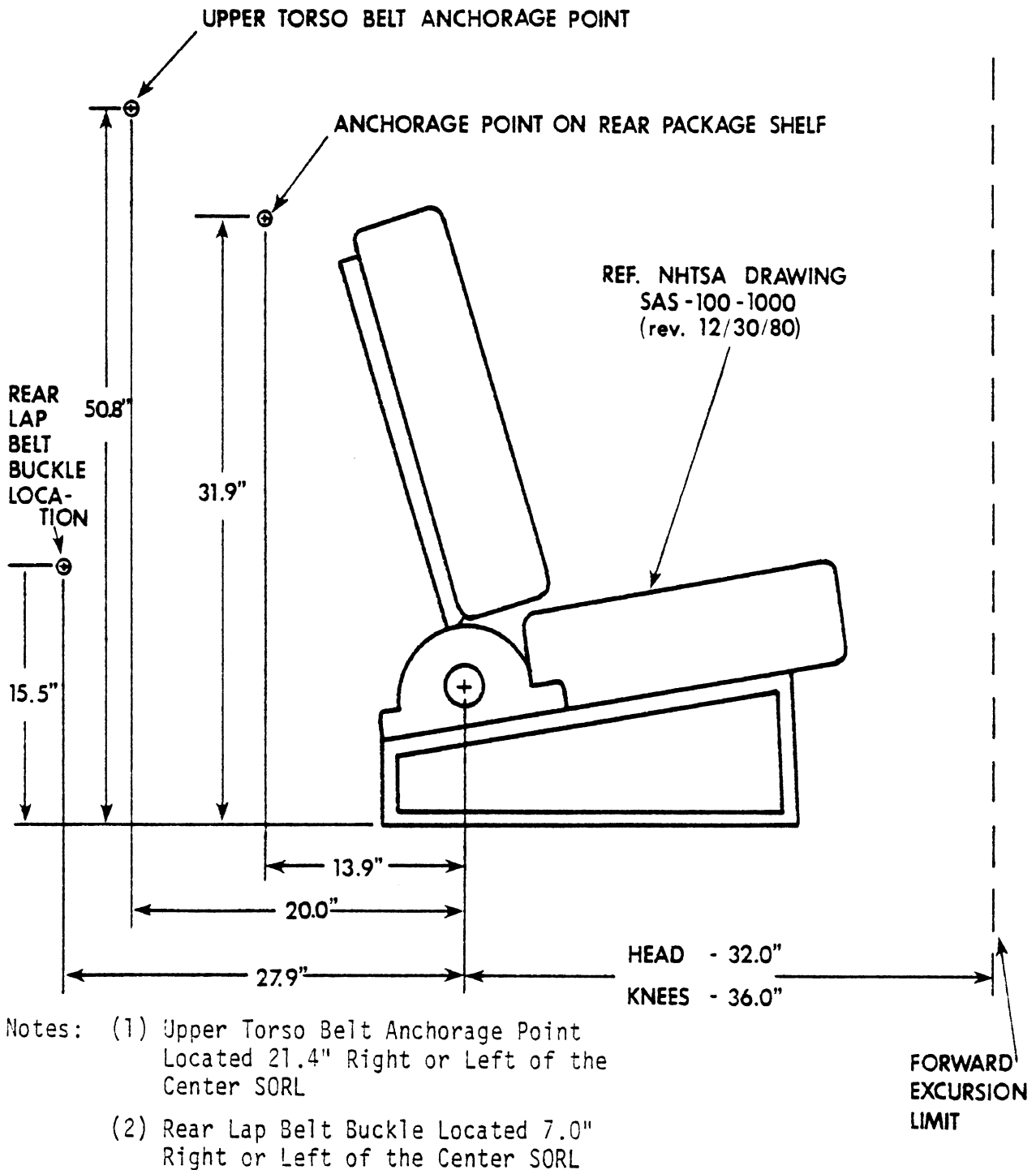


Figure 5-2 Belt Anchorage Points and Forward Excursion Limit

each belt half is recommended. A threaded rod with hex nut through each belt attaching hole in the standard seat frame and connected to the corresponding Type I belt end is a convenient method of fine-adjusting the belt tension.

Before conducting a Dynamic Impact Test, measure the force-deflection characteristics of all four foam inserts used in the standard seat. Using the test methodology and apparatus described in section 3.4.1 of this procedure for testing urethane-base materials, determine the load required to produce a 25% compression of the foam thickness. To be suitable for use in compliance testing, the foam inserts shall compress 25% under the following load limits:

2-inch thick foam: 45 to 55 lb.  
4-inch thick foam: 21 to 27 lb.

If a foam insert has already been used in a Dynamic Impact Test, allow a minimum of twelve hours recovery time before measuring the force-deflection characteristics. Also, inspect each used foam insert for damage or permanent deformation, and replace any insert judged to be defective.

## 5.1.2 Instrumentation

### 5.1.2.1 Transducers (FMVSS 213, S5.1.2, S6.1.1.1, S7.2)

The following transducers are required:

- (1) Accelerometer for monitoring impact sled deceleration.
- (2) Two triaxial accelerometer packages for mounting one each in the head and the thorax of the three-year-old dummy. Each axis of the triaxial accelerometers shall meet the following minimum performance requirements:



Mounting frequency response:  $\pm 5\%$ , 0 to 2000 Hz  
Maximum damping: 0.005 of critical, nominal  
Transverse sensitivity: 5% maximum  
Linearity and hysteresis:  $\pm 3\%$  of reading, maximum  
Dynamic range:  $\pm 500$  g, minimum

(3) Seat belt webbing load cells to monitor belt preload during seat installation. This item is not required if an equivalent belt tension measurement device is utilized to determine the preload on the Type I seat belt assembly.

(4) Velocity transducer to verify speed of Dynamic Impact Test.

(5) Force transducer to monitor the load applied to the dummy sling during the Buckle Release Tests described in sections 5.5.5 and 5.7.1 of this procedure.

(6) Force transducer to measure buckle release force.

#### 5.1.2.2 Playback and Recording Equipment

Equipment shall be provided that has the following capabilities:

(1) Have a minimum capability of 8 data channels for measuring the following during the Dynamic Impact Test:

- 6 - Dummy accelerations
- 1 - Sled acceleration
- 1 - Sled velocity

(2) Provide a permanent record of all data channels during dynamic impact.

(3) Provide a permanent record of seat belt preload.

(4) Provide a permanent record of force applied to the dummy sling during the Buckle Release Tests described in sections 5.5.5 and 5.7.1 of this procedure.

(5) Provide a permanent record of buckle release force.

### 5.1.2.3 High Speed Cameras

A minimum of one 16-mm high speed movie camera capable of 1000 frames per second is required to record the dynamic performance of the child restraint system. The movie film will be analyzed to determine occupant excursions as outlined in section 5.7.4 of this procedure.

In order to obtain a complete view of the restraint system behavior during the entire test, a large field of view is required. An onboard camera system is suggested for maximum resolution of head and knee-target excursions of the three-year-old dummy. For a typical sled configuration, a single onboard camera mounted 6 feet from and perpendicular to the SORL, with its optical axis approximately 25 inches above the base plane of the standard seat assembly and 34 inches forward of the seat back pivot axis, will provide a suitable arrangement for accurately assessing the excursions near the 32-inch head limit and the 36-inch knee pivot-point limit. If a single camera is used, a 13-mm lens mounted as suggested above will have a field of view approximately 59 inches wide and 42 inches high. When placed at the 34-inch location, the camera will cover the initial installation configuration of the test as well as the maximum forward motions of the restraint system and dummy.

For a test of a forward-facing restraint in which the target point on either side of the dummy's head is above the top of the standard seat assembly, a second camera is required for observing the rebound phase of the test. This camera should be mounted at the same height and distance from the SORL as the first camera but directly above the seat back pivot axis. Insure that the field of view of the camera includes a vertical reference.

The limiting resolution of typical onboard camera/film systems is approximately 40 line-pairs per millimeter. With a 59- by 42-inch field of view, the corresponding lower limit on position-resolution capability is 0.15 inch. Any angle determinations made from reading the positions of two targets will also be affected by the resolution limit. This uncertainty can be minimized by placing targets as far apart as possible.

Place a rigidly-fixed reference grid on the far side of the standard seat assembly, with field calibration targets and head and knee pivot-point limit lines displayed vertically on it. The vertical limit lines should be positioned to account for parallax such that, when the head leading-edge or knee pivot-points reach those lines in the camera field of view, they have exceeded their excursion limits beyond any question of experimental error. This will allow a simple pass/fail determination to be made before the excursions are actually measured. Even though the knee pivot-points are on either side of the SORL, the placement of the camera at 34 inches will result in such a small parallax error that a single line can be used for determining the excursion of either knee pivot-point. The vertical grid lines will also serve as a reference for the measurement of the back support angle of rear-facing restraints.

If an alternate method of comparable accuracy is available for observing and measuring occupant excursions, this method may be used instead of a high speed movie system with the concurrence of the CTM.

## 5.2 Systems Check

Before beginning a series of child restraint system compliance tests, conduct one trial test to determine that all systems are functioning properly. In particular:

(1) Ensure the test velocities and severity conditions given in sections 5.3.2 and 5.3.3 of this procedure are met.

(2) When applicable, conduct the trial test with an instrumented dummy to assure correct operation of transducers, signal conditioning, and record/playback equipment.

(3) Review high-speed movie coverage of the test setup and timing of the camera operation.

(4) Ensure accurate calibrations of the high-speed movie field of view are available in the plane of motion of the child restraint system.

## 5.3 Test Conditions

### 5.3.1 Environmental Conditions (FMVSS 213, S6.1.1.4)

The Dynamic Impact Test shall be performed under the following environmental conditions:

Temperature	66 to 78 degrees F
Relative Humidity	10% to 70%

### 5.3.2 Impact Speed (FMVSS 213, S6.1.1.2)

Configuration I tests of proper restraint usage shall be conducted at an impact speed of 30 (+0,-3) mph or 44 (+0,-4.4) ft/s.

Configuration II tests of restraint misuse mode shall be conducted at an impact speed of 20 (+0,-2) mph or 29.33 (+0,-2.93) ft/s.

5.3.3 Impact Severity  
(FMVSS 213, S6.1.1.2)

The impact sled acceleration function envelopes shown in Figure 5-3 and 5-4 are defined by the coordinates in Table 5-1 and Table 5-2.

The sled acceleration shall not exceed the upper limit of the appropriate envelope at any time. The sled acceleration may exhibit short-duration deviations below the lower limit of the envelope provided the integrated total of such deviations does not exceed 0.44 feet per second for Configuration I or 0.29 feet per second for Configuration II.

5.4 Dummy Preparation

5.4.1 Dummy Selection  
(FMVSS 213, S6.1.2.3, S7.1, S7.2)

Determine whether to use the six-month-old dummy or the three-year-old dummy based on the manufacturer's label information for occupant weight class. (See section 4.1 of this procedure.)

Use the six-month-old dummy to evaluate restraints recommended for occupants weighing not more than 20 pounds. Use the three-year-old dummy to evaluate restraints recommended for occupants weighing more than 20 pounds. Indicate the dummy to be used on Compliance Datasheet D-1.

5.4.2 Pre-Test Conditioning

5.4.2.1 Six-Month-Old Dummy  
(FMVSS 213, S6.1.2.3.2)

Place the dummy on its back on a flat, horizontal surface, and hold the torso firmly in position. Limber the dummy legs by lifting both feet and rotating the legs until the feet touch the dummy head and the

Table 5-1  
Test Configuration I Acceleration Function Envelope

Time (ms)	Upper Limit Acceleration (g's)	Lower Limit Acceleration (g's)
0	0.0	-2.5
10	22.0	17.0
14	23.5	19.5
20	24.0	21.0
28	23.0	19.2
33.5	20.5	17.6
48	20.25	17.5
58	18.5	16.0
66	15.0	11.5
72	10.0	5.0
81	0.0	-3.0

Table 5-2  
Test Configuration II Acceleration Function Envelope

Time (ms)	Upper Limit Acceleration (g's)	Lower Limit Acceleration (g's)
0	0.0	-2.0
9.5	14.0	9.4
14	17.0	13.5
20	17.7	14.0
25	17.5	14.0
32	16.5	12.5
40	14.8	11.0
44	15.3	11.5
50	15.0	11.5
60	12.0	9.0
66	9.0	6.0
72	5.0	2.0
76	0.0	-2.0

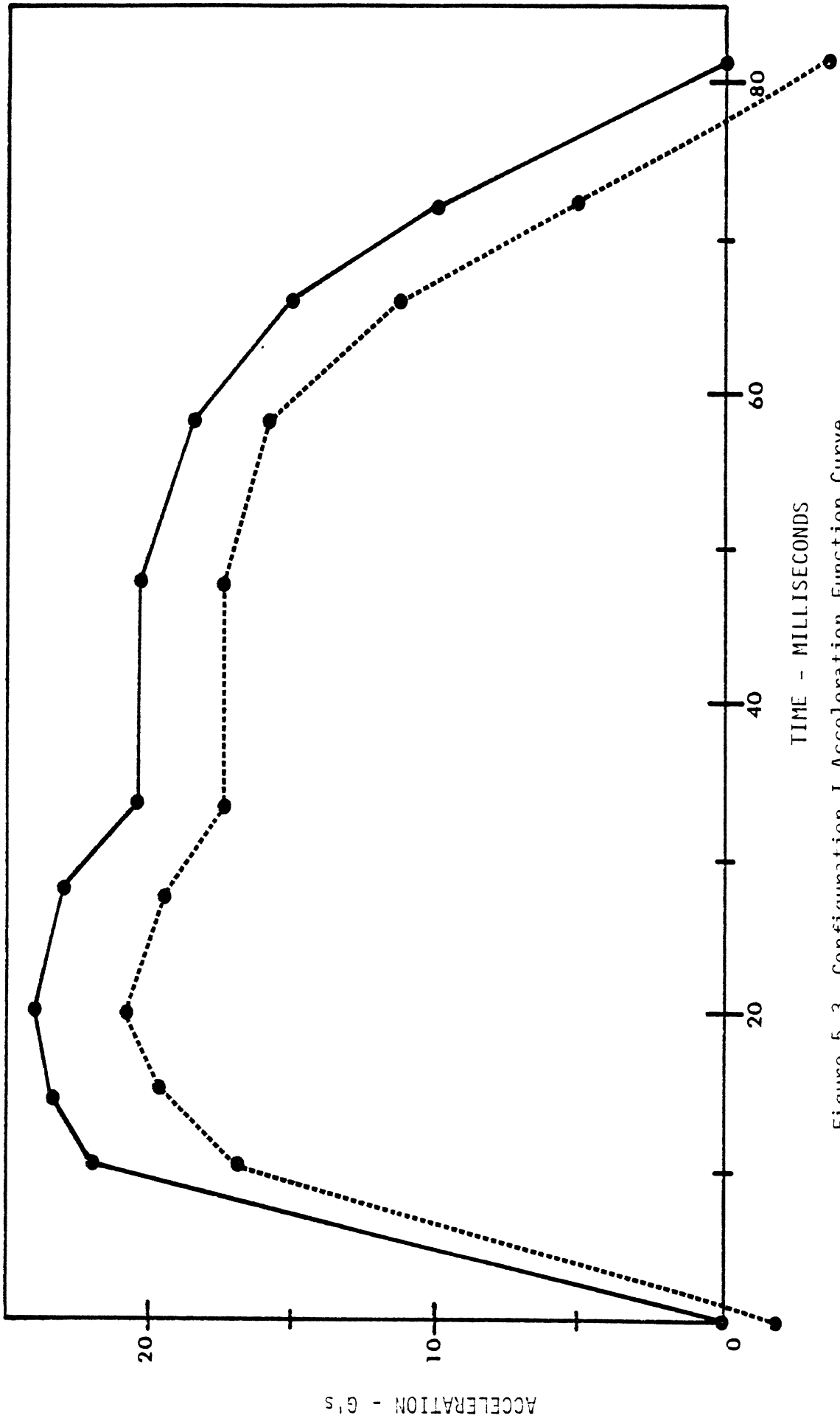


Figure 5-3 Configuration I Acceleration Function Curve

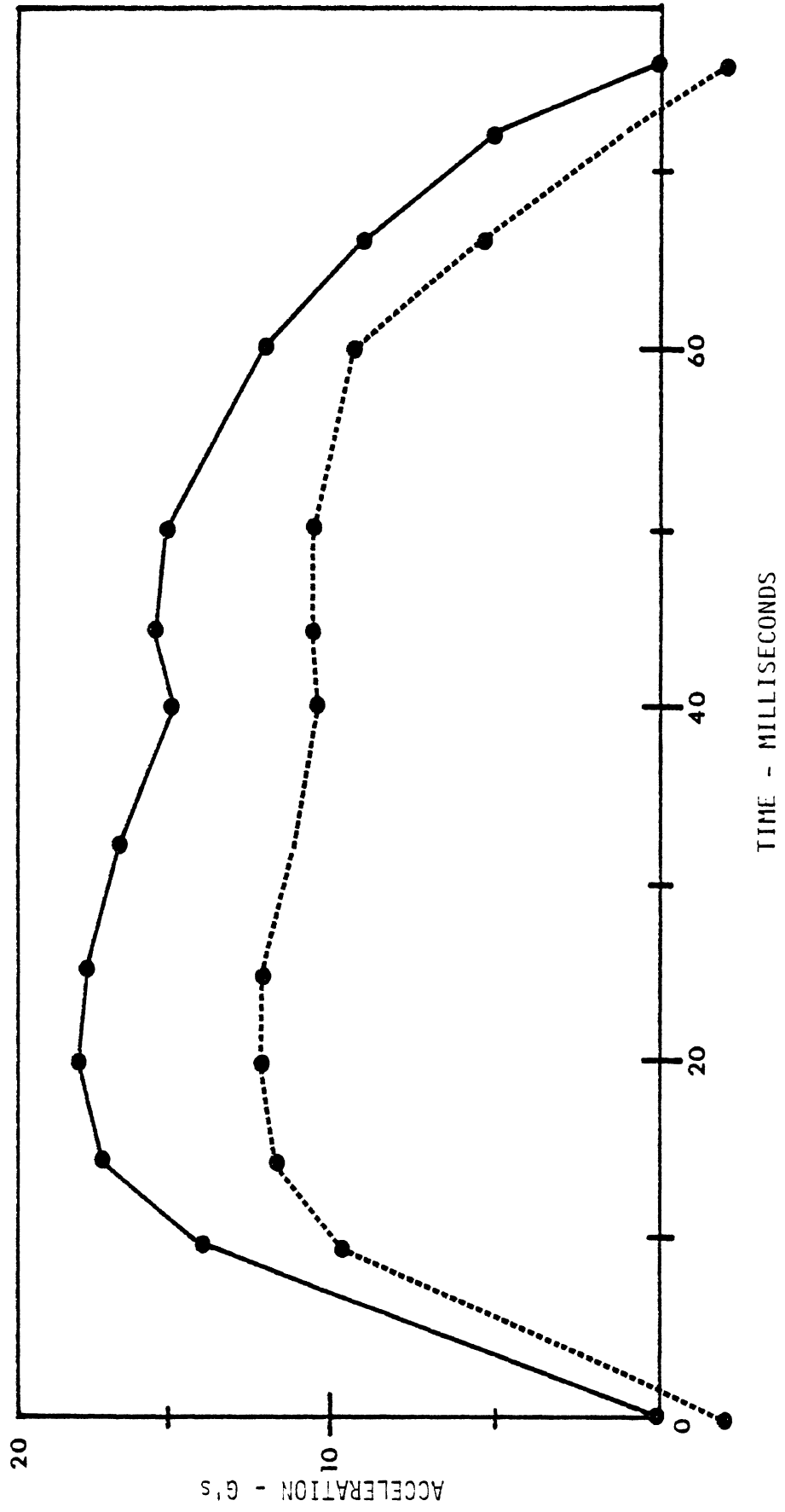


Figure 5-4 Configuration II Acceleration Function Curve



legs contact the torso. Release the feet slowly and do not push them back toward the horizontal surface.

5.4.2.2 Three-Year-Old Dummy  
(FMVSS 213, S7.2)

Calibrate the three-year-old dummy according to the requirements of 49 CFR 572, Subpart C, as described in Appendix I of this procedure, before testing begins, after an apparent noncompliance, and regularly at six-month intervals. Ensure the dummy's limb joints remain adjusted between the 1-g and 2-g force setting before each test.

5.4.3 Dummy Instrumentation

5.4.3.1 Six-Month-Old Dummy

No instrumentation is installed in the six-month-old dummy.

5.4.3.2 Three-Year-Old Dummy

Two triaxial accelerometers are used to instrument the three-year-old dummy. One is installed in the dummy's head and one in the dummy's thorax per the requirements of 49 CFR 572, Subpart C.

5.4.4 Dummy Clothing

5.4.4.1 Six-Month-Old Dummy  
(FMVSS 213, S7.1)

The six-month-old dummy is tested unclothed.

5.4.4.2 Three-Year-Old Dummy  
(FMVSS 213, S7.2.2)

The three-year-old dummy is clothed in thermal knit waffle-weave polyester and cotton underwear, a size 4 long-sleeved shirt weighing approximately 0.2 pounds, a size 4 pair of long pants weighing approximately 0.2 pounds and cut off just far enough above the knee to allow the knee target to be visible, and size 7M sneakers with rubber toe caps, uppers of dacron and cotton or nylon and a total weight of

approximately 1 pound. Machine-wash the clothing, other than the shoes, in 160 degrees F (71 degrees C) to 180 degrees F (82 degrees C) water, and machine-dry at 110 degrees F (43 degrees C) to 130 degrees F (54 degrees C) approximately 30 minutes. Shirt sleeves may be cut off at the elbows to improve the visibility of the dummy head during maximum excursion.

#### 5.4.5 Dummy Targeting

##### 5.4.5.2 Six-Month-Old Dummy

Photographic targets are required to identify the head center of gravity of the six-month-old dummy, which is located 3.0 inches from the top surface and 2.5 inches from the front surface of the dummy head. Adhesive backed paper or fabric targets with a pattern that facilitates identifying and tracking the head center of gravity in the high speed movies are recommended.

##### 5.4.5.1 Three-Year-Old Dummy

Photographic targets are required to identify the head center of gravity and the pivot points of the knees of the three-year-old dummy. Adhesive backed paper or fabric targets having a pattern that facilitates identifying and tracking of the head and knee reference points in the high speed movies are recommended. The head center of gravity is identified by the head center of gravity reference pin, which protrudes from each side of the head. Note that the head center of gravity target is not used for maximum forward excursion measurements. It may be used, however, along with a second target placed on the head to facilitate determination of maximum head/torso angle (see section 5.7.4.1(4) of this procedure). The knee pivot-points are defined by the

centers of the knee pivot bolts and are used for maximum forward excursion measurements.

### 5.5 Restraint Setup

This section describes the procedure to be followed for installing the dummy in the child restraint system and for installing the child restraint system on the standard seat for dynamic impact testing.

Place the child restraint system in the appropriate installation mode (i.e., rear- or forward-facing) on the standard seat in the center seating position and proceed as indicated below, with the following exceptions:

(1) If the manufacturer's instructions indicate the Type I seat belt assembly is to be installed between the restraint and the occupant, fasten the Type I belt in position before installing the dummy, but do not apply the specified tension until the dummy installation in the restraint is complete.

(2) For rear-facing restraint systems requiring Buckle Release Tests (see sections 5.5.5 and 5.7.1 of this procedure), temporarily place the restraint on the standard seat facing forward, even if this mode is not recommended by the manufacturer. Secure the restraint to the standard seat with the Type I seat belt assembly, and perform the pre-impact Buckle Release Test. Then properly install the restraint in the rear-facing mode for the Dynamic Impact Test.

## 5.5.1 Restraints Other Than Car Beds

### 5.5.1.1 Installation Using Six-Month-Old Dummy (FMVSS 213, S6.1.2.3.2)

Position the test dummy according to the instructions for child positioning provided by the manufacturer while conforming to the procedures below.

(1) Prepare the dummy as outlined in section 5.4.2.1 of this procedure, and place the dummy in the child restraint system so that the back of the dummy torso contacts the back support surface of the system.

(2) Test Configuration I (30 mph): Attach all appropriate child restraint belts and tighten them as indicated in section 5.5.3.1 of this procedure. Attach the Type I belts on the standard seat and an additional anchorage belt (tether), if provided, according to the manufacturer's instructions. Tighten the belts as indicated in section 5.5.3.2 of this procedure. Position each movable surface in accordance with the manufacturer's instructions.

(3) Test Configuration II (20 mph):

(a) For a forward-facing child restraint system with a fixed or movable surface described in section 4.6.4 of this procedure and with child restraint belts that are not an integral part of this surface, do not attach any of the child restraint belts except those that are an integral part of the fixed or movable surface. Attach the Type I belts on the standard seat and an additional anchorage belt (tether), if provided, according to the manufacturer's instructions.

(b) For a child restraint system, other than a child harness, that is equipped with an anchorage belt (tether), attach all appropriate child restraint belts and tighten them as indicated in section 5.5.3.1

of this procedure. Attach the Type I belts on the standard seat, but do not attach the tether.

(c) For a forward-facing child restraint system that has a fixed or movable surface described in section 4.6.4 of this procedure, child restraint belts that are not an integral part of this surface, as well as an anchorage belt, and that is being tested under simultaneous "misuse" conditions (see section 2.7.3(2) of this procedure), do not attach any of the child restraint belts except those that are an integral part of the fixed or movable surface. Attach the Type I belts on the standard seat, but do not attach the tether.

(d) For all of the above installation conditions, tighten the belts as indicated in section 5.5.3.2 of this procedure, and position each movable surface in accordance with the manufacturer's instructions.

(4) If the dummy's head does not remain erect, tape it against the front of the restraint seat back surface by means of a single thickness of 1/4-inch-wide paper masking tape placed across the center of the dummy face.

(5) Position the dummy arms vertically upward and then rotate each arm downward toward the dummy's lower body until it contacts a surface of the child restraint system or the standard seat assembly, ensuring that no arm is restrained from movement in other than the downward direction by any part of the system or the belts used to anchor the system to the standard seat assembly.

5.5.1.2 Installation Using Three-Year-Old Dummy  
(FMVSS 213, S6.1.2.3.1)

Position the test dummy according to the instructions for child positioning provided by the manufacturer conforming to the procedures below.

(1) Place the test dummy in the seated position within the system with the midsagittal plane of the test dummy head coincident with the center SORL of the standard seating assembly, holding the torso upright until it contacts the system's design seating surface.

(2) Extend the arms of the test dummy as far as possible in the upward vertical direction. While holding the dummy firmly against the restraint back surface, grasp one of the dummy's shoulders and rotate it forward and upward until the pivot stops are encountered. Repeat for the other shoulder. Extend the legs of the dummy as far as possible in the forward horizontal direction, with the dummy feet perpendicular to the centerline of the lower legs.

(3) Using a flat square surface with an area of 4 square inches, apply a force of 40 pounds, perpendicular to the plane of the back of the standard seat assembly, first against the dummy crotch and then at the dummy thorax in the midsagittal plane of the dummy.

(4) Test Configuration I (30 mph): Attach all appropriate child restraint belts and tighten them as indicated in section 5.5.3.1 of this procedure. Attach the Type I belts on the standard seat and an additional anchorage belt (tether), if provided, according to the manufacturer's instructions. Tighten the belts as indicated in section 5.5.3.2 of this procedure. Position each movable surface in accordance with the manufacturer's instructions.

(5) Test Configuration II (20 mph):

(a) For a forward-facing child restraint system with a fixed or movable surface described in section 4.6.4 of this procedure and with child restraint belts that are not an integral part of this surface, do not attach any of the child restraint belts except those that are an

integral part of the fixed or movable surface. Attach the Type I belts on the standard seat and an additional anchorage belt (tether), if provided, according to the manufacturer's instructions.

(b) For a child restraint system, other than a child harness, that is equipped with an anchorage belt (tether), attach all appropriate child restraint belts and tighten them as indicated in section 5.5.3.1 of this procedure. Attach the Type I belts on the standard seat, but do not attach the tether.

(c) For a forward-facing child restraint system that has a fixed or movable surface described in section 4.6.4 of this procedure, child restraint belts that are not an integral part of this surface, as well as an anchorage belt, and that is being tested under simultaneous "misuse" conditions (see section 2.7.3(2) of this procedure), do not attach any of the child restraint belts except those that are an integral part of the fixed or movable surface. Attach the Type I belts on the standard seat, but do not attach the tether.

(d) For all of the above installation conditions, tighten the belts as indicated in section 5.5.3.2 of this procedure, and position each movable surface in accordance with the manufacturer's instructions.

(6) Rotate each dummy limb downward in the plane parallel to its midsagittal plane until the limb contacts a surface of the child restraint system or the standard seat. Position the limbs, if necessary, so that limb placement does not inhibit torso or head movement during dynamic testing.

5.5.2 Car Beds  
(FMVSS 213, S6.1.2.3.3)

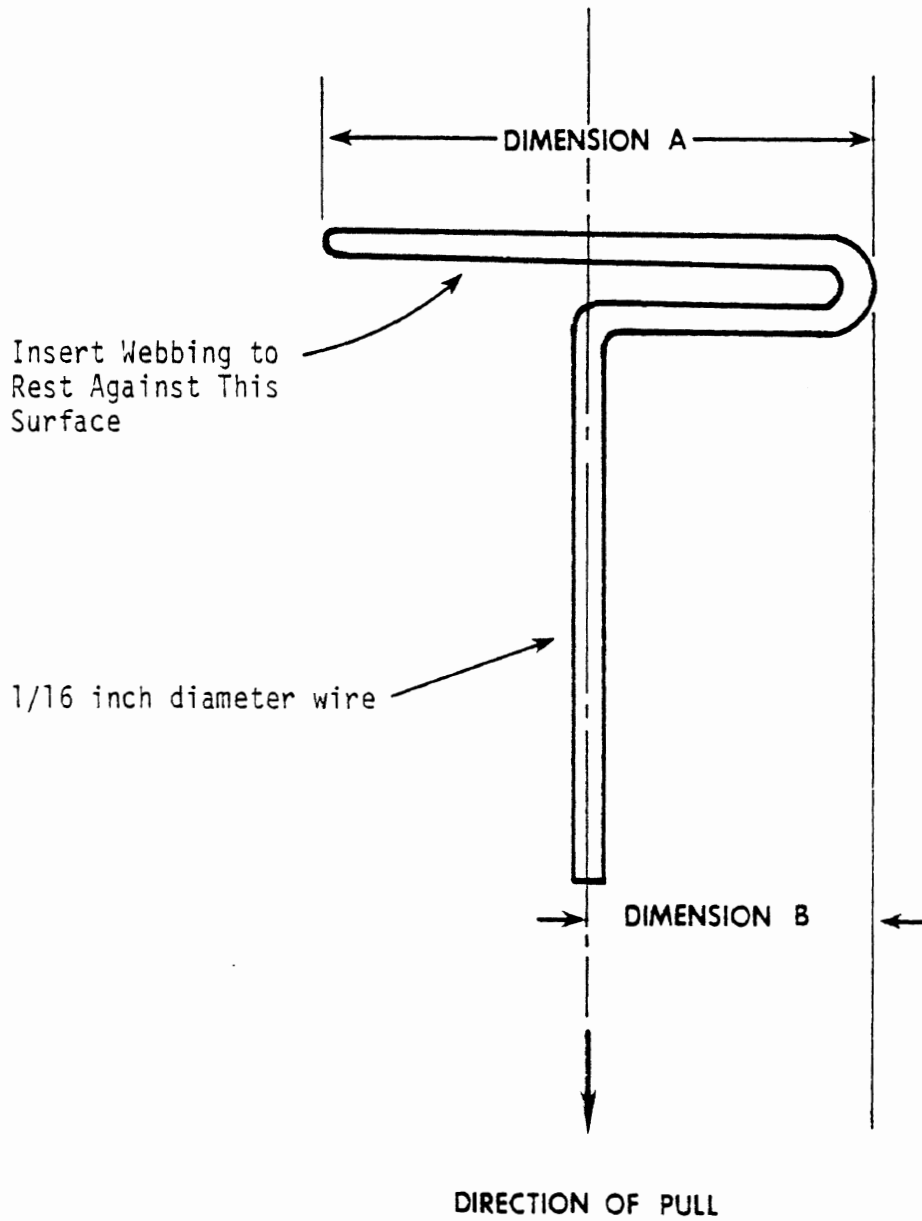
Place the appropriate dummy in the car bed in the supine position with its midsagittal plane perpendicular to the center SORL of the standard seat assembly, and position the dummy within the car bed in accordance with instructions for child positioning provided by the manufacturer. Attach all appropriate child restraint belts, if provided, and tighten them as indicated in section 5.5.3.1 of this procedure. Attach the Type I belts on the standard seat according to the manufacturer's instructions, and tighten them as indicated in section 5.5.3.2 of this procedure.

5.5.3 Belt Tension

5.5.3.1 Child Restraint Pelvic and Shoulder Belts  
(FMVSS 213, S6.1.2.4)

Tension shoulder and pelvic belts, with the appropriate dummy installed in the restraint, so that there is a 1/4-inch gap between the dummy and belt webbing when a two pound force is applied to lift the webbing. Check the tension at both the top of each dummy shoulder and at the pelvic webbing two inches on either side of the torso midsagittal plane. Use the webbing tension pull device specified in FMVSS 213, S6.1.2.4, and reproduced below in Figure 5-5 to perform this evaluation. If before this check there should already be a gap between the belt webbing and dummy at the locations to be evaluated, the belts are correctly tensioned if there is a 1/4-inch deflection of the webbing from its initial position when the two pound force is applied.





Dimension A - Width of Webbing  
Plus 1/8 inch  
Dimension B - 1/2 of Dimension A

Figure 5-5 Webbing Tension Pull Device

#### 5.5.3.2 Child Restraint Attachment Belts (FMVSS 213, S6.1.2.2)

Tension the Type I seat belt assembly and the anchorage belt (tether), if provided, to a preload between 12 and 15 pounds. The use of threaded rod belt ends through the belt anchor holes on the standard seat and held in position with hex nuts can facilitate the Type I seat belt tension adjustment. Gently perturb the seat belt assembly after tensioning to ensure there are no frictional binding forces that would produce false tension readings. Recheck all belt tensions to verify the 12- to 15-pound preload.

#### 5.5.4 Restraint Targeting

Rear-facing restraints, depending on their design, require the use of targets visible to the high-speed movie camera to allow determination of compliance with occupant excursion and back support angle requirements. A target identifying the forward-most and top-most point on the restraint (see section 5.7.4.2(2) of this procedure) is necessary if that point is not visible from the side.

If a surface parallel to the back support surface is not externally visible, targets identifying that surface may be necessary for determining its maximum deviation from vertical (see section 5.7.4.2(3) of this procedure). An alternate method for defining the seatback plane is to determine the angular relationship between an externally visible surface and the actual back support surface prior to the Dynamic Impact Test.

If the back support surface is curved, a target is necessary that identifies the top of the dummy's shoulder, as defined in section 4.6 of this procedure, on the surface to be observed. The angle determination

will then be made using a tangent to the surface at the "shoulder height" point (see section 5.7.4.2(3) of this procedure).

Do not modify the restraint in any manner that will affect its structure or performance to achieve the targeting requirement. The use of adhesive-backed paper or fabric photographic targets is recommended for this application.

5.5.5 Buckle Release Test (Pre-Impact)  
(FMVSS 213, S5.4.3.5, S6.2)

The buckle release test applies to any child restraint system using buckled belts and shall be performed with the restraint system and specified dummy installed on the standard seat. Fasten and tension all belts that are associated with a Configuration 1 dynamic test as indicated in sections 5.5.1, 5.5.2, and 5.5.3 of this procedure. For rear-facing restraints, install the system facing forward, even if this mode is not recommended by the manufacturer, to facilitate performance of this test. Care must be taken, however, that the Type 1 belt will not load the dummy and thus interfere with the buckle release test.

Tie a self-adjusting sling to each ankle and wrist of the dummy in the manner illustrated in Figure 5-6. Pull the sling horizontally in the manner illustrated, parallel to the center SORL of the seat assembly, and apply a force of 20 (+0,-1) pounds in the case of a system tested with a six-month-old dummy, and 45 (+0,-1) pounds in the case of a system tested with a three-year-old dummy. A pulley and dead weight loading system is suggested. A permanent record is required of the actual force applied to the sling.

With the load applied to the sling, gradually apply force to the buckle release mechanism in a manner and direction typical of those that

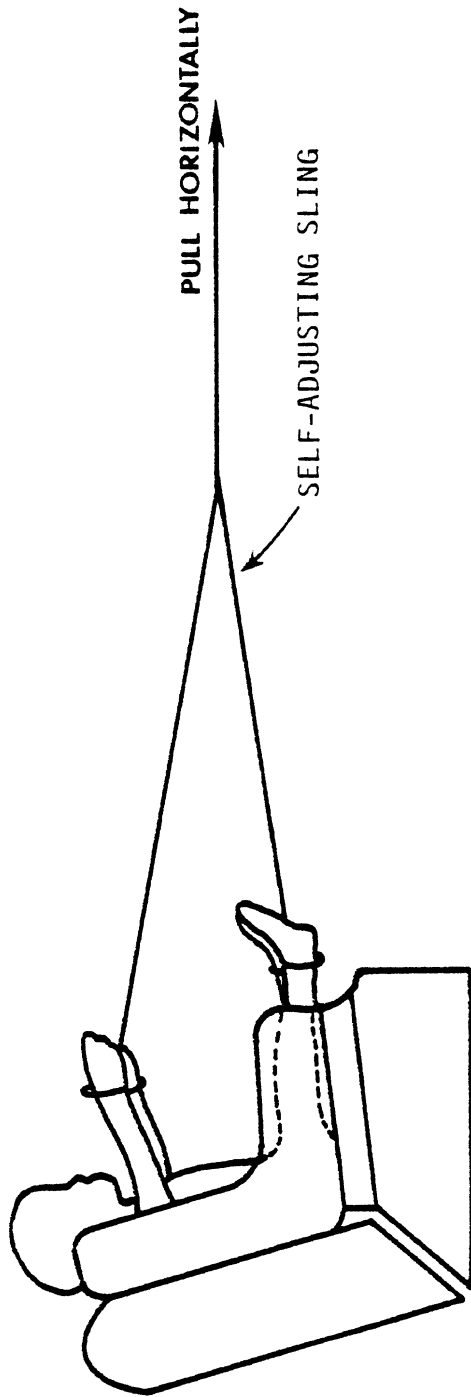


Figure 5-6 Buckle Release Test Configuration

would be employed by a restraint user, and measure the force required to release the buckle. For pushbutton release buckles, apply the force at least 0.125 inch from the edge of the pushbutton access opening of the buckle in a direction that produces maximum releasing effect. For lever-release buckles, apply the force on the centerline of the buckle lever or finger tab in a direction that produces maximum releasing effect. Should difficulty in determining buckle release be encountered because of interference with the dummy or dummy clothing, it may be necessary to support the buckle from behind while applying the release force.

For compliance, the buckle shall not release at any force below 12 pounds. Record the actual buckle release force on Compliance Datasheet D-2. If any difficulty in operating the buckle release mechanism is encountered, it should be noted in Remarks on the Datasheet.

Completely separate and re-engage the buckle, replace the 6-month-old dummy against the back support surface or reapply the 40-pound load to the 3-year-old dummy crotch and thorax, recheck the tightness of the restraint belts and the preload on the Type I belt assembly, and make any necessary adjustments to conform to the requirements outlined in section 5.5.3 of this procedure.

#### 5.6 Impact Test (FMVSS 213, S6.1.2.5)

Photograph the restraint set-up to document the final pre-test configuration. Include this documentation with Compliance Datasheet D-1.

Before conducting the Dynamic Impact Test, ensure that:

(1) The restraint system and dummy are properly installed on the standard seat, and all belts are adjusted and tensioned as required.

(2) Restraint and dummy targeting required to measure performance are properly installed.

(3) All required calibrations of instrumentation, transducers, and high speed movie camera field are completed and recorded.

(4) All parameters relating to the required impact severity and velocity have been correctly set.

(5) The environmental requirements are met.

When all pre-test requirements are met, conduct the Dynamic Impact Test.

Immediately after the Dynamic Impact Test, photograph the restraint and dummy in their final post-test positions and configurations on the standard seat. Include this documentation with Compliance Datasheet D-1. Provide, in addition, a plot of the sled acceleration-time history for the test, showing its relationship to the acceleration-function envelope. Indicate on Datasheet D-1 the actual sled velocity change for the test and the cumulative velocity change associated with acceleration deviations below the acceleration-function envelope.

In the event of a noncompliance, a post-test calibration check of critically sensitive test equipment and instrumentation shall be required at the discretion of the CTM.

5.7 Performance Requirements  
(FMVSS 213, S5.1)

5.7.1 Buckle Release Test (Post-Impact)  
(FMVSS 213, S5.4.3.5, S6.2)

Reattach the self-adjusting sling to the dummy's hands and feet as outlined in section 5.5.5 of this procedure and repeat the buckle release test as outlined in that section. To facilitate performing this test on rear-facing restraints, reinstall the system facing forward, being careful not to disturb the buckle assembly. Record the buckle release force on Compliance Datasheet D-2. For compliance, the buckle release force shall be 20 pounds or less. Indicate with a comment on the Datasheet if any difficulty is encountered in releasing the buckle.

5.7.2 Restraint System Integrity  
(FMVSS 213, S5.1.1)

After the Dynamic Impact Test, the child restraint system shall:

(1) Exhibit no complete separation of any load bearing structural element and no partial separation exposing either surfaces with a radius of less than 1/4 inch or surfaces with protrusions greater than 3/8 inch above the immediate adjacent surrounding contactable surface of any structural element of the system.

(2) If adjustable to different positions, remain in the same adjustment position during the testing as it was immediately before the testing.

(3) If a forward-facing child restraint system, not allow the angle between the system's back support surface for the child and the system's seating surface to be less than 45 degrees at the completion of the test.

Observe, measure, and record the results, including maximum protrusion values, on Compliance Datasheet D-3.

5.7.3 Injury Criteria  
(FMVSS 213, S5.1.2)

Restraints tested with the three-year-old dummy shall be evaluated for injury potential. For compliance, the child restraint system shall:

(1) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy head as specified in 49 CFR, Part 572, such that the expression:

$$\left[ \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a \, dt \right]^{2.5} (t_2 - t_1)$$

shall not exceed 1,000, where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t<sub>1</sub> and t<sub>2</sub>, are any two moments during the impact.

(2) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy upper thorax as specified in 49 CFR, Part 572, to not more than 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

Record the results on Compliance Datasheet D-4.

5.7.4 Occupant Excursion  
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

By analysis of the high speed movie of the Dynamic Impact Test, or from an equivalent method approved by the CTM, the dummy excursion must be within the following limits during the impact test.



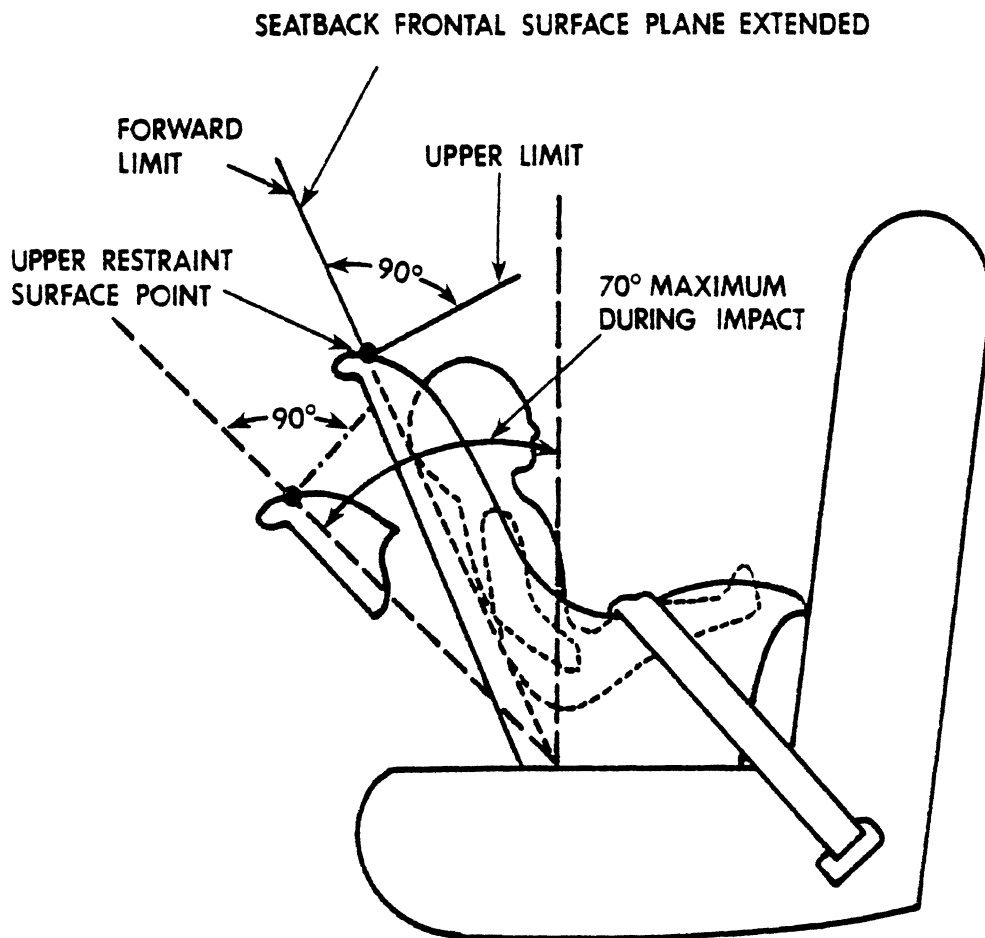
5.7.4.1 Forward-Facing Restraints  
(FMVSS 213, S5.1.3.1, S5.2.1.1(c))

- (1) The test dummy's torso shall be retained within the system.
- (2) No portion of the test dummy's head shall pass through the vertical transverse plane that is 32 inches forward of point Z on the standard seat assembly, measuring along the center SORL. (See Figure 5-2.)
- (3) Neither knee pivot point shall pass through the vertical transverse plane that is 36 inches forward of point Z on the standard seat assembly, measured along the center SORL. (See Figure 5-2.)
- (4) If the dummy head center of gravity target point is higher than the top edge of the standard seat seatback, with both dummy and restraint properly installed on the standard seat, the restraint seatback shall limit the rearward rotation of the dummy head such that the angle between the dummy head and torso does not change in a rearward direction with respect to the dummy more than 45 degrees from the pre-test installed configuration.

Record the results of the film analysis, including maximum excursions and angles observed, on Compliance Datasheet D-5.

5.7.4.2 Rear-Facing Restraints  
(FMVSS 213, S5.1.3.2, S5.1.4, S5.2.1.1(c))

- (1) All portions of the test dummy's torso shall be retained within the system.
- (2) No portion of the target point on either side of the dummy's head shall pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the child restraint system surfaces as illustrated in Figure 5-7.



Note: The limits illustrated move during dynamic testing.

Figure 5-7 Rear Facing Restraint Excursion Limits

(3) The angle between the restraint system's back support surface for the child and the vertical shall not exceed 70 degrees as illustrated in Figure 5-7. If the back support surface is curved, determine the angle using the line tangent to the restraint back surface at a point above the seating surface indicated as "shoulder height" in section 4.6 of this procedure.

(4) The angle between the dummy head and torso may not change in a rearward direction with respect to the dummy more than 45 degrees from the pre-test installed configuration.

Record the results of the film analysis, including maximum angles observed, on Compliance Datasheet D-5.

5.7.4.3 Car Beds  
(FMVSS 213, S5.1.3.3)

All portions of the test dummy's head and torso shall be retained within the confines of the car bed during the Dynamic Impact Test. 0  
Record the results of the film analysis on Compliance Datasheet D-5.



## 6.0 Compliance Datasheets

One sample of each Compliance Datasheet is included in this section. More than one copy of a Datasheet may be needed for a complete compliance test series.

Record test data in standard engineering units, determine compliance, and record Pass, Fail, NA (not applicable), or See Remarks in the spaces provided. Any noncompliance should be explained under Remarks.

## 6.1 Materials Tests Compliance Datasheets

M-1 Flammability Test

M-2 Webbing Performance Tests

M-3 Belt Buckle and Adjustment Hardware Performance Tests

M-4 Energy Absorbing Materials Performance Tests



COMPLIANCE TEST DATA: FMVSS 213

Compliance Datasheet M-1: Flammability Test  
(FMVSS 213, S5.7; FMVSS 302, S4.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Item Code \_\_\_\_\_

Laboratory Ambient Conditions During Testing

Temperature Range \_\_\_\_\_ to \_\_\_\_\_ Degrees F

Relative Humidity Range \_\_\_\_\_% to \_\_\_\_\_%

Type of Material \_\_\_\_\_

Function \_\_\_\_\_

Sample Dimensions L=\_\_\_\_in., W=\_\_\_\_in., H=\_\_\_\_in.

Burn Direction \_\_\_\_\_

Burn Distance \_\_\_\_\_ in.

Burn Time \_\_\_\_\_ sec.

Test	Compliance Requirement	Test Result	Pass/Fail
Burn Rate	≤4 in./min.		
Flame-Front Transmission Rate	≤4 in./min.		
Self-Extinguishment	Time <60 sec. Burn distance ≤2 in.		

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Compliance Datasheet M-2: Webbing Performance Tests  
(FMVSS 213, S5.4.1)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Item Code \_\_\_\_\_

Laboratory Ambient Conditions During Testing

Temperature Range \_\_\_\_\_ to \_\_\_\_\_ Degrees F

Relative Humidity Range \_\_\_\_\_ % to \_\_\_\_\_ %

Webbing Usage On Restraint \_\_\_\_\_

Test	Compliance Requirement	Test Result	Pass/Fail
Non-Degraded Webbing (FMVSS 209, S5.1(b))	This test provides baseline webbing breaking strength.	1 _____ 2 _____ 3 _____ Median _____	N/A (Provides baseline strength)
Resistance to Abrasion (FMVSS 209, S4.2(d), S5.1(d))  Abrasion cycles performed _____ (2500 required)	Median breaking strength $\geq$ _____ lb. (75% of median baseline strength)	1 _____ 2 _____ 3 _____ Median _____	
Resistance to Buckle Abrasion (FMVSS 209, S5.3(c))  Abrasion cycles performed _____ (2500 required)	Median breaking strength $\geq$ _____ lb. (75% of median baseline strength)	1 _____ 2 _____ 3 _____ Median _____	



Test	Compliance Requirement	Test Result	Pass/Fail
Resistance to Light (FMVSS 209, S4.2(e)), S5.1(e))  Exposure time _____ (100 hours required)	Median breaking strength $\geq$ _____ lb. (60% of median baseline strength)	1 _____ 2 _____ 3 _____ Median _____	
	Color retention $\geq$ No. 2 on the Geometric Gray Scale	1 _____ 2 _____ 3 _____	
Resistance to Micro-Organisms (FMVSS 209, S4.2(f), S5.1(f))  Burial duration _____ (2 weeks required)	Median breaking strength $\geq$ _____ lb. (85% of median baseline strength)	1 _____ 2 _____ 3 _____ Median _____	
Colorfastness to Crocking (FMVSS 209, S4.2(g), S5.1(g))	Color transfer $\leq$ Class 3 on AATCC Chart	1 _____ 2 _____ 3 _____	
Colorfastness to Staining (FMVSS 209, S4.2(h), S5.1(h))	Stain $\leq$ Class 3 on AATCC Chart	1 _____ 2 _____ 3 _____	
Width Requirement (FMVSS 209, S5.4.1(c), S5.4.1.1))	Width $\geq$ 1.5 in.	1 _____ 2 _____ 3 _____	

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Compliance Datasheet M-3: Belt Buckle and Adjustment Hardware  
 Performance Tests  
 (FMVSS 213, S5.4.2; FMVSS 209, S4.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Item Code \_\_\_\_\_

Laboratory Ambient Conditions During Testing

Temperature Range \_\_\_\_\_ to \_\_\_\_\_ Degrees F

Relative Humidity Range \_\_\_\_\_% to \_\_\_\_\_%

Test	Compliance Requirement	Test Result	Pass/Fail
Corrosion Resistance (FMVSS 209, S4.3(a) (2))  Exposure time _____ (24 hours required)  Drying time _____ (1 hour required)	No Corrosion	1 _____ 2 _____ 3 _____	
Temperature Resistance (FMVSS 209, S4.3(b))  Exposure time, moist _____ (24 hours required)  Exposure time, dry _____ (24 hours required)	No functional deterioration	1 _____ 2 _____ 3 _____	
Buckle Release Access (FMVSS 209, S4.3(d) (2))			
Pushbuttons	Area $\geq 0.7$ sq. in.		
	Linear dimensions		
Lever Release	Cylinder insertion		
Other	Two-finger access		

Test	Compliance Requirement	Test Result	Pass/Fail
Adjustment Force (FMVSS 209, S4.3(e))  Conditioning cycles performed _____ (10 required)	Force $\leq$ 11 lb. (5 kg)	1 _____ 2 _____ 3 _____	
Tilt-Lock Adjustment (FMVSS 209, S4.3(f))	Lock angle $\geq$ 30 degrees	1 _____ 2 _____ 3 _____	
Buckle Latch (FMVSS 209, S4.3(g))  Conditioning cycles performed _____ (200 required)	No functional deterioration	1 _____ 2 _____ 3 _____	
Metal-to-Metal Buckles	Partial-engagement separation force $\leq$ 5 lb. (2.3 kg)	1 _____ 2 _____ 3 _____	

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Compliance Datasheet M-4: Energy Absorbing Materials  
 Performance Tests  
 (FMVSS 213, S5.2.3, S6.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_/\_\_\_\_/\_\_\_\_ Item Code \_\_\_\_\_

Laboratory Ambient Conditions During Testing

Temperature Range \_\_\_\_\_ to \_\_\_\_\_ Degrees F

Relative Humidity Range \_\_\_\_\_% to \_\_\_\_\_%

S6.3 Compression-Deflection Resistance (25% compression)

Base Material Type	Test Procedure Used	Normalized Load Value (lb./sq. in.)

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

## 6.2 Inspection of Physical Features Compliance Datasheets

- F-1 Labeling
- F-2 Installation Instructions
- F-3 Installation
- F-4 Minimum Head Support Surface
- F-5 Belt Restraint
- F-6 Torso Impact Protection
- F-7 Head Impact Protection
- F-8 Protrusion Limitation



COMPLIANCE TEST DATA: FMVSS 213

Compliance Datasheet F-1: Labeling  
(FMVSS 213, S5.5)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Pass/Fail

S5.5.1 The information specified below is included on permanent labels.

\_\_\_\_\_

S5.5.2 The labels are in English, the characters are not smaller than 10 point type, and the characters are on a contrasting background.

\_\_\_\_\_

The following information is included:

- (a) Model name or number \_\_\_\_\_
- (b) Name of manufacturer or responsible distributor \_\_\_\_\_
- (c) Month and year of manufacture, included in the statement "Manufactured in \_\_\_\_."
- (d) Place (city and state, or foreign country) of manufacture or principal offices of the distributor. \_\_\_\_\_
- (e) The statement: "This child restraint system conforms to all applicable Federal Motor Vehicle Safety Standards." \_\_\_\_\_
- (f) One of the following statements, inserting the manufacturer's recommendations for the maximum weight and height of children who can safely occupy the system:
  - (i) THIS INFANT RESTRAINT IS DESIGNED FOR USE BY CHILDREN WHO WEIGH \_\_\_\_ POUNDS OR LESS AND WHOSE HEIGHT IS \_\_\_\_ INCHES or LESS; or
  - (ii) THIS CHILD RESTRAINT IS DESIGNED FOR USE ONLY BY CHILDREN WHO WEIGH BETWEEN \_\_\_\_ AND \_\_\_\_ POUNDS AND WHOSE HEIGHT IS \_\_\_\_ INCHES OR LESS AND WHO ARE CAPABLE OF SITTING UPRIGHT ALONE; OR
  - (iii) THIS CHILD RESTRAINT IS DESIGNED FOR USE ONLY BY CHILDREN WHO WEIGH \_\_\_\_ AND \_\_\_\_ POUNDS AND ARE BETWEEN \_\_\_\_ AND \_\_\_\_ INCHES IN HEIGHT.\_\_\_\_\_
- (g) The following statement, inserting the location of the manufacturer's installation instruction booklet or sheet on the restraint. \_\_\_\_\_

WARNING! FAILURE TO FOLLOW EACH OF THE FOLLOWING INSTRUCTIONS CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH. SECURE THIS CHILD RESTRAINT WITH A VEHICLE BELT AS SPECIFIED IN THE MANUFACTURER'S INSTRUCTIONS LOCATED \_\_\_\_\_.

(h) In the case of each child restraint system that has belts designed to restrain children using them, the statement:  
SNUGLY ADJUST THE BELTS PROVIDED WITH THIS CHILD RESTRAINT AROUND YOUR CHILD. \_\_\_\_\_

(i) In the case of each child restraint system which is not intended for use in motor vehicles at certain adjustment positions, the following statement, inserting the manufacturer's adjustment restrictions:  
DO NOT USE THE \_\_\_\_\_ ADJUSTMENT POSITION(S) OF THIS CHILD RESTRAINT IN A MOTOR VEHICLE. \_\_\_\_\_

(j) In the case of each child restraint system equipped with an anchorage strap, the statement:  
SECURE THE TOP ANCHORAGE STRAP PROVIDED WITH THIS CHILD RESTRAINT AS SPECIFIED IN THE MANUFACTURER'S INSTRUCTIONS. \_\_\_\_\_

(k) In the case of each child restraint system which can be used in a rear-facing position, one of the following statements:  
(i) PLACE THE CHILD RESTRAINT IN REAR-FACING POSITION WHEN USING IT WITH AN INFANT; or  
(ii) PLACE THIS INFANT RESTRAINT IN A REAR-FACING POSITION WHEN USING IT IN THE VEHICLE. \_\_\_\_\_

(l) An installation diagram showing the child restraint system installed in the right front outboard seating position equipped with a continuous-loop lap/shoulder belt and in the center rear seating position as specified in the manufacturer's instructions. \_\_\_\_\_

S5.5.3 The information specified in FMVSS 213, S5.5.2 (g)-(k), is located on the child restraint system so that it is visible when the system is installed according to the installation instructions included with the child restraint. \_\_\_\_\_

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_



Compliance Datasheet F-2: Installation Instructions  
(FMVSS 213, S5.6)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Pass/Fail

S5.6 The child restraint system is accompanied by printed instructions in the English language that provide a step-by-step procedure, including diagrams, for installing the system in motor vehicles, securing the system in the vehicles, positioning a child in the system, and adjusting the system to fit the child.

\_\_\_\_\_

S5.6.1 The instructions state that the rear center seating position is the safest position in most vehicles for installing a child restraint system.

\_\_\_\_\_

S5.6.2 The instructions specify in general terms the types of vehicles, seating positions, and vehicle lap belts with which the system can or cannot be used.

\_\_\_\_\_

S5.6.3 The instructions explain the primary consequences of not following the warnings required to be labeled on the child restraint system.

\_\_\_\_\_

S5.6.4 The instructions for each car bed explain that the car bed should be positioned in such a way that the child's head is near the center of the vehicle.

\_\_\_\_\_

S5.6.5 The instructions state that child restraint systems should be securely belted to the vehicle, even when they are not occupied, since in a crash an unsecured child restraint system may injure other occupants.

\_\_\_\_\_

S5.6.6 The child restraint has a location on the restraint for storing the manufacturer's instructions.

\_\_\_\_\_

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet F-3: Installation  
(FMVSS 213, S5.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

	<u>Pass/Fail</u>
<u>S5.3.1</u> No attachment to vehicle seat cushion or seat back, nor insert between them.	_____
<u>S5.3.2</u> Secured by means of (check one)	
____ Lap belt only	
or	
____ Lap belt and tether	_____
<u>S5.3.3</u> Lateral installation for car beds.	_____

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet F-4: Minimum Head Support Surface  
(FMVSS 213, S5.2.1)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

S5.2.1.2 The child restraint system is low enough to be exempt from this requirement.

\_\_\_\_\_  
(yes, no)

S5.2.1.1

Back Support Height

Maximum Child Weight	Required Minimum Height	Measured Height	Pass/Fail

Back Support Width

Required Minimum Width	Measured Width	Side Wing Depth	Pass/Fail

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet F-5: Belt Restraint  
(FMVSS 213, S5.4.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Pass/Fail

S5.4.3.1 Snug Fit of Belts \_\_\_\_\_

Extra Webbing

Dummy	Each Shoulder Belt	Each Lap Belt Side	Crotch Belt

S5.4.3.2 Direct Restraint Belts \_\_\_\_\_

Yes/No

- (1) Belt/dummy contact for restraint \_\_\_\_\_
- (2) Rigid structure behind dummy \_\_\_\_\_
- (3) Belt/child restraint slip possible \_\_\_\_\_

Note: If all "yes," restraint fails.

S5.4.3.3 Seating System Belts and/or Shields \_\_\_\_\_

- (1) Upper torso \_\_\_\_\_
- (2) Lower torso \_\_\_\_\_
- (3) Crotch restraint \_\_\_\_\_

S5.4.3.4 Child Harness Belts \_\_\_\_\_

- (1) Upper torso \_\_\_\_\_
- (2) Lower torso \_\_\_\_\_
- (3) Prevent standing \_\_\_\_\_

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet F-6: Torso Impact Protection  
(FMVSS 213, S5.2.2)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

S5.2.2.1

Test	Compliance Requirement	Test Result	Pass/Fail
Back Support Surface	Flat or concave		
	Area $\geq 85$ sq. in.		
Side Support Surface	Flat or concave		
Max. weight $\geq 20$ lb.	Area $\geq 24$ sq. in.		
Max. weight $< 20$ lb.	Area $\geq 48$ sq. in.		
Forward Restraining Surface			
Horiz. Cross Section	Flat or concave		
Vertical Longitudinal Cross Section	Flat or convex		
	Radius of curvature $\geq 2$ in.		

Yes/No

Pass/Deferred

S5.2.2.2 Forward Fixed or Movable Surface

\_\_\_\_\_

\_\_\_\_\_

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet F-7: Head Impact Protection  
(FMVSS 213, S5.2.3)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Item Code \_\_\_\_\_

Pass/Fail

S5.2.3.2(a) Slow recovery, energy absorbing padding materials, having a 25% compression-deflection resistance of from 0.5 to 10 psi, cover the head impact area. \_\_\_\_\_

S5.2.3.2(b) Padding Thickness

Compliance Requirement		Test Result		Pass/Fail
Resistance Value Range	Minimum Thickness	Resistance Value	Thickness	
0.5 psi-1.79 psi	3/4 in.			
1.8 psi-10.0 psi	1/2 in.			

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Compliance Datasheet F-8: Protrusion Limitation  
(FMVSS 213, S5.2.4)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Test	Compliance Requirement	Test Result	Pass/Fail
Height	$\leq 3/8$ in.		
Edge Radius	$\geq 1/4$ in.		

Remarks:

Technician \_\_\_\_\_

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





### 6.3 Dynamic Impact Test Compliance Datasheets

D-1 Dynamic Impact Test Conditions

D-2 Buckle Release

D-3 Restraint System Integrity

D-4 Injury Criteria

D-5 Occupant Excursion



COMPLIANCE TEST DATA: FMVSS 213

Compliance Datasheet D-1: Dynamic Impact Test Conditions  
(FMVSS 213, S6.1)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Item Code \_\_\_\_\_

Laboratory Ambient Conditions During Testing

Temperature Range \_\_\_\_\_ to \_\_\_\_\_ Degrees F

Relative Humidity Range \_\_\_\_\_ % to \_\_\_\_\_ %

Test Configuration (I or II) \_\_\_\_\_

Nominal velocity (mph) \_\_\_\_\_

Dummy Used \_\_\_\_\_

Child Restraint System

Installation mode \_\_\_\_\_

Adjustment position \_\_\_\_\_

"Misuse" mode \_\_\_\_\_

Test Results

Actual velocity (ft/s) \_\_\_\_\_

(mph) \_\_\_\_\_

Integrated area of sled acceleration  
deviation below the lower severity  
boundary (ft/s) \_\_\_\_\_

Limits:

Configuration I - 0.44 ft/s

Configuration II - 0.29 ft/s

Include pre- and post-test photographs and acceleration-time  
history plot.

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Compliance Datasheet D-2: Buckle Release  
(FMVSS S5.4.3.5, S6.2)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Test	Compliance Requirement	Test Result	Pass/Fail
Pre-Impact Release Force	$\geq 12$ lb.		
Post-Impact Release Force	$\leq 20$ lb.		

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet D-3: Restraint System Integrity  
(FMVSS 213, S5.1.1)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Test	Compliance Requirement	Test Result	Pass/Fail
Structural Integrity	No complete separation		
	No partial separation with exposed edge radius <1/4 in.		
	No partial separation with protrusion >3/8 in.		
Adjustment Position	No change		
Back Surface/ Seating Surface Angle	Not <45 degrees		

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet D-4: Injury Criteria  
(FMVSS 213, S5.1.2)

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Test	Compliance Requirement	Test Result	Pass/Fail
Head Injury Criterion	$\leq 1000$		
Chest Injury Criterion	Cumulative duration over 60g $\leq 3$ ms	Peak g= _____ Duration exceeding 60g= _____	

Remarks:

Technician \_\_\_\_\_

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

Compliance Datasheet D-5: Occupant Excursion  
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

Report No. \_\_\_\_\_

Date of Test \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Item Code \_\_\_\_\_

Forward-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.1)	Retain within system		
Head Excursion (FMVSS 213, S5.1.3.1)	≤32 in.		
Knee Target Excursion (FMVSS 213, S5.1.3.1)	≤36 in.		
Head-Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤45 degrees		

Rear-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.2)	Retain within system		
Head Target Excursion (FMVSS 213, S5.1.3.2)	Not beyond restraint's top and forward edge		
Back Support Angle (FMVSS 213, S5.1.4)	≤70 degrees		
Head-Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤45 degrees		

Car Beds

Test	Compliance Requirement	Test Result	Pass/Fail
Head/Torso Retention (FMVSS 213, S5.1.3.3)	Retain within confines of system		

Remarks:

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_



## 7.0 Final Documentation Format and Preparation

### 7.1 Final Test Report

#### 7.1.1 Outside Front Cover

Heavy paper front and back covers shall be provided for protection of reports. The front cover shall include the information shown in Figure 7-1. The following information is required on the cover.

(1) Report number - Each report will have the following numbering system.

Example: 213-ABC-FY-001

Coding: 213 - FMVSS tested  
ABC - Initials of laboratory performing tests  
(3 letters maximum)  
FY - Fiscal year of contract award  
001 - Report serial number (starting with 001)

(2) Title and subtitle - Display the title prominently and make it indicate clearly and briefly the subject coverage of the report. Set subtitle in small type or otherwise subordinate it to the main title. NHTSA report titles shall appear in basically the following manner:

CHILD RESTRAINT SYSTEMS - FMVSS NO. 213  
Manufacturer Model

(3) Performing organization name and address - Give the laboratory name, street and number, city, state, and zip code.

(4) Date - Each report shall carry the date of report preparation.

(5) Type of report - Indicate "FINAL REPORT."

(6) Sponsoring agency's name and address - Give data as follows:

U.S. Department of Transportation  
National Highway Traffic Safety Administration  
400 Seventh Street, S.W.  
Washington, D.C. 20590

1. REPORT NUMBER: 213-ABC-81-001
  
2. TITLE: CHILD RESTRAINT SYSTEM TESTS - FMVSS NO. 213  
SUBTITLE: Kiddie Kar Company  
Model 3 Safety Seat
  
3. PERFORMING ORGANIZATION: A.B.C. Laboratories  
405 Main Street  
Detroit, Michigan 48070



4. DATE: June 30, 1981
  
5. TYPE OF REPORT: FINAL REPORT
  
6. SPONSORING AGENCY: PREPARED FOR:  
U. S. Department of Transportation  
National Highway Traffic Safety Administration  
400 Seventh Street, S.W.  
Washington, D.C. 20590

Figure 7-1 Sample Front Cover

### 7.1.2 Acceptance Page

An acceptance signature block, as shown in Figure 7-2, shall be provided as the first page after the cover.

### 7.1.3 Technical Report Documentation Page

Include one completed Technical Report Documentation (TRD) Page, Form DOT F1700.7 (Figure 7-3) following the Acceptance Page. Complete only those items that are applicable. The other spaces are to be left blank. Item 16 (Abstract) should contain a statement briefly describing the results of the tests; special emphasis should be placed on tests resulting in a noncompliance with the requirements. Any question concerning this page should be resolved with the CTM. Copies of the form may be obtained from the CTM.

### 7.1.4 Contents of the Report

The Table of Contents shall be as given in Figure 7-4. Each section and appendix shall be preceded by a separate title sheet.

Purpose and Test Procedure (Section I) shall be stated as given in Figure 7-5.

A Child Restraint System Identification page, as shown in Figure 7-6, shall be included in Section II following the section title sheet. This is followed by the completed set of Compliance Datasheets.

The contents of the appendices are discussed in sections 1.0, 2.10, and 2.12 of this procedure.

Prepared for the United States Department of Transportation,  
National Highway Traffic Safety Administration, under  
Contract No. \_\_\_\_\_ . This document is  
disseminated under the sponsorship of the United States  
Department of Transportation in the interest of information  
exchange. The United States Government assumes no liability  
for its contents or use thereof.

REPORT ACCEPTED BY:

\_\_\_\_\_  
Contract Technical Manager,  
Office of Vehicle Safety Compliance

\_\_\_\_\_  
Acceptance Date

Figure 7-2 Sample Acceptance Page

Technical Report Documentation Page

1. Report No. 213-ABC-81-001	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Child Restraint System Tests - FMVSS 213 Kiddie Kar Company Model 3 Safety Seat		5. Report Date June 30, 1981	
		6. Performing Organization Code	
7. Author(s) John Doe		8. Performing Organization Report No. ABC-81-57	
9. Performing Organization Name and Address ABC Laboratories 405 Main Street Detroit, Michigan 48070		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-81-C-	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, D.C. 20590		13. Type of Report and Period Covered Final Report June 1981	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract  This report contains results of tests performed in accordance with FMVSS 213, Child Restraint Systems, on the Kiddie Kar Safety Seat. The restraint system complied with all requirements except as noted below:  (1) System did not comply with Labeling requirements. (2) System was questionable on Snug Fit requirement.			
17. Key Words FMVSS 213 Child Restraint Systems Compliance Testing		18. Distribution Statement	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 50	22. Price

Figure 7-3 Sample Technical Report Documentation Page

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SECTION I	Purpose and Test Procedure
SECTION II	Inspection and Test Data
APPENDIX A	Interpretations and/or Deviations from FMVSS No. 213
APPENDIX B	Equipment List and Calibration Schedules
APPENDIX C	Photographs of Equipment

Figure 7-4 Sample Table of Contents

## PURPOSE AND TEST PROCEDURE

Purpose: The purpose of the test was to determine if the production child restraint systems supplied by the National Highway Traffic Safety Administration met the requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 213 - Child Restraint Systems.

Test Procedure: The "ABC Laboratories Test Procedure for FMVSS No. 213," submitted and approved by the Office of Vehicle Safety Compliance, National Highway Traffic Safety Administration, contains the specific procedures used to conduct this test. This procedure shall not be interpreted to be in conflict with any portion of FMVSS No. 213 and amendments in effect as noted in the applicable contract.

Figure 7-5 Purpose and Test Procedure

INSPECTION AND TEST DATA  
FMVSS NO. 213 - CHILD RESTRAINT SYSTEMS

Report No. \_\_\_\_\_ Lab Group No. \_\_\_\_\_

Child Restraint System Identification

Manufacturer:

Name \_\_\_\_\_

Address \_\_\_\_\_

Model \_\_\_\_\_

Distributor:

Name \_\_\_\_\_

Address \_\_\_\_\_

Date of Manufacture \_\_\_\_/\_\_\_\_/\_\_\_\_

Technician \_\_\_\_\_ Project Manager \_\_\_\_\_

Date \_\_\_\_/\_\_\_\_/\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_

Figure 7-6 Child Restraint System Identification Page



## 7.2 Film Documentation

### 7.2.1 Specifications

At the very beginning, and for each separate segment, film an identification placard or slate covering the following description of the film:

- (1) Project title
- (2) Test number where appropriate
- (3) Date filmed
- (4) Type of test or product being filmed
- (5) Conditions of test or product being filmed

### 7.2.2 Film Preservation and Identification

(1) The film actually shot in the camera (the original) should never be screened. After the original is developed, add an identifying leader to the beginning of the film (the head) with the following information on it:

- (a) Project title
- (b) Inclusive test numbers where appropriate
- (c) The name of the filming organization
- (d) Date
- (e) The word "original"

(2) Make a high quality duplicate of the original film (a B-wind optical duplicate master, liquid gate) as a protection copy in case the original is lost or damaged. Make a workprint from the original to be used for editing. Affix identifying leaders to the heads of both the B-wind master and workprint as described in 7.2.2(1) above.

(3) Store the original and B-wind master on cores, heads out, in plastic bags, and the bags in dust-proof cans or containers. Label storage containers with the same information as on the leaders, plus a notation of the length (time and feet), color or black and white, and silent or sound (magnetic or optical). Store containers in climate controlled vaults.

#### 7.2.3 Film Editing

Edit the workprint to remove extraneous material.

#### 7.2.4 Films for Circulation

Reproduce prints for distribution (release prints) from the original film based on the final edited workprint.

#### 7.2.5 Film Abstract

Prepare an abstract or description of the film's content to accompany the film when it is delivered to NHTSA.

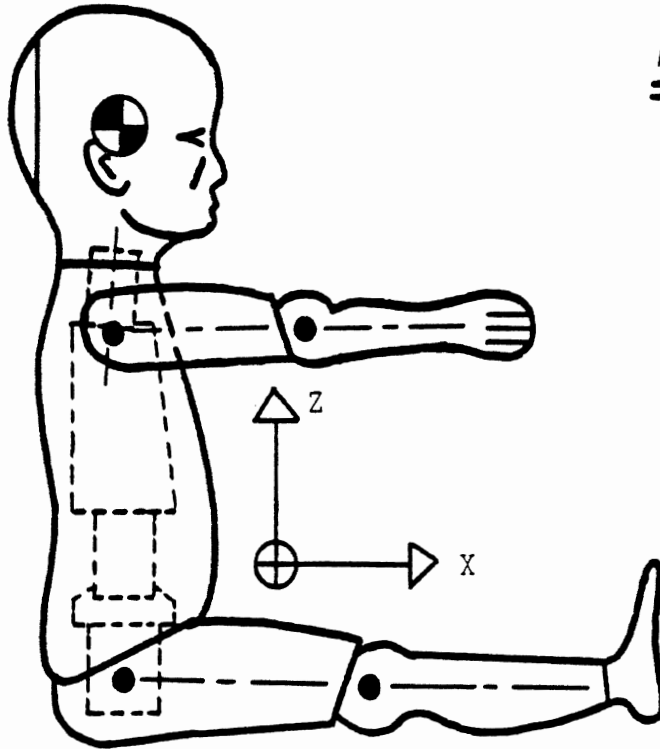
#### 7.2.6 Disposition of Films

(1) For the purpose of duplicating prints for NHTSA and outside sources, the contractor shall retain the original and the B-wind master until NHTSA requests that they be delivered to NHTSA.

(2) In addition to the number of prints required by the Contract Technical Monitor, the contractor shall provide one (1) print to the Technical Reference Branch, along with a copy of the abstract or description.

APPENDIX I





PART 572 THREE YEAR OLD

CHILD TEST DUMMY

PERFORMANCE CALIBRATION

TEST PROCEDURE

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

Enforcement

Office of Vehicle Safety Compliance  
400 Seventh Street, S.W.  
Washington, D.C. 20590



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1. INTRODUCTION:

The Regulation Part 572 Three Year Old Child anthropomorphic test dummy is a tool used to determine compliance of child restraint systems as specified in Federal Motor Vehicle Safety Standard (FMVSS) No. 213, "Child Restraint Systems". Part 572 specifies the child dummy configuration and the performance criteria which the dummy must meet both before and after each child restraint system dynamic test in order to be an acceptable compliance test tool.

2. PURPOSE:

The purpose of this laboratory procedure is to provide child dummy users (independent testing laboratories under contract with the Office of Vehicle Safety Compliance) with standard test procedures for conducting receiving-inspection and child restraint system dynamic test usage performance calibration so that repetitive and correlative test results can be obtained. The following four component calibration tests have been developed that establish a uniform calibration procedure for all users prior to use of the child dummy in dynamic testing, and a means of checking calibration of the dummy for purposes of compliance following testing.

- (1) Head Impact Test
- (2) Head-Neck Pendulum Test
- (3) Chest Impact Test
- (4) Lumbar Flexion Test

### 3. APPLICATION:

This laboratory procedure for calibration of the Part 572 Three Year Old Child Dummy is intended to be utilized by child dummy users and not necessarily dummy manufacturers. This procedure must be used by NHTSA contract laboratories conducting FMVSS No. 213 tests for the Office of Vehicle Safety Compliance. This calibration procedure does not in itself impose duties or liabilities on any person. It is a description of tools that measure the performance of child restraint systems required by FMVSS No. 213. It is designed to be referenced by, and become part of, the compliance test procedures specified in FMVSS No. 213.

### 4. TERMINOLOGY:

- (1) The term Three Year Old Child Dummy refers to the test device described by this procedure and consists of the component parts and assemblies shown in FIGURES 1, 2, and 3.
- (2) Terms describing parts of the child dummy, such as "head", are the same as names for corresponding parts of the human body.
- (3) The term "UPRIGHT SEATED POSITION" means the position of the child dummy when it is seated as shown in FIGURE 4.

FIGURE 1

THREE YEAR OLD CHILD DUMMY

FRONT VIEW

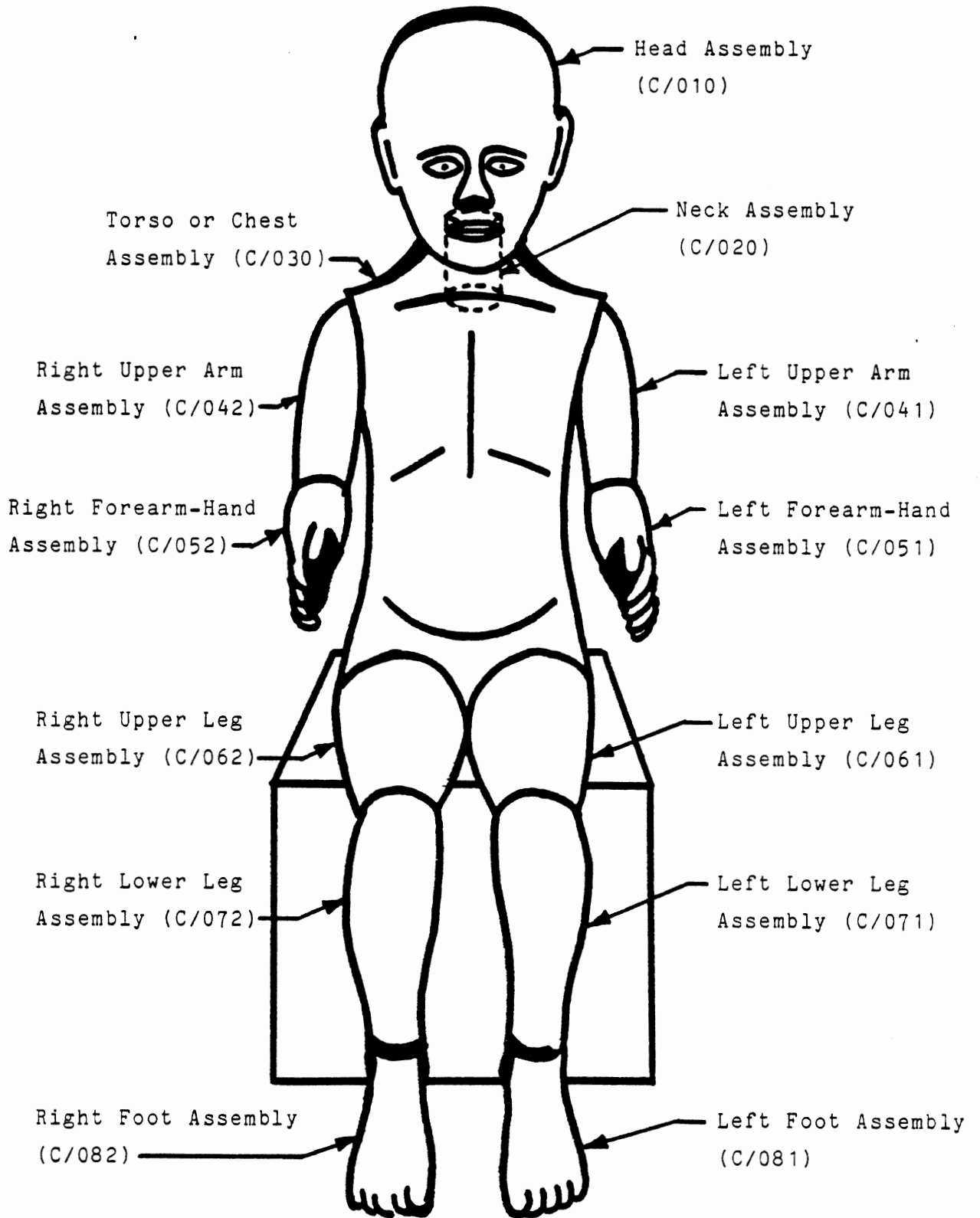


FIGURE 2

THREE YEAR OLD CHILD DUMMY

3/4 VIEW

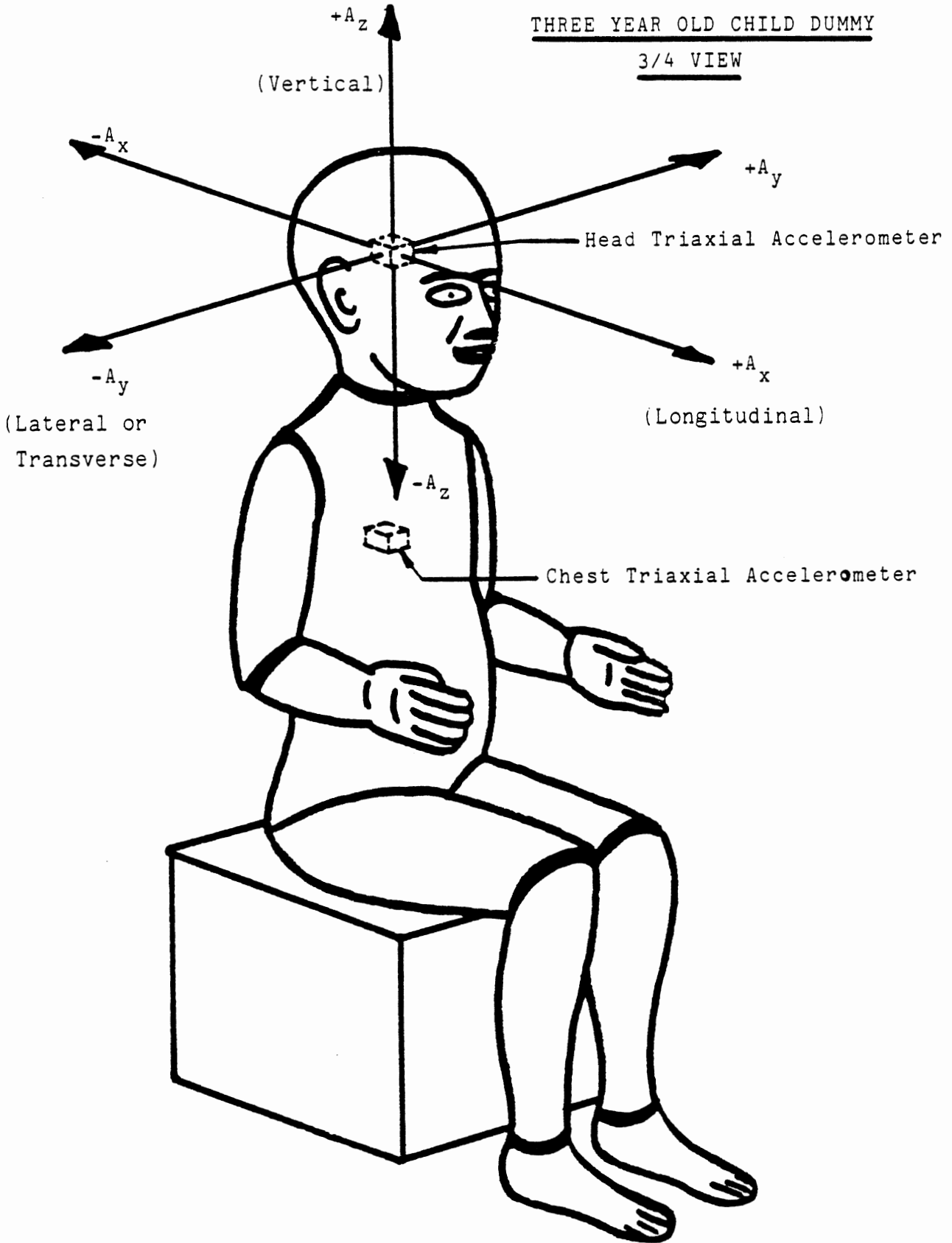


FIGURE 3  
THREE YEAR OLD CHILD DUMMY SIDE VIEW  
(WITH PLANES OF DIRECTION SHOWN)

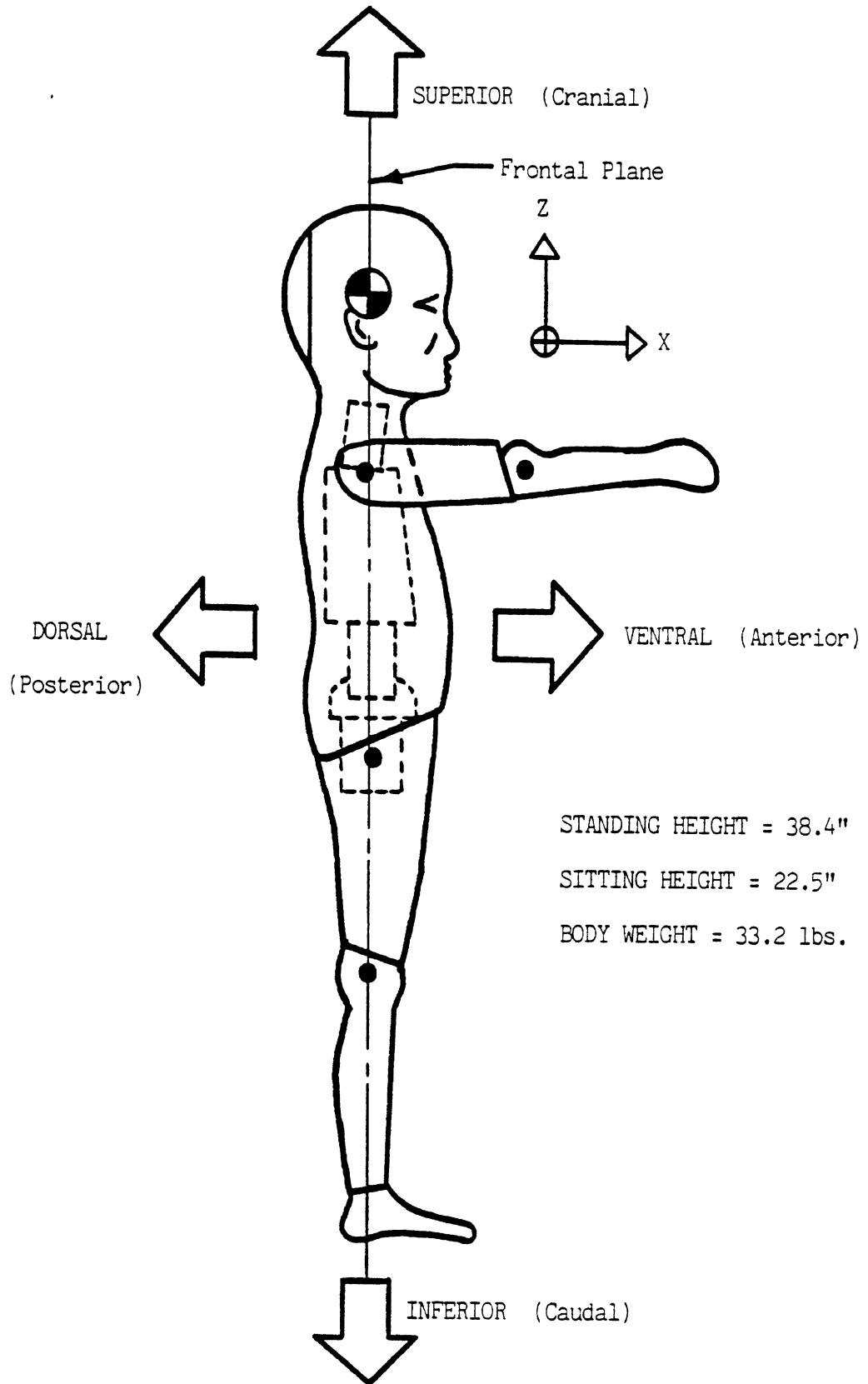


FIGURE 4  
THREE YEAR OLD CHILD DUMMY  
"UPRIGHT SEATED POSITION"

Adjust dummy for head impact and lumbar flexion tests so rear surfaces of shoulders and buttocks are tangent to transverse vertical plane.

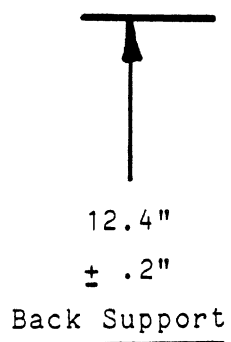
Dummy's midsagittal plane is vertical and centered on the teflon sheet.

Shoulder yokes adjusted so they are at midpoint of their anterior-posterior travel with upper surfaces horiz.

Arms and legs positioned so that centerlines are in planes parallel to midsagittal plane.

Limb joints adjusted to setting of 1-2g which just supports limbs' weight when limb is extended horizontally forward.

FOR HEAD TEST ONLY



TEFLON SHEET ON TEST SURFACE

16" min.  
Deep &  
16" (min.) Wide

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 16 inches minimum.

5. SECURITY:

All NHTSA Part 572 Three Year Old Child Dummies delivered to the contract laboratory as Government Furnished Equipment (GFE) will be stored in a safe and secure area such as the child dummy calibration room. The contractor is responsible for the wellbeing of the NHTSA child test dummies, and must protect and segregate the data that evolves from conducting Part 572 child dummy calibration tests before and after each dynamic test usage.

No information concerning the Part 572 child dummy calibration data shall be transmitted to anyone except the NHTSA Contract Technical Manager (CTM). No individuals, other than contractor personnel directly involved in the child dummy calibration test program, shall be allowed to witness any dummy calibration tests unless specifically authorized by the NHTSA CTM.

6. CALIBRATION TEST SCHEDULING AND MONITORING:

Since the Part 572 child dummies are being calibrated as test tools to be used in child restraint system dynamic tests to determine compliance of restraint systems with the requirements of FMVSS No. 213, the schedule of these performance calibration tests must be correlated with that of the dynamic tests.

The conduct of all tests shall be coordinated to permit monitoring by the FMVSS No. 213 CTM.

Prior to conducting any child dummy performance calibration

tests, the contract laboratory shall submit a copy of detailed laboratory procedures and a list of test equipment to be used including instrument accuracy and dates of calibration to the CTM for approval. The laboratory procedure should include such items as check-off lists and individual worksheets for each phase of child dummy calibration.

7. CALIBRATION TEST DATA DISPOSITION:

The contractor shall make all child dummy calibration data available to the CTM for review and analysis as required. All calibration test data for each particular Part 572 child dummy will be maintained in sequence by date during the testing program, and then summarized at the end of the program.

8. APPARENT NONCONFORMANCE:

Any indications of apparent nonconformance to the requirements of Part 572 shall be communicated by telephone to the CTM. The CTM will be responsible for procuring child dummy replacement components so that nonconforming dummies can be calibrated and meet the specific performance requirements of Part 572.

9. COPIES OF FINAL CHILD DUMMY CALIBRATION TEST REPORTS:

The pre-test and post-test calibration data for each Part 572 child dummy utilized in the FMVSS No. 213 dynamic test program will be contained in the FMVSS No. 213 final test



report for the child restraint system tested. However, at the end of each restraint system test program (unless otherwise instructed by the CTM), the contractor will submit six copies of a final child dummy calibration test report for each NHTSA child dummy used in the restraint system dynamic test program. This final report will summarize the pre-test and post-test calibration data for one particular Part 572 child dummy in sequence by date. In other words, all head impact test data will be summarized, all head-neck pendulum test data will be summarized, etc.

Each Part 572 child dummy calibration final test report shall have a standard report cover first page and title page prepared in accordance with item no. 13 on page 44 of this procedure. The other pages of the report shall be compiled in the following sequence:

- (1) Child Dummy Calibration Test Data Sheets
- (2) Discussion of Test Results
- (3) Photographs of the dummy in each stage of calibration
- (4) List of Test Equipment--calibration dates, accuracy, etc.
- (5) Detailed Laboratory Test Procedure

#### 10. CALIBRATION OF TEST INSTRUMENTATION:

Before starting the child dummy performance calibration test program, the user shall implement and maintain a measurement and test equipment calibration system in accordance with established calibration practices. Guidelines

for setting up and maintaining such systems are described in MIL-C-45662A, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

- (1) Standards for calibrating the measuring and test equipment shall be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- (2) 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 six months. Records, showing the calibration traceability to the National Bureau of Standards, shall be maintained for all measuring and test equipment.
- (3) All measuring and test equipment and measuring standards shall be labeled with the following information:
  - (a) Date of calibration
  - (b) Date of next scheduled calibration
  - (c) Name of the individual who calibrated the equipment
- (4) A written calibration procedure shall be provided by the contractor, which includes, as a minimum, the following information for all measurement and test equipment:
  - (a) Type of equipment, manufacturer, model number, etc.
  - (b) Measurement range
  - (c) Accuracy
  - (d) Calibration interval
  - (e) Type of standard used to calibrate the equipment

- (5) Records of calibrations for all measuring and test equipment 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 authorized by the CTM. The calibration system will need the acceptance of the CTM before testing commences.

#### 11. GENERAL INFORMATION:

- (1) The structural properties of the child dummy are such that the dummy conforms to the calibration procedure in every respect both before and after being used in tests specified by FMVSS No. 213, "Child Restraint Systems".
- (2) The outputs of accelerometers installed in the child dummy, and of the test apparatus specified by this test procedure, are recorded in individual data channels that conform to the requirements of SAE Recommended Practice J211a, dated December 1971, with channel classes as follows:
  - (a) Head acceleration--Class 1000
  - (b) Pendulum acceleration--Class 60
  - (c) Chest acceleration--Class 180
- (3) Child dummy calibration performance tests are conducted at any temperature from 66 to 78 degrees F and at any relative humidity from 10 to 70 percent after exposure of the child dummy to these conditions for a period of not less than 4 hours.

- (4) 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 the CTM.
- (5) Surfaces of the dummy components are not painted except as specified.
- (6) Limb joints are set at the force between 1 to 2 g, which just supports the limbs' weight when the limbs are extended horizontally forward. The force required to move a limb segment does not exceed 2g throughout the range of limb motion.
- (7) Adjacent segments of the child dummy 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.
- (8) Copies of the Operation and Maintenance Manual with instructions for the use and maintenance of the child test dummies dated May 28, 1976, Contract No. DOT-HS-6-01294 can be obtained from the Keuffel & Esser Co.

## 12. CHILD DUMMY COMPONENT CALIBRATION TESTS:

### A. Dummy Preparation--

Each three year old child dummy will contain an identification serial number marked on the outer skin. This number will be used throughout the calibration test. In preparation for the calibration 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 calibration test report along with a list of replacement components added to the child dummy.

After the initial inspection, the outer vinyl skin of the child dummy will be cleaned to remove any residues which may have remained from previous testing or usage. The child dummy will then be reassembled in preparation for the calibration tests. The dummy will be instrumented with triaxial accelerometers in the head and chest at this time.

### B. Calibration Tests--

Calibration tests will be performed on each child dummy according to the four standard tests specified in Part 572, Subpart C. If the performance of each component falls within the required ranges, only one test will be conducted on each child dummy. The various component tests will be performed with the test equipment and

instrumentation meeting the Part 572 requirements.

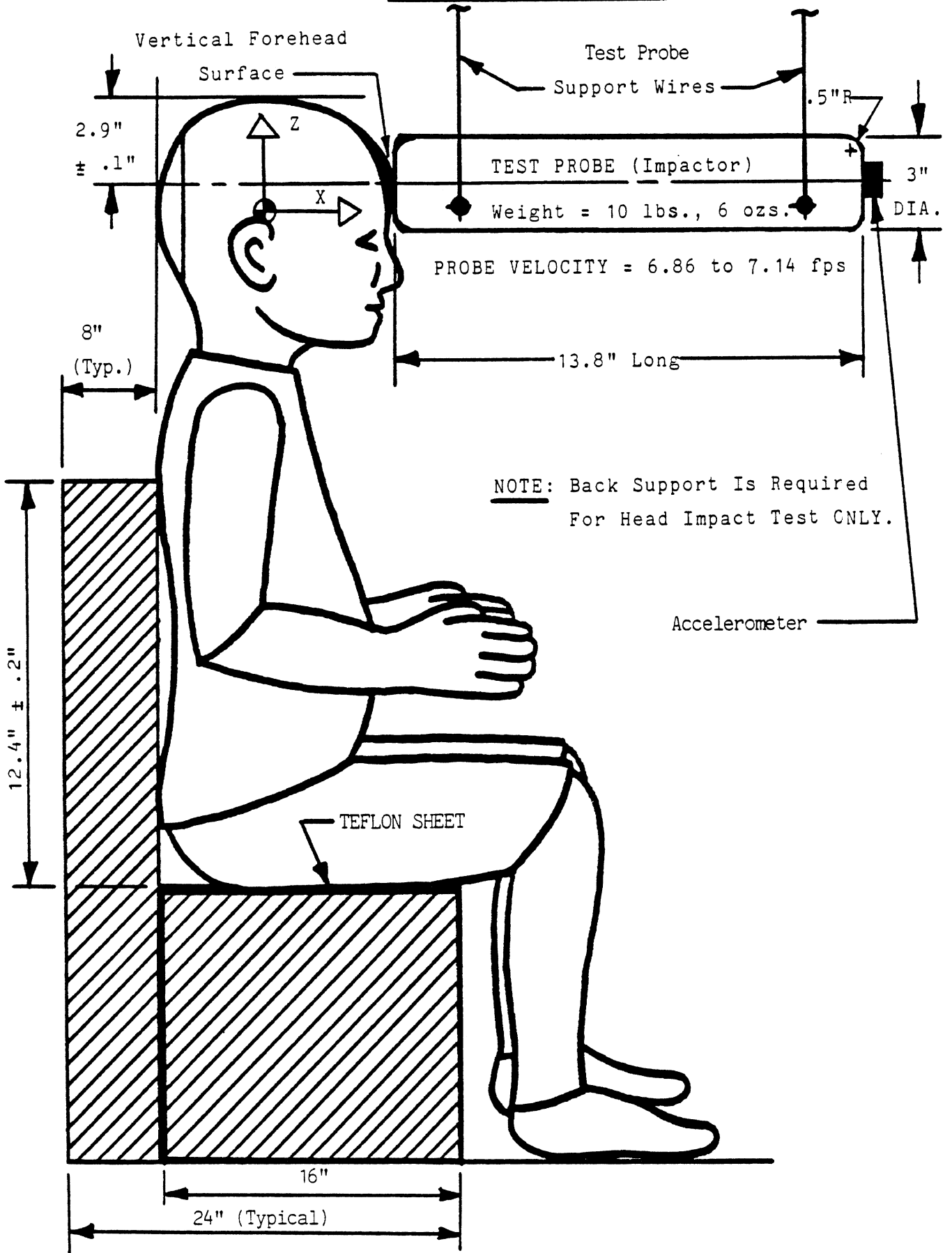
A brief description of the test apparatus is included in each of the following sections with a particular type of test.

(1) HEAD IMPACT TEST:

- (a) Seat the child dummy on a seating surface having a back support as shown in FIGURE 4. Adjust the joints of the limbs at any setting between 1g and 2g which just supports the limbs' weight when the limbs are extended horizontally forward.
- (b) Adjust the test probe as shown in FIGURE 5 so that its longitudinal centerline is 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 of the head (longitudinal centerline of the skull anchor) and is located  $0.6 \pm .1$  inches above the centers of the head center of gravity reference pins and coincides within 2 degrees with the line made by the intersection of horizontal and midsagittal planes passing through this point.
- (c) Adjust the dummy so that the surface area on the forehead immediately adjacent to the projected longitudinal centerline of the test probe is vertical.
- (d) Impact the head with the test probe so that at the moment of impact the probe's longitudinal centerline falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.

FIGURE 5

HEAD IMPACT TEST SETUP



NOTE: Back Support Is Required For Head Impact Test ONLY.

Accelerometer

Vertical Forehead Surface

Test Probe

Support Wires

TEST PROBE (Impactor)

Weight = 10 lbs., 6 ozs.

PROBE VELOCITY = 6.86 to 7.14 fps

13.8" Long

2.9"

± .1"

.5"R

3"

DIA.

8"

(Typ.)

12.4" ± .2"

TEFLON SHEET

16"

24" (Typical)

- (e) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.
- (f) When the head is impacted by the test probe at 7 fps  $\pm$  .14 fps (measured with a light-beam speed trap), the peak resultant accelerations measured at the location of the triaxial accelerometer mounted in the headform as shown in FIGURES 6 and 7 shall be not less than 95g and not more than 118g.

The triaxial accelerometer mounted in the head has its axes aligned in the same way that the axes of three separate or uniaxial accelerometers are aligned. The X (longitudinal), Y (transverse or lateral), and Z (vertical) axes are positioned relative to the HEAD ACCELEROMETER REFERENCE POINT (HARP) located at the intersection of a line connecting the longitudinal centerlines of the transfer pins in the sides of the dummy's head with the midsagittal plane of the dummy's head.

The triaxial accelerometer will be mounted on the mounting block located on the head's horizontal transverse bulkhead.

SENSITIVE AXES:

- "X" - horizontal and parallel to midsagittal plane
- "Y" - horizontal and perpendicular to midsag. plane
- "Z" - vertical and parallel to midsagittal plane

SEISMIC MASS CENTERS: ( $\pm$  .05")

- "X" - .4" lateral right, .1" downward (inferior), and .6" rearward (dorsal) of HARP.



FIGURE 6

HEAD ACCELEROMETER LOCATION

SIDE VIEW

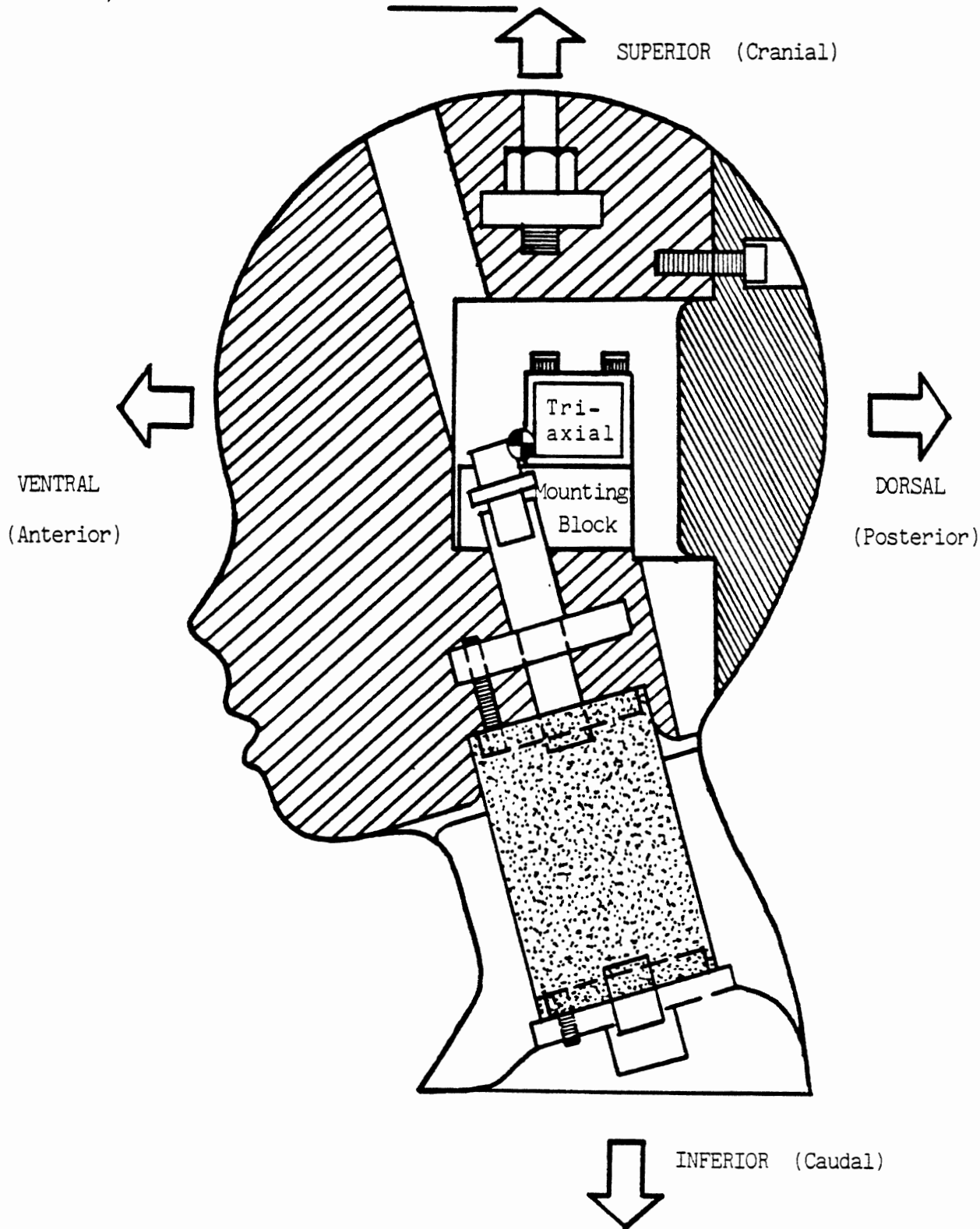
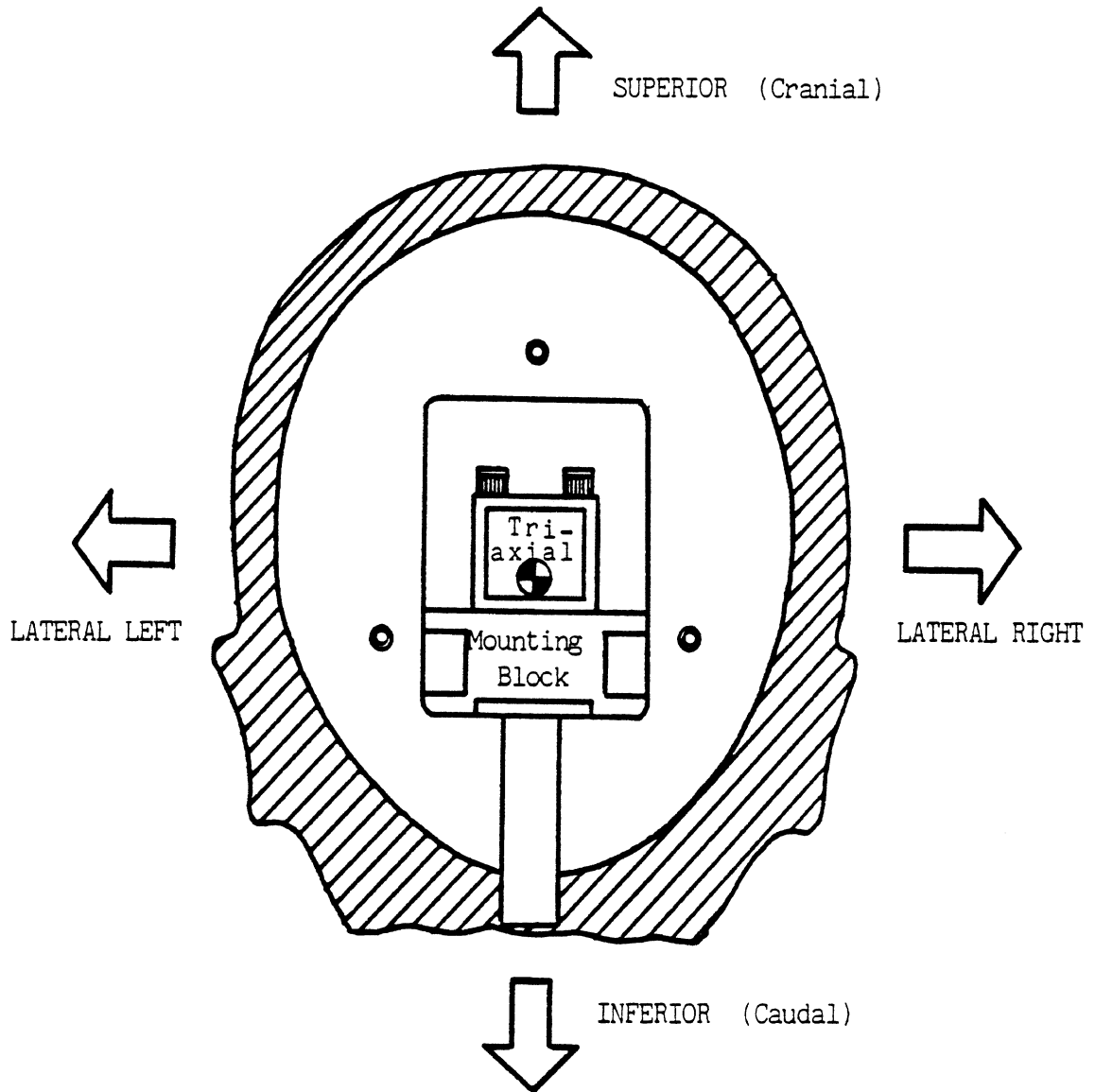


FIGURE 7

HEAD ACCELEROMETER LOCATION

REAR VIEW



"Y" - .4" lateral right, .1" downward,  
and .9" rearward of HARP.

"Z" - midsagittal plane, .1" downward,  
and .2" rearward of HARP.

The mounting for the triaxial accelerometer shall have no resonance frequency less than 3 times the cut-off frequency of the applicable channel class which is 1000 for head acceleration.

The recorded acceleration-time (a-t) curve for this head impact test shall be unimodal at, or above the 50g level and shall lie at, or above that level for an interval not less than 2.0 and not more than 3.0 milliseconds (ms).

The lateral acceleration vector shall not exceed 7g. Typical time histories of the head X, Y, and Z acceleration components and the resultant acceleration responses are shown in FIGURE 8 for the head impact test (data filtered with a SAE class 1000 filter).

A summary of the head impact pre-test and post-test calibration data for the child dummy is shown in TABLE 1.

- (g) Allow a time period of at least 20 minutes between successive tests of the head.

FIGURE 8

TYPICAL HEAD IMPACT ACCELERATION RESPONSE

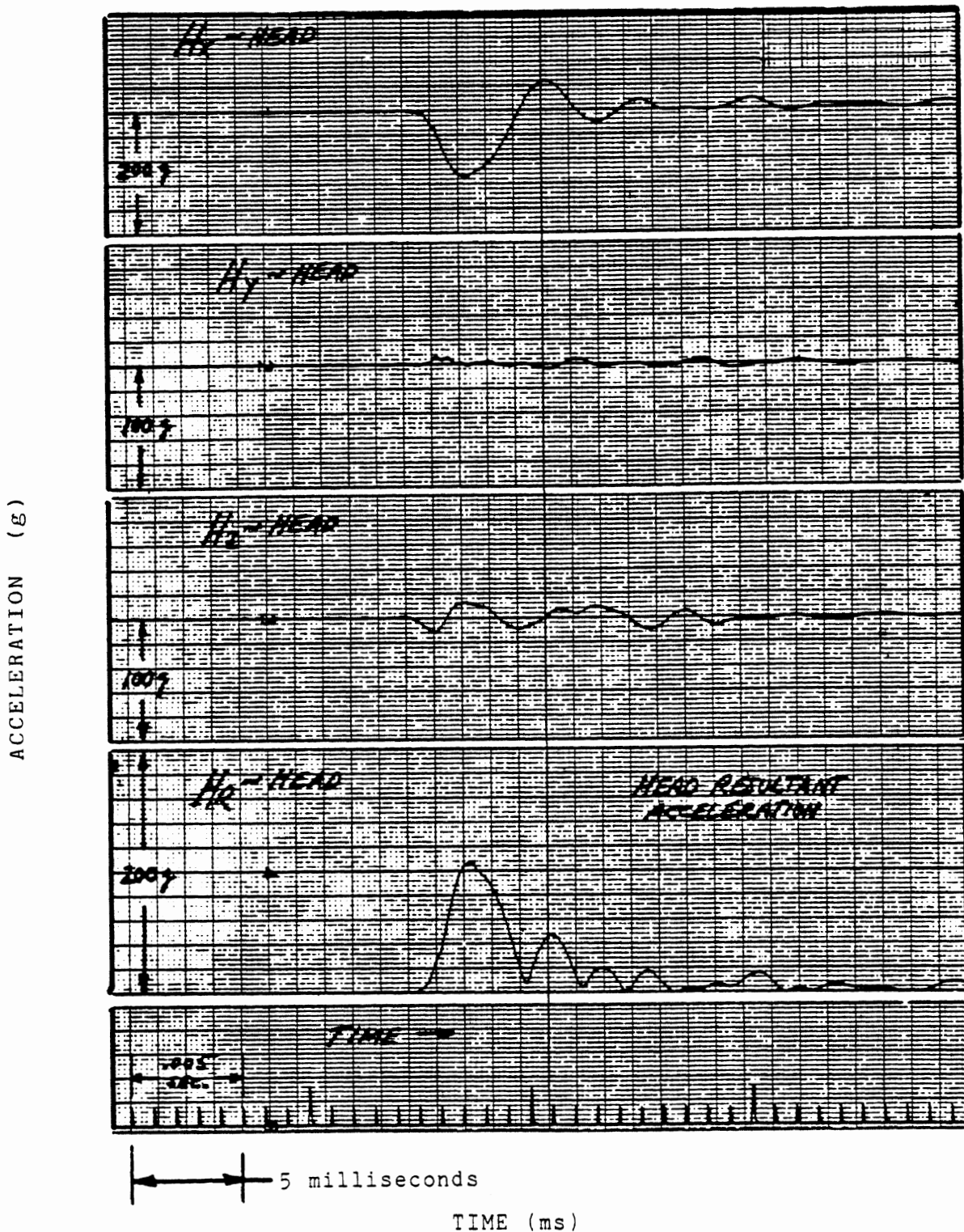


TABLE 1

SUMMARY OF HEAD IMPACT TEST CALIBRATION DATA

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

DATE OF CALIBRATION - - - - -

/ /8

/ /8

ROOM TEMPERATURE (66-78° F.)- -

°F

°F

ROOM RELATIVE HUMIDITY (10-70%)

%

%

TEST MEASUREMENT:	PRE-TEST DATA	POST-TEST DATA	PART 572 REQMT.
TEST PROBE IMPACT VELOCITY, fps			6.86 to 7.14 fps
PEAK HEAD RESULTANT ACCEL., g			95-118g
PEAK HEAD LATERAL ACCEL., g			≤ 7g
PULSE $\Delta$ TIME @ 50g, ms			2-3 ms

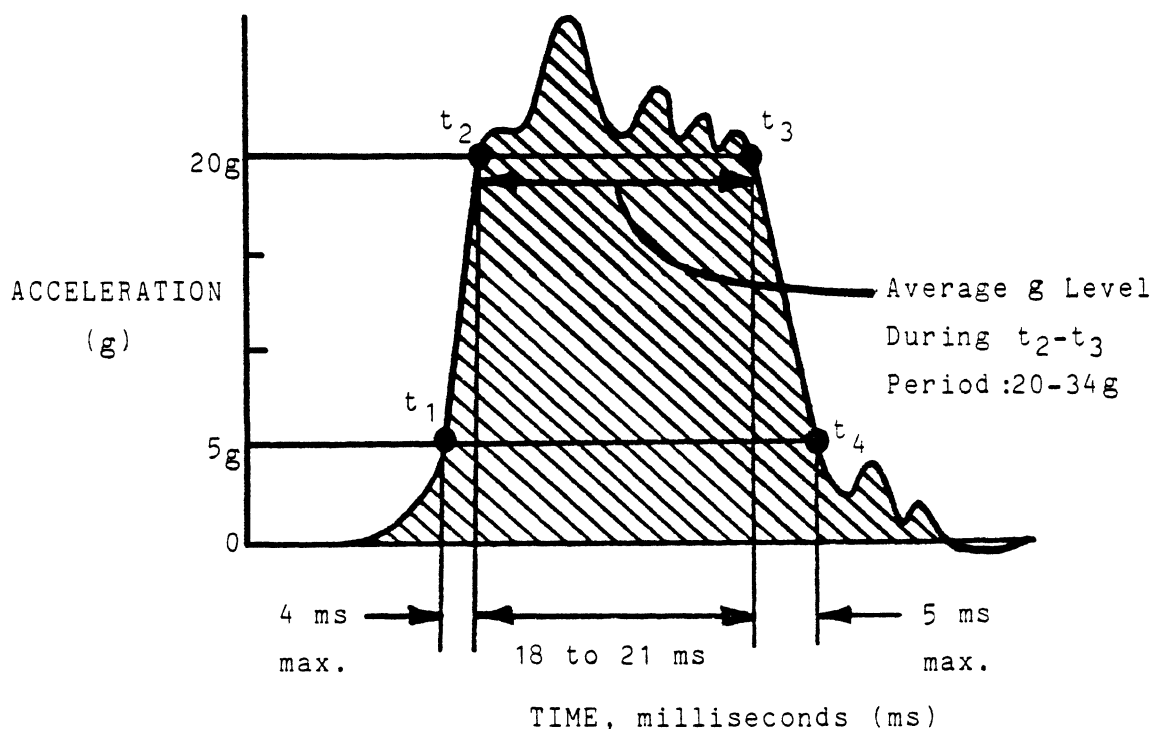
REMARKS:

TECHNICIAN(S): \_\_\_\_\_

PROJECT ENGINEER(S): \_\_\_\_\_

(2) HEAD-NECK PENDULUM TEST:

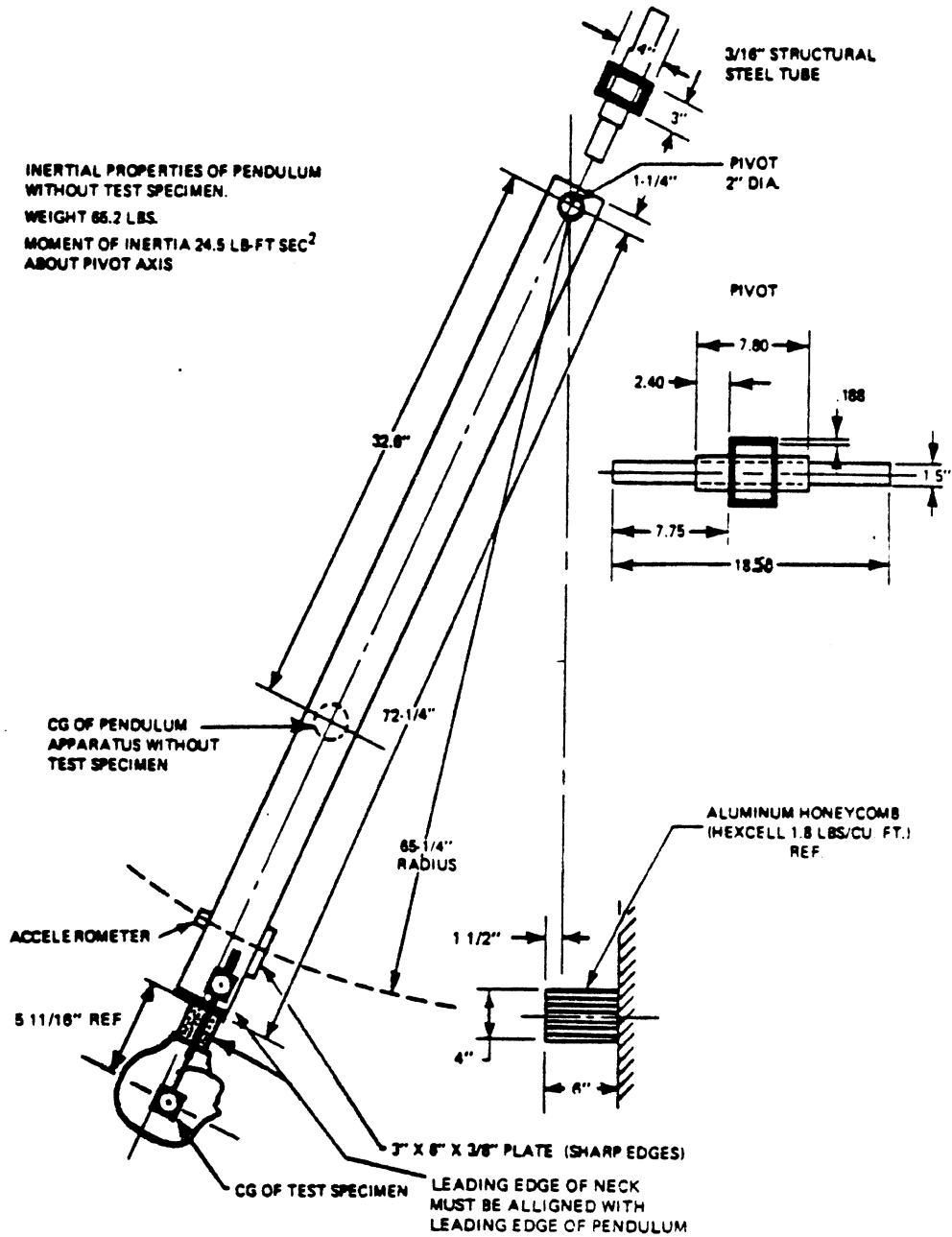
- (a) Mount the head and neck assembly on a rigid pendulum as shown in FIGURE 9 so that the head's midsagittal plane is vertical and coincides with the plane of the pendulum's longitudinal centerline. Mount the neck directly to the pendulum as shown in FIGURE 9.
- (b) Release the pendulum and allow it to fall freely from a height such that the velocity at impact is 17 fps  $\pm$  1 fps (feet per second) measured at the center of the accelerometer shown in FIGURE 9.
- (c) Decelerate the pendulum to a stop with an acceleration-time (a-t) pulse shown below:



- (d) Allow the neck to flex without contact of the head or neck with any object other than the pendulum arm.
- (e) When the head-neck assembly is tested on the pendulum the head shall rotate in reference to the pendulum's

FIGURE 9

HEAD-NECK PENDULUM TEST SETUP



PENDULUM VELOCITY = 16 to 18 fps

longitudinal centerline a total of 84 degrees  $\pm$  8 degrees about its center of gravity, rotating to the extent specified in the following table at each indicated point in time, measured from impact, with the chordal displacement measured at its center of gravity.

ROTATION	TIME (ms)	CHORDAL DISPLACEMENT
0°	-2.00 to 2.00	-0.8 to 0.8"
30°	17.32 to 24.68	1.4 to 3.0"
60°	31.12 to 40.88	3.5 to 5.1"
Maximum	55.04 to 68.96	5.0 to 6.6"
60°	81.72 to 100.28	3.5 to 5.1"
30°	97.36 to 118.64	1.4 to 3.0"
0°	111.16 to 134.84	-0.8 to 0.8"

The chordal displacement at time T is defined as the straight line distance between--

1. the position relative to the pendulum arm of the head center of gravity at time zero, and
2. the position relative to the pendulum arm of the head center of gravity at time T as shown in

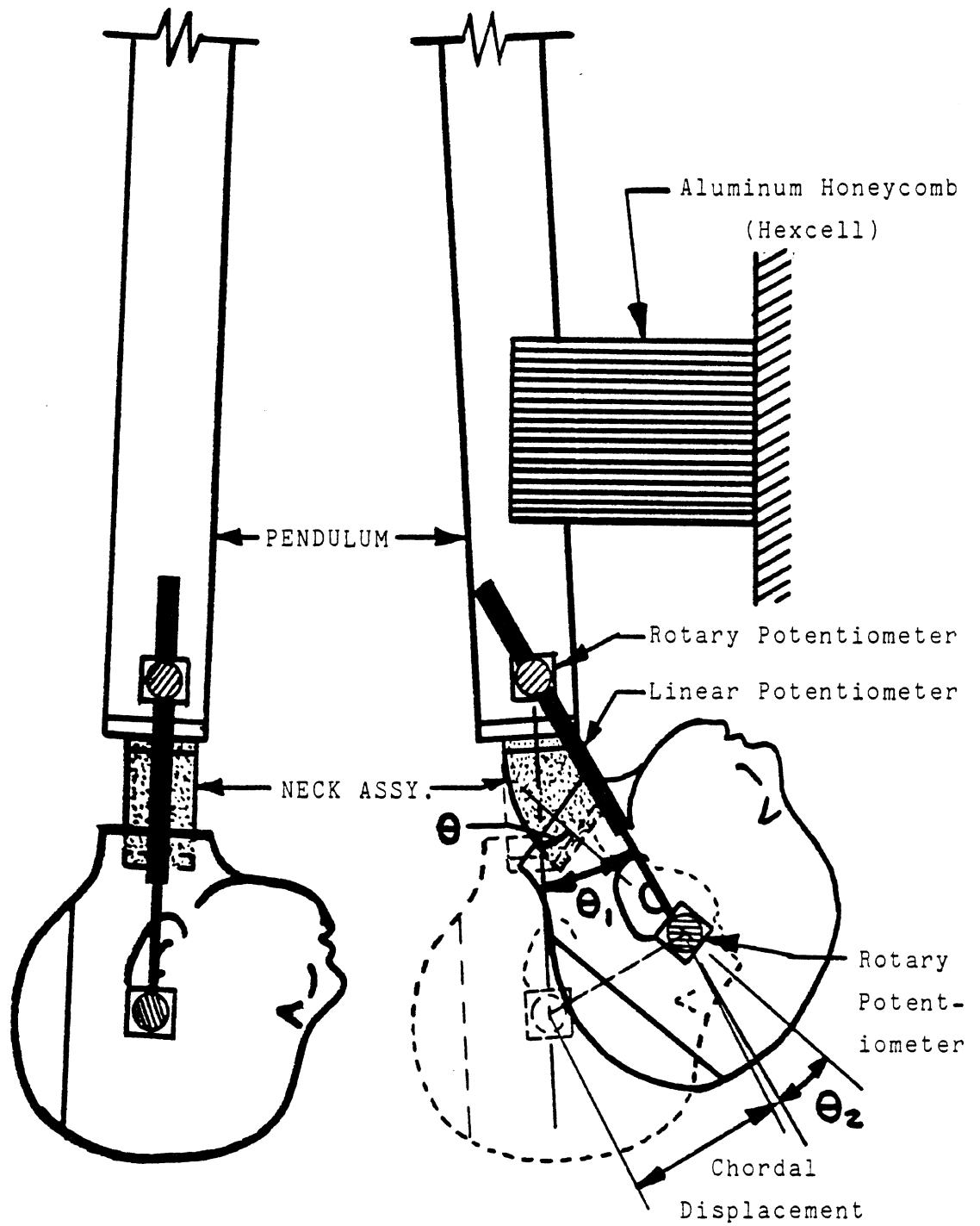
FIGURES 10 and 11.

The peak resultant acceleration recorded at the location of the accelerometers mounted in the headform shall not exceed 30g. The precise location of the accelerometer, is the same as for the Head Impact Test.

A typical head-neck pendulum impact response is shown in FIGURE 12.



FIGURE 10

MEASUREMENT OF CHORDAL DISPLACEMENT

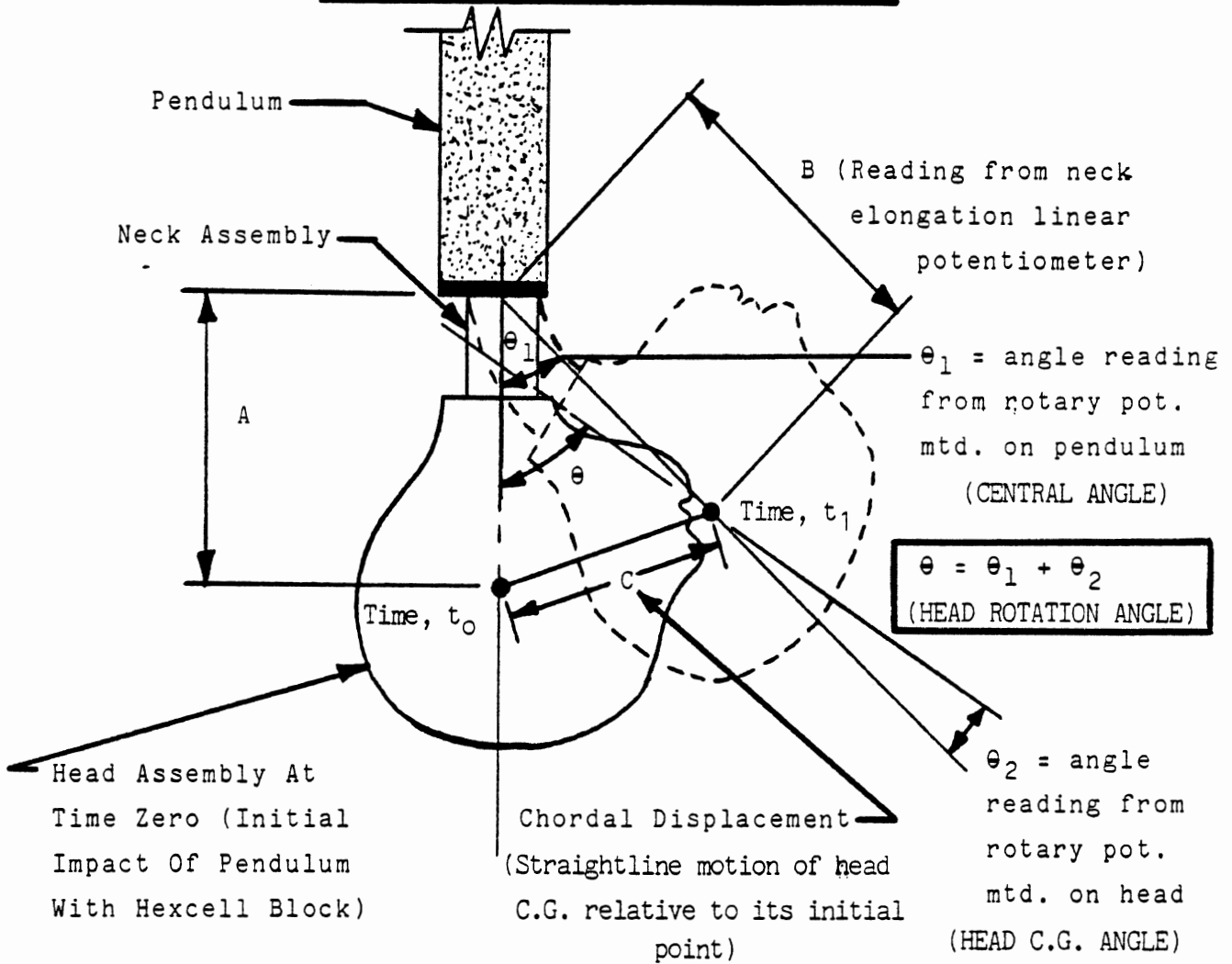
PENDULUM VELOCITY = 16 to 18 fps

$\theta$  = HEAD ROTATION ANGLE ( $\theta_1 + \theta_2$ )

$\theta_1$  = CENTRAL ANGLE MEASURED AT  
PENDULUM

$\theta_2$  = HEAD C.G. ANGLE

CALCULATION OF CHORDAL DISPLACEMENT

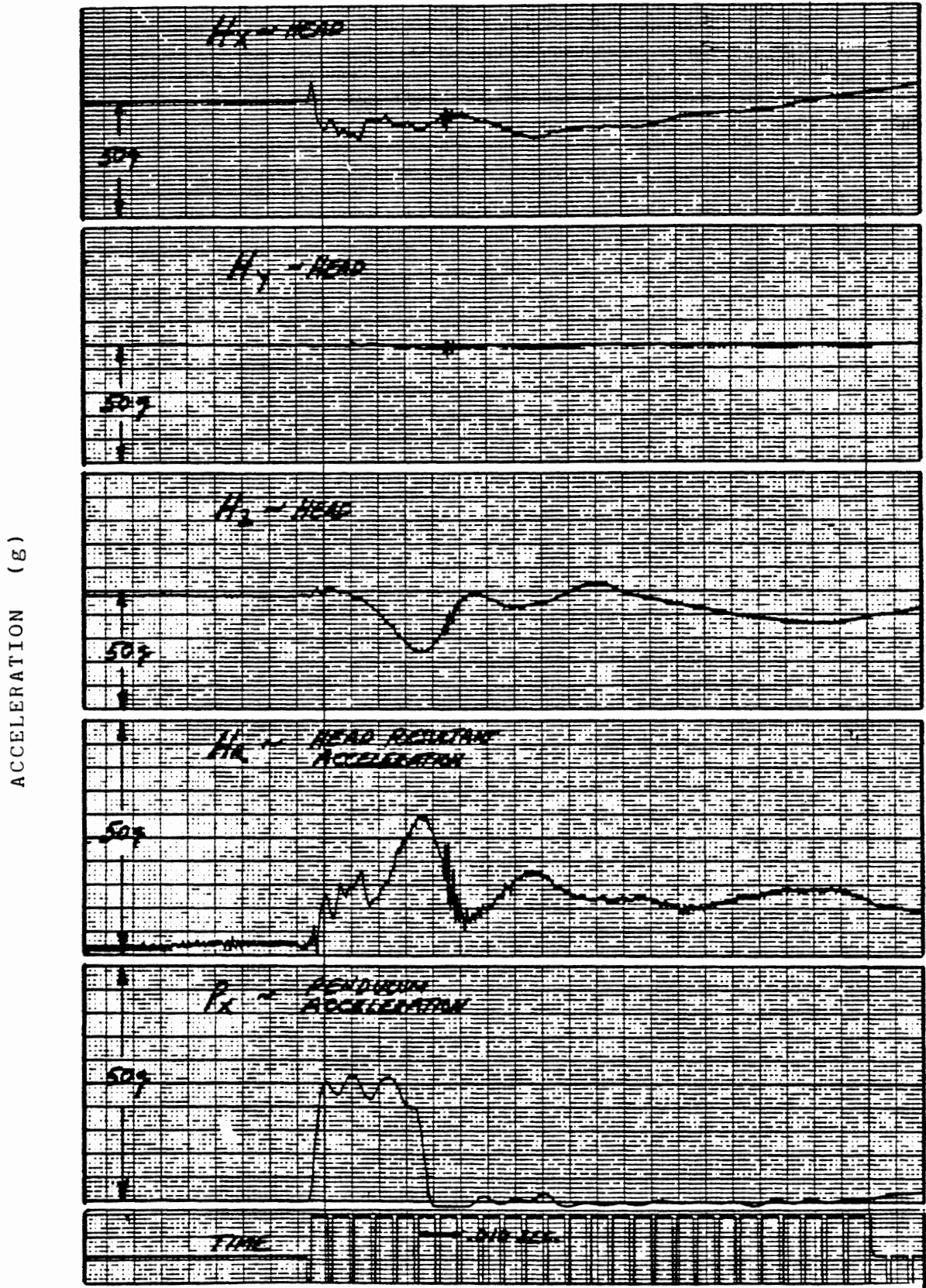


COSINE LAW--the square of the length of any side of any triangle is equal to the sum of the squares of the lengths of the other two sides minus twice their product times the cosine of the included angle.

$$C^2 = A^2 + B^2 - 2AB\cos\theta_1$$

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

TYPICAL HEAD-NECK PENDULUM IMPACT RESPONSE



10 milliseconds

TIME (ms)

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\*.

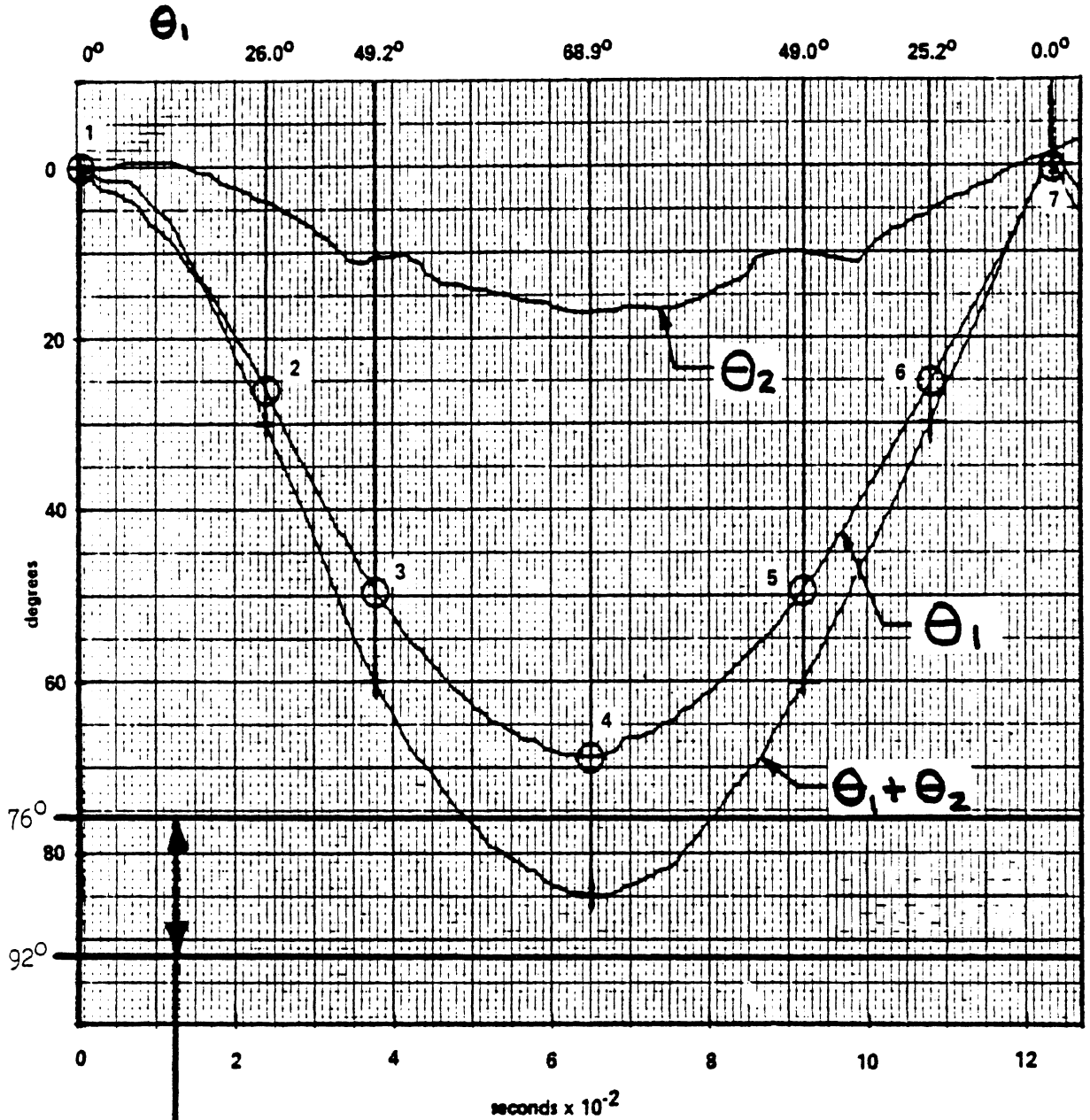
The velocity of the pendulum at impact can be measured with a light-beam speed trap. One linear and two angular potentiometers shall be mounted as shown in FIGURE 10 which will provide data from which the angular orientation and chordal displacement of the head as functions of time will be readily determined. Chordal displacement and angle-time history data are derived from a reduction process involving analog computing circuits designed specifically for the head-neck pendulum test. The plots shown in FIGURES 13 and 14 are typical outputs of the trajectory computing system. To determine chordal displacement, at the head angles ( $\theta_1 + \theta_2$ ) of  $0^\circ$ ,  $30^\circ$ ,  $60^\circ$  and the maximum, the  $\theta_1$  components are read at time intervals determined by the intersection of the ( $\theta_1 + \theta_2$ ) plot with  $0^\circ$ ,  $30^\circ$ ,  $60^\circ$  and maximum values as shown in FIGURE 13. The same angular values of  $\theta_1$  are then marked on the scale in FIGURE 14 and radii are projected from the radius center of the scale through each inscribed point on the  $\theta_1$  scale. The intersections of the radii with the actual trajectory plot are the end points (circled in FIGURE 14) of respective chordal distances measured from the initial head reference point of  $\theta_1 = 0^\circ$ . The time intervals read from FIGURE 13

\*As determined through high speed film analysis

FIGURE 13

TYPICAL HEAD-NECK ANGLE TIME HISTORIES

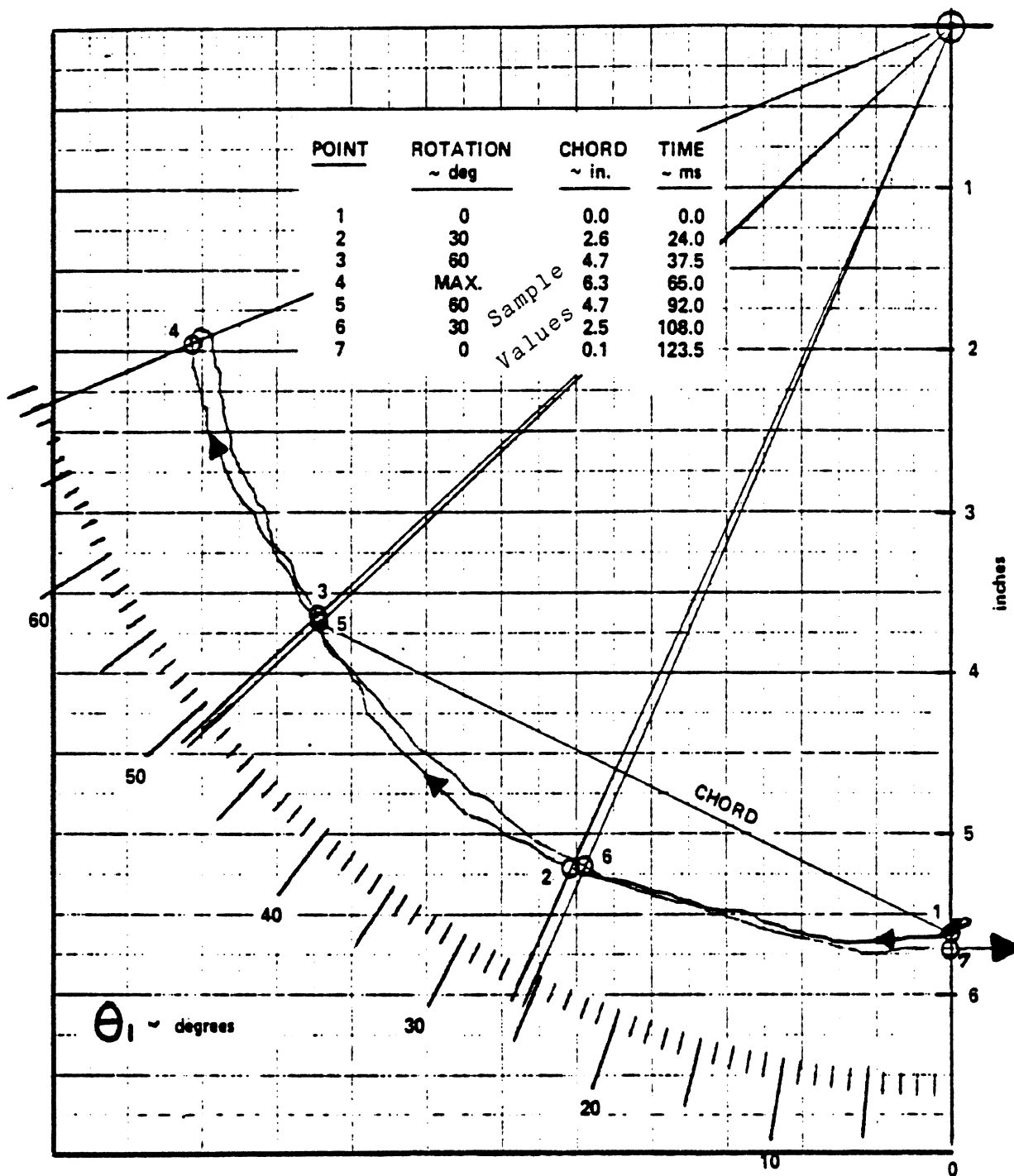
$\Theta$  = Head Rotation Angle ( $\Theta_1 + \Theta_2$ )  
 $\Theta_1$  = Central Angle Measured At Pendulum  
 $\Theta_2$  = Head C.G. Angle



- PART 572 SPECIFICATION RANGE

FIGURE 14

TYPICAL HEAD C.G. TRAJECTORY



for the specific total head angles ( $\theta_1 + \theta_2$ ) are also those which must be in the ranges specified in the Part 572 regulation.

Results from the head-neck pendulum pre-test and post-test calibration data will be presented in TABLE 2 in which the Part 572 requirements are also listed.

- (f) Allow a time period of at least 1 hour between successive tests of the head and neck.

TABLE 2

SUMMARY OF HEAD-NECK PENDULUM TEST DATA

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

DATE OF CALIBRATION - - - - -	/ /8	/ /8	
ROOM TEMPERATURE (66-78° F.)- -	°F	°F	
ROOM RELATIVE HUMIDITY (10-70%)	%	%	
TEST MEASUREMENT:	PRE-TEST DATA	POST-TEST DATA	PART 572 REQMT.
PENDULUM IMPACT VELOCITY, fps			16-18 fps
PEND. MIN./MAX. DECEL. OVER (t <sub>3</sub> -t <sub>2</sub> ), g			20-34g
PEAK HEAD RESULTANT ACCEL., g			≤ 30g
PEND. DECEL. PULSE Δ TIME (t <sub>2</sub> -t <sub>1</sub> ), ms			≤ 4 ms
PEND. DECEL. PULSE Δ TIME (t <sub>3</sub> -t <sub>2</sub> ), ms			18-21 ms
PEND. DECEL. PULSE Δ TIME (t <sub>4</sub> -t <sub>3</sub> ), ms			≤ 5 ms
HEAD ZERO POSITION TIME/ PEND. REVERSAL TIME			-/-
HEAD MAX. ROTATION ANGLE, °			76-92°
TIME (ms) @ HEAD ROT. ANGLE-- 0°			-2-+2ms
30°			17.3-24.7ms
60°			31.1-40.9ms
Max.			55.0-69.0ms
60°			81.7-100.3ms
30°			97.4-118.6ms
0°			111.2-134.8ms
CHORDAL DISPLACEMENT (In.) @ HEAD ROTATION ANGLE OF----- 0°			-0.8-+0.8"
30°			1.4-3.0"
60°			3.5-5.1"
Max.			5.0-6.6"
60°			3.5-5.1"
30°			1.4-3.0"
0°			-0.8-+0.8"

TECHNICIAN(S): \_\_\_\_\_

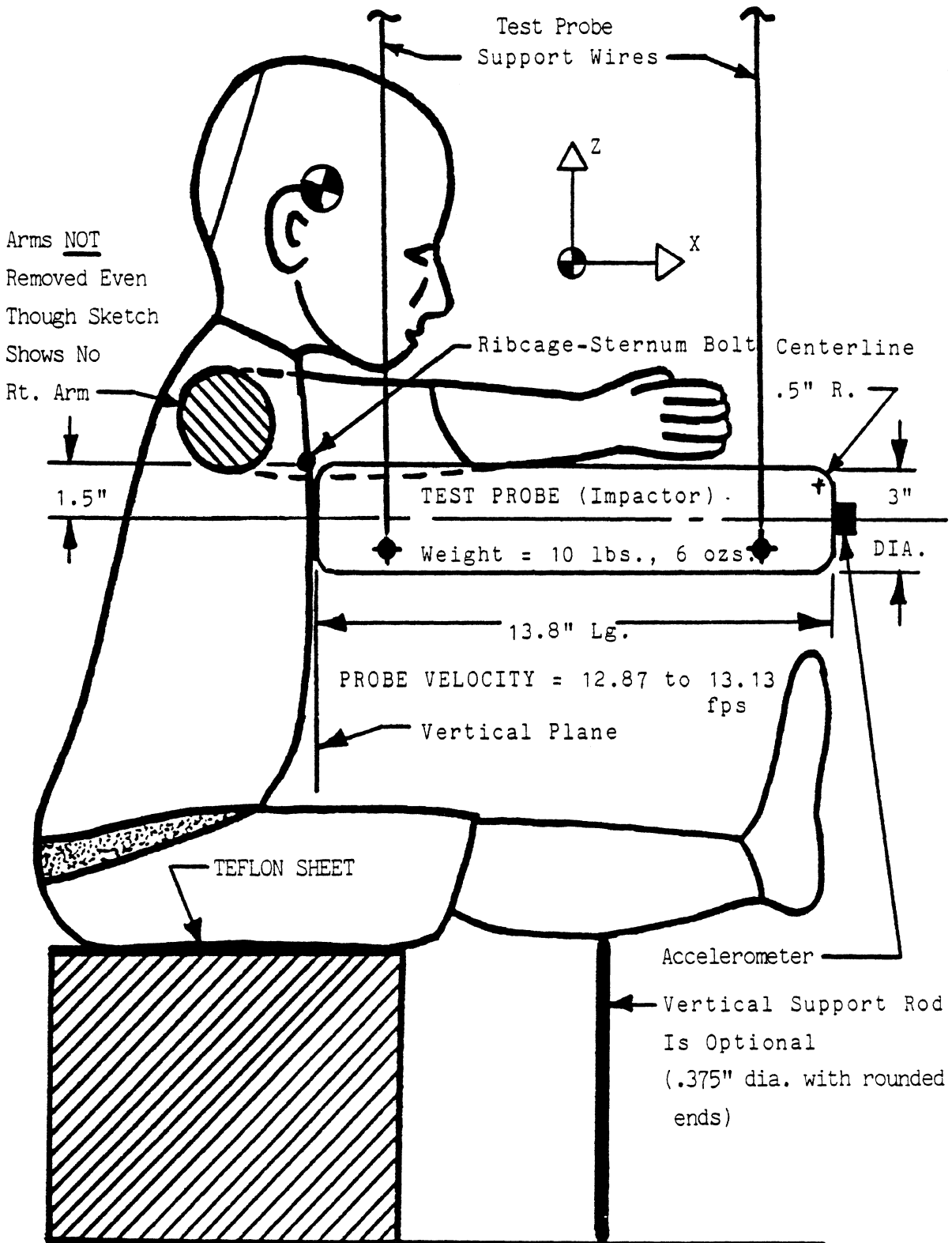
PROJECT ENGINEER(S): \_\_\_\_\_



(3) CHEST IMPACT TEST:

- (a) With the child dummy seated without back support on a surface as shown in FIGURE 15 and oriented as shown in FIGURE 4, adjust the dummy arms and legs until they are extended horizontally forward parallel to the midsagittal plane, the joints of the limbs are adjusted to any setting between 1g and 2g, which just supports the limbs' weight when the limbs are extended horizontally forward.
- (b) Establish the impact point at the chest midsagittal plane so that it is 1.5" below the longitudinal centerline of the bolt that attaches the top of the ribcage sternum to the thoracic spine box.
- (c) Adjust the dummy so that the tangent plane at the surface on the chest or thorax immediately adjacent to the designated impact point is vertical and parallel to the face of the test probe.
- (d) Place the longitudinal centerline of the test probe to coincide with the designated impact point and align the test probe so that at impact its longitudinal centerline coincides within  $2^{\circ}$  with the line formed by the intersection of the horizontal and midsagittal planes passing through the designated impact point.
- (e) Impact the chest with the test probe so that at the moment of impact the probe's longitudinal centerline falls within  $2^{\circ}$  of a horizontal line in the dummy midsagittal plane.

CHEST IMPACT TEST SETUP



NOTE: Impactor Face To Be Vertical  $\pm$  2 degrees  
At Contact Of Chest

- (f) Guide the test probe during impact so that it moves with no significant lateral, vertical, or rotational movement.
- (g) When impacted by a test probe at a velocity of 13 fps  $\pm$  .13 fps (measured by light-beam speed trap), the peak resultant acceleration at the location of the triaxial accelerometer mounted in the chest cavity shall be not less than 50g and not more than 70g. The triaxial accelerometer mounted in the chest has its axes aligned in the same way that the axes of three separate or uniaxial accelerometers are aligned. The X (longitudinal), Y (transverse or lateral), and Z (vertical) axes are positioned relative to the CHEST ACCELEROMETER REFERENCE POINT (CARP) located in the midsagittal plane 3" above the top surface of the lumbar spine and .3" rearward (dorsal) of the triaxial accelerometer mounting plate surface. The triaxial accelerometer will be mounted in the thorax or chest on a mounting plate located on the vertical transverse bulkhead.

SENSITIVE AXES:

- "X" - horizontal and parallel to midsagittal plane  
"Y" - horizontal and perpendicular to midsag. plane  
"Z" - vertical and parallel to midsagittal plane

SEISMIC MASS CENTERS: ( $\pm$  .05")

- "X" - .5" lateral right, .2" upward (superior),  
and .1" forward (ventral) of CARP.

"Y" - .2" lateral right, .1" downward (inferior),  
and .2" forward of CARP.

"Z" - .2" lateral left, .1" downward,  
and .2" forward of CARP.

The mounting for the triaxial accelerometer shall have no resonance frequency less than 3 times the cut-off frequency of the applicable channel class which is 180 for chest acceleration.

The acceleration-time (a-t) curve for the chest impact test shall be unimodal at or above the 30g level and shall lie at or above the 30g level for an interval not less than 2.5 milliseconds and not more than 4.0 milliseconds.

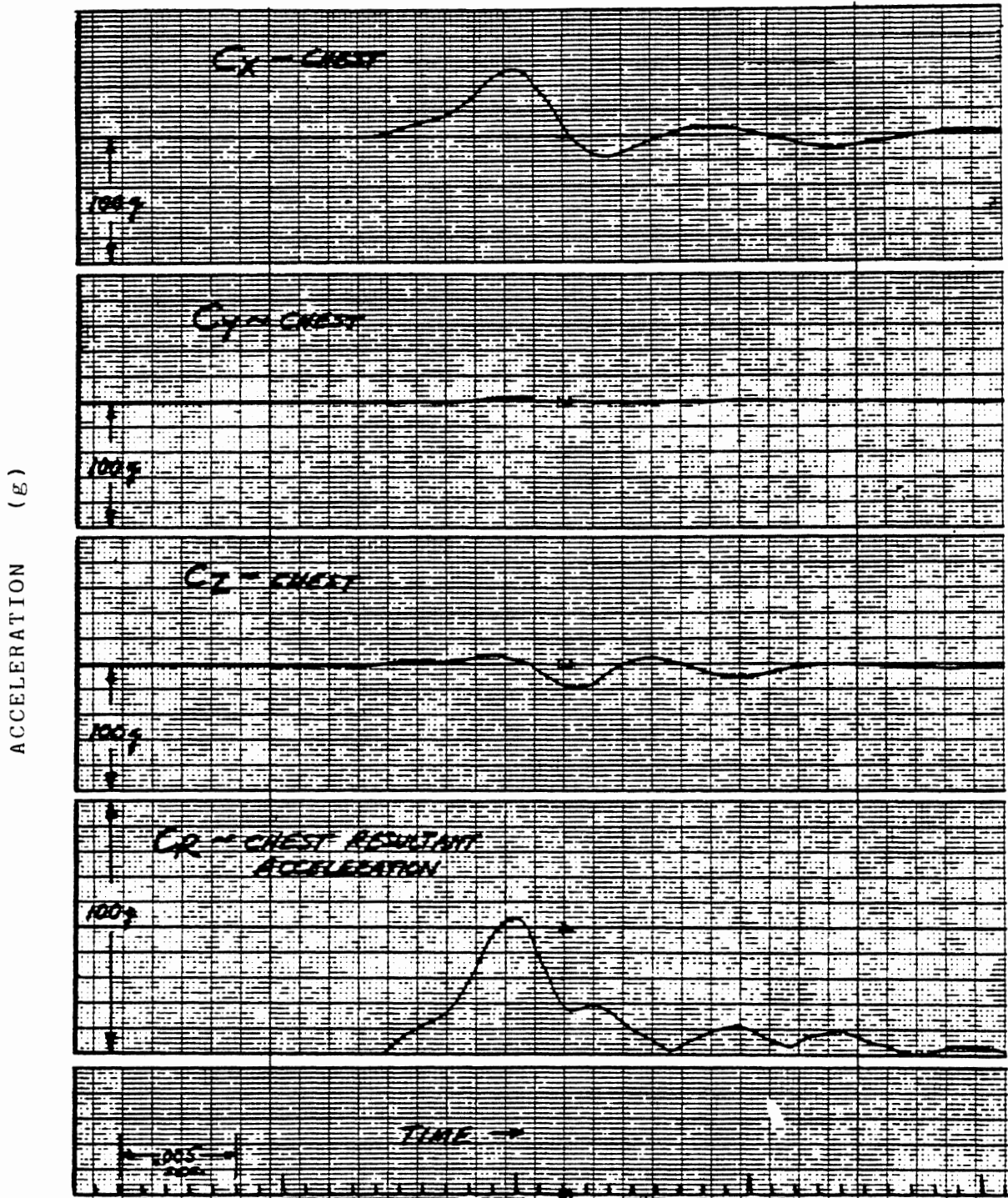
The lateral acceleration shall not exceed 5g.

Typical time histories of the chest component and resultant acceleration (with SAE class 180 filtering) are presented in FIGURE 16.

The data from the chest impact pre-test and post-test calibrations will be summarized in TABLE 3 along with the Part 572 specifications.

- (h) Allow a time period of at least 20 minutes between successive tests of the chest.

TYPICAL CHEST IMPACT ACCELERATION  
RESPONSE



5 milliseconds

TIME (ms)

TABLE 3  
SUMMARY OF CHEST IMPACT TEST DATA

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

DATE OF CALIBRATION - - - - -	/ /8	/ /8	
ROOM TEMPERATURE (66-78° F.)-	°F	°F	
ROOM RELATIVE HUMIDITY (10-70%)	%	%	
TEST MEASUREMENT:	PRE-TEST DATA	POST-TEST DATA	PART 572 REQMTS.
TEST PROBE IMPACT VELOCITY, fps			12.87-13.13
PEAK CHEST RESULT. ACCEL., g			50-70g
PEAK CHEST LATERAL ACCEL., g			≤ 5g
PULSE $\Delta$ TIME @ 30g, ms			2.5-4.0ms

REMARKS:

TECHNICIAN(S): \_\_\_\_\_

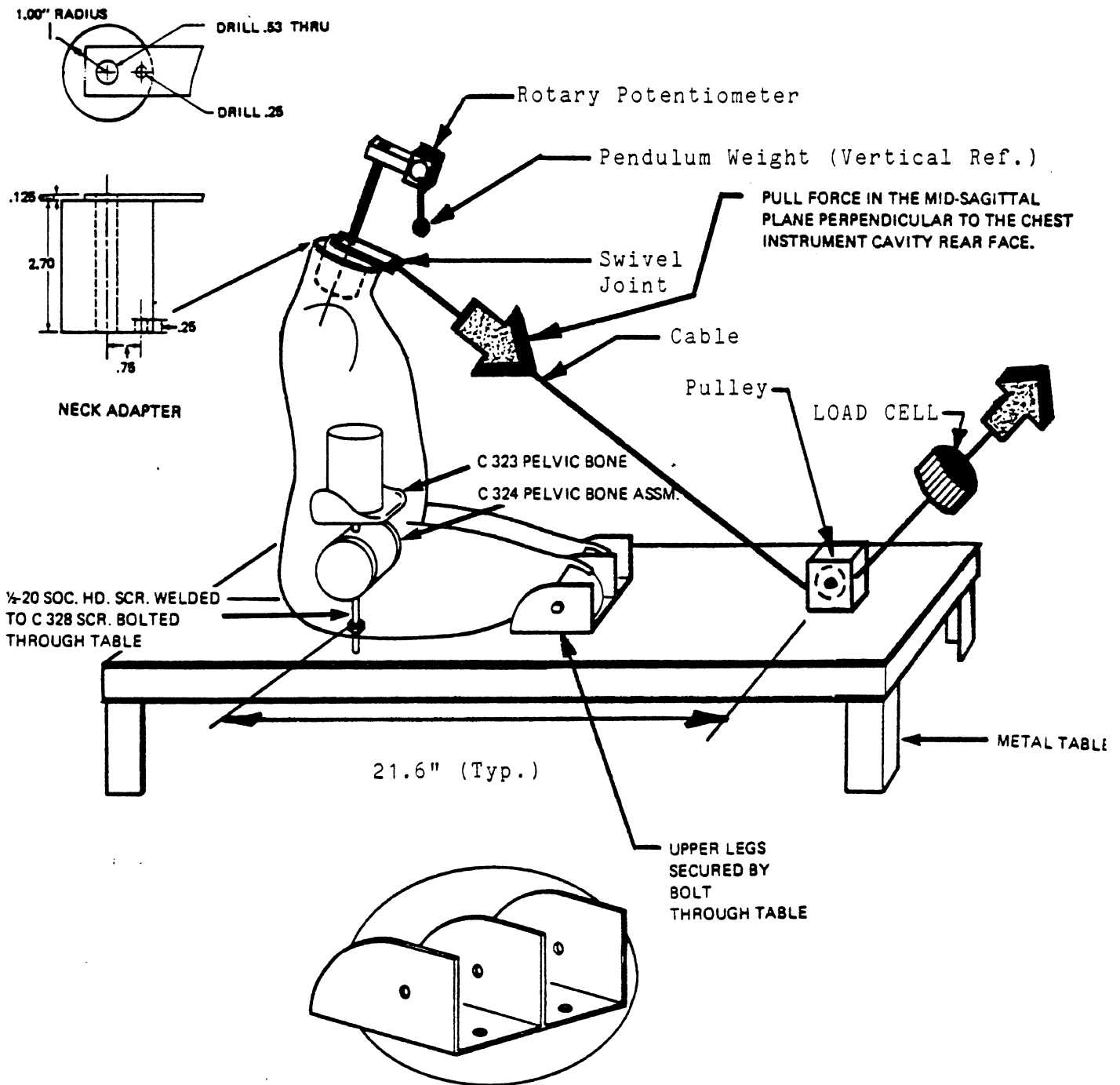
PROJECT ENGINEER(S): \_\_\_\_\_

(4) LUMBAR FLEXION TEST:

- (a) The child dummy with lower legs removed is positioned in an upright seated position on a seat as indicated in FIGURE 17, ensuring that all dummy component surfaces are clean, dry, and untreated unless otherwise specified.
- (b) Attach the pelvis to the seating surface by a bolt C/328, modified as shown in FIGURE 17, and the upper legs at the knee axial rotation joints by the attachments shown in FIGURE 17. Tighten the mountings so that the pelvis-lumbar joining surface is horizontal and adjust the femur ball-flange screws at each hip socket joint to 50 inch-pounds of torque. Remove the head and the neck and install a cylindrical aluminum adapter 2" in diameter and 2.8" long in place of the neck.
- (c) Flex the chest or thorax forward  $50^{\circ}$  and then rearward as necessary to return to its initial position in accordance with FIGURE 17 unsupported by external means.
- (d) Apply a forward pull force in the midsagittal plane at the top of the neck adapter, so that at  $40^{\circ}$  of the lumbar spine flexion the applied force is perpendicular to the thoracic spine box. Apply the force at any torso deflection rate between  $0.5^{\circ}$  and  $1.5^{\circ}$  per second up to  $40^{\circ}$  of flexion but no further. Continue to apply for 10 seconds the force necessary to maintain  $40^{\circ}$  of flexion, and record

FIGURE 17

LUMBAR FLEXION TEST SETUP





the highest applied force at that time. Release all force as rapidly as possible and measure the return angle 3 minutes after the release.

- (e) When subjected to continuously applied force, the lumbar spine assembly shall flex by an amount that permits the rigid thoracic spine to rotate from its initial position in accordance with FIGURE 17 by  $40^{\circ}$  at a force level of not less than 34 pounds and not more than 47 pounds, and straighten upon removal of the force to within  $5^{\circ}$  of its initial position. The flexion angle of the upper torso shall be monitored by a rotary potentiometer attached to a bracket on the top of the neck adapter. A small pendulum arm attached to this potentiometer will provide a constant vertical reference. The force and angle transducer signals will be amplified and simultaneously recorded on an X-Y plotter. During application of the force the load cell will be maintained perpendicular to the neck adapter\* as the upper torso is rotated. FIGURE 18 shows a typical graph of a lumbar flexion test.

The data from the lumbar flexion pre-test and post-test calibrations will be shown in TABLE 4.

\* through movement of pulley location

FIGURE 18

TYPICAL LUMBAR FLEXION PERFORMANCE

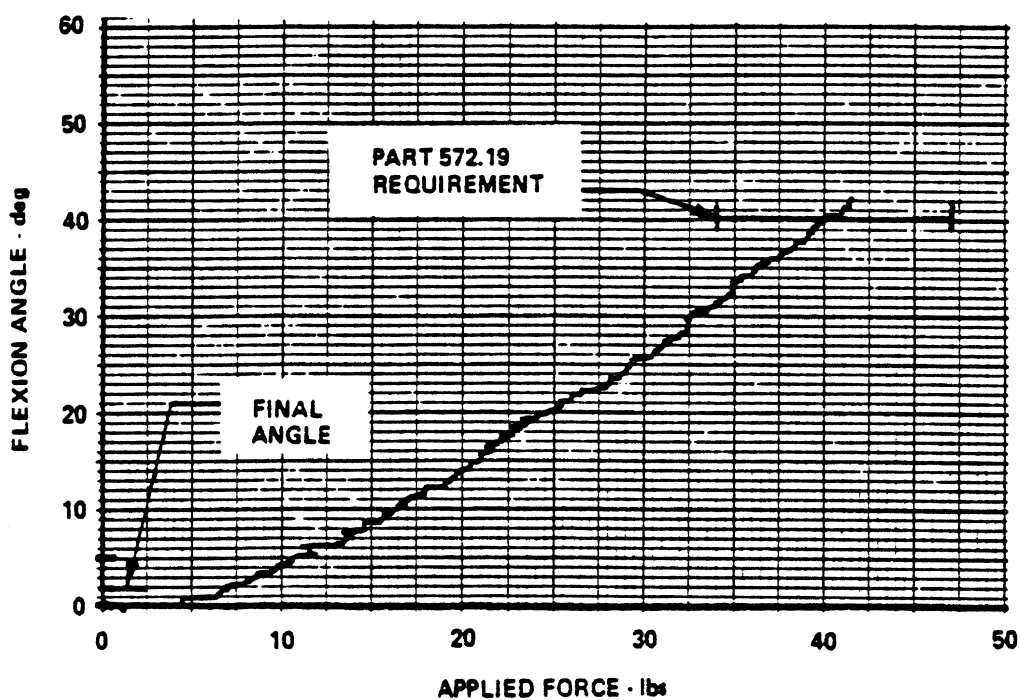


TABLE 4

SUMMARY OF LUMBAR FLEXION TEST DATA

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

DATE OF CALIBRATION - - - - -	/ / 8	/ / 8	
ROOM TEMPERATURE (66-78° F.) -	°F	°F	
ROOM RELATIVE HUMIDITY (10-70%)	%	%	
TEST MEASUREMENT:	PRE-TEST DATA	POST-TEST DATA	PART 572 REQMT.
FORCE @ 40° FLEXION ANGLE, lbs.			34-47 lbs.
SPINAL COLUMN ANGLE @ 3 MIN. POST TEST, °			≤ 5°

REMARKS:

TECHNICIAN(S): \_\_\_\_\_

PROJECT ENGINEER(S): \_\_\_\_\_

13. PREPARATION OF CALIBRATION TEST REPORTS:

Front Cover--a heavy paper-back cover or transparency shall be provided for the protection of the dummy calibration test report with the following information presented on the front cover: (see FIGURE 19)

- a. Report Number--all calibrations of child dummies from one particular dummy manufacturer will be contained in a single calibration report which will have the following number system:

EXAMPLE: 572C-ADT-82-H01

CODING: 572C - Regulation Part 572-Child (3 Yr. Old)

ADT - Initials of contract laboratory

82 - Fiscal year of contract award

H01 - I.D. number for NHTSA child dummy

- b. Title and Subtitle--display the title prominently and make it indicate clearly and briefly the subject coverage of the calibration report. Set subtitle in small type or otherwise subordinate it to the title. The report title shall appear as follows:

PART 572 THREE YEAR OLD CHILD

TEST DUMMY PERFORMANCE CALIBRATION

Humanoid Systems

NHTSA H01

- c. Performing Organization--give contract laboratory name, street and number, city, state, and zip code.
- d. Date--give the month and year of report completion.
- e. Type of Report--indicate "FINAL CALIBRATION REPORT"

f. Sponsoring Agency--give data as follows:

U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
Enforcement  
Office of Vehicle Safety Compliance  
400 Seventh Street, S.W.  
Washington, D.C. 20590

First Page After Front Cover--a report acceptance signature block for the CTM will be provided as shown in FIGURE 20.

Second Page After Front Cover--include a completed Technical Report Standard Title Page as shown in FIGURE 21.

FIGURE 19SAMPLE FRONT COVER

a. Report Number: REPORT NO. 572C-ADT-82-H01

b. Title: PART 572 THREE YEAR OLD CHILD  
TEST DUMMY PERFORMANCE CALIBRATION

Subtitle: Humanoid Systems

NHTSA H01

NOTE: The other dummy manufacturer and sample  
I.D. number is as follows:  
Alderson Research Laboratories  
NHTSA A01

c. Performing Organization:

Automotive Dynamic Testing, Inc.  
100 S. Airport Way  
Tempe, Arizona 85010



d. Date: December 1981

e. Type of Report: FINAL CALIBRATION REPORT

f. Sponsoring Agency:

Prepared For

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Enforcement

Office of Vehicle Safety Compliance

400 Seventh Street, S.W.

Washington, D.C. 20590

SAMPLE FIRST PAGE

Prepared for the United States Department of  
Transportation, National Highway Traffic Safety  
Administration, under Contract No. \_\_\_\_\_.  
This document is disseminated under the  
sponsorship of the United States Department of  
Transportation in the interest of information  
exchange. The United States Government assumes  
no liability for its contents or use thereof.

Prepared by \_\_\_\_\_

Approved by \_\_\_\_\_

Date \_\_\_\_\_

REPORT ACCEPTED BY:

\_\_\_\_\_  
Contract Technical Manager  
Office of Vehicle Safety Compliance

\_\_\_\_\_  
Date of Report Acceptance

SAMPLE SECOND PAGE

Technical Report Documentation Page

1. Report No. 572C-ADT-82-H01		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Performance Calibration Report For Part 572 Three Year Old Child Test Dummy Number H01 Manufactured by Humanoid Systems				5. Report Date December 1981	
				6. Performing Organization Code	
7. Author(s) John Smith Project Manager				8. Performing Organization Report No. ADT-9310-001	
9. Performing Organization Name and Address Automotive Dynamic Testing, Inc. 100 S. Airport Way Tempe, Arizona 85010 Telephone No.: 602-944-6252				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. DOT-HS-X-XXXXX	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance 400 Seventh St. SW, Washington, D.C. 20590				13. Type of Report and Period Covered Final Calibration Report Oct. 1 to Dec. 15, 1981	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract  Performance calibration tests performed on a Part 572 Three Year Old Child Test Dummy at the Automotive Dynamic Testing facility, with the following tests being performed:  <ol style="list-style-type: none"> <li>1. Head Impact Test</li> <li>2. Head-Neck Pendulum Test</li> <li>3. Chest Impact Test</li> <li>4. Lumbar Flexion Test</li> </ol> The child test dummy manufactured by Humanoid Systems, NHTSA I.D. No. H01, appeared to meet all of the performance calibration requirements of Regulation Part 572, Subpart C.					
17. Key Words Part 572, Subpart C--Three Year Old Child Dummy FMVSS 213--Child Restraint Systems			18. Distribution Statement Copies of this report are available from: Technical Reference Division Nat'l. Hwy. Traffic Safety Administration Room 5108 (NAD-41) 400 7th. St. SW, Washington, DC 20590		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages XX	22. Price



TABLE OF CONTENTS

1. Part 572 Child Dummy Calibration Test  
Data Sheets (Re: TABLE 1, 2, 3, and 4)
2. Discussion of Test Results
3. Photographs of the child dummy in each  
stage of calibration
4. Instrument Calibration Information
5. Laboratory Test Procedure

