TP-222-05
October 21, 2011

(For school buses manufactured on or after October 21, 2011)

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 222

School Bus Passenger Seating And Crash Protection

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

OVSC LABORATORY TEST PROCEDURE No. 222
TABLE OF CONTENTS

PREFACE……II
1. PURPOSE AND APPLICATION…….. 1
2. GENERAL REQUIREMENTS……...2
3. SECURITY……3
4. GOOD HOUSEKEEPING…….. 3
5. TEST SCHEDULING AND MONITORING…… 3
6. TEST DATA DISPOSITION…….. 4
7. GOVERNMENT FURNISHED PROPERTY (GFP)……5
8. CALIBRATION OF TEST INSTRUMENTS…… 6
9. SUGGESTED TEST EQUIPMENT…….. 8
10. PHOTOGRAPHIC DOCUMENTATION…….. 9
11. DEFINITIONS…… 11
12. PRETEST REQUIREMENTS…… 22
13. RECEIVING INSPECTION OF THE SCHOOL BUS…….. 23
14. COMPLIANCE TEST EXECUTION……...25
15. POST TEST REQUIREMENTS……..26
16. REPORTS…….. 26
17. DATA SHEETS…… 33
18. FORMS……...79

APPENDIX A – FMVSS 207 SEATING SYSTEMS; FMVSS 210 SEAT BELT ASSEMBLY ANCHORAGES, FOR CLASS 2 SCHOOL BUSES
APPENDIX B - OCCUPANT CRASH PROTECTION, FMVSS 208, FOR CLASS 2 SCHOOL BUSES
APPENDIX C - WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES
REFERENCES - SAE J826 & SAE J383

REVISION CONTROL LOG
FOR OVSC LABORATORY
TEST PROCEDURES

TP-222
School Bus Passenger Seating and Crash Protection

TEST PROCEDURE		49 CFR Part 571.222		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	03/03/77			Original release signed by O.D.
01	03/31/80			Minor revisions
02	07/16/91			Minor revisions
03	07/20/93	58FR4586-99		Appendix 3 added Metric conversions
04	10/21/08	73FR62743 10/21/08 Final Rule	10/21/09	Update seat back and restraining barrier height requirement Update seat and barrier measurement procedures Add seat cushion latching requirement. Minor revisions
05	XX/XX/XX	73FR62743 10/21/08 Final Rule	10/21/11	Add definitions Add quasi-static test requirement for passenger seats with Type 2 seat belts Add FMVSS No. 207 requirement Update FMVSS Nos. 208 and 210 requirements Minor revisions

PREFACE

On October 21, 2008, the National Highway Traffic Safety Administration (NHTSA) issued a final rule to upgrade Federal Vehicle Motor Safety Standard No. 222, “School bus passenger seating and crash protection.” The final rule sets forth new performance requirements for school buses with a gross vehicle weight rating (GVWR) of 4,536 kilograms (10,000 pounds) or less to have lap/shoulder belts instead of the lap belts as currently required and, for larger school buses with a GVWR greater than 4,536, provisions for each State or local jurisdiction to voluntarily install seat belts. These requirements become effective on buses manufactured on or after October 21, 2011. The final rule also changes requirements by raising the height of seat backs from 508 mm (20 inches) to 610mm (24 inches) and requiring a self-latching mechanism on seat bottom cushions that are designed to flip up or be removable without tools for school buses manufactured on or after October 21, 2009.

This test procedure addresses the requirements that become effective on school buses manufactured on or after October 21, 2011. For buses manufactured from October 21, 2009 through October 20, 2011 the previous test procedure, TP-222-04, is applicable.

1. PURPOSE AND APPLICATION

This document is a laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) for the purpose of presenting guidelines for a uniform testing data and information recording format, and providing suggestions for the use of specific equipment and procedures for contracted testing laboratories. The data correspond to specific requirements of the Federal Motor Vehicle Safety Standard(s) (FMVSS). The OVSC test procedures include requirements that are general in scope to provide flexibility for contracted laboratories to perform compliance testing and are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data. These test procedures do not constitute an endorsement or recommendation for use of any particular product or testing method.

Prior to conducting compliance testing, contracted laboratories are required to submit a detailed test procedure to the Contracting Officer's Technical Representative (COTR) to demonstrate concurrence with the OVSC laboratory test procedure and the applicable FMVSS. If any contractor views any part of an OVSC laboratory test procedure to be in conflict with a FMVSS or observes deficiencies in a laboratory test procedure, the contractor is required to advise the COTR and resolve the discrepancy prior to the start of compliance testing or as soon as practicable. The contractor’s test procedure must include a step-by-step description of the methodology and detailed check-off sheets. Detailed check-off sheets shall also be provided for the testing instrumentation including a complete listing of the test equipment with make and model numbers. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer’s instructions. There shall be no contradictions between the laboratory test procedure and the contractor’s in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the compliance test program.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The laboratory test procedures are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC laboratory test procedures do not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the laboratory test procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the laboratory test procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory test procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC laboratory test procedures.

2. GENERAL REQUIREMENTS

Federal Motor Vehicle Safety Standard (FMVSS) No. 222 establishes occupant protection requirements for school bus passenger seating and restraining barriers. The purpose of this standard is to reduce the number of deaths and the severity of injuries that result from the impact of school bus occupants against structures within the vehicle during crashes and sudden driving maneuvers.

Standard 222 applies to school buses in two separate classes:

Class 1. Vehicles with a gross vehicle weight rating of more than 4,536 kg (10,000 lb).

Class 2. Vehicles with a gross vehicle rating of 4,536 kg (10,000 lb) or less.

REQUIREMENTS

Class 1. All requirements under S5(a) of FMVSS 222.

NOTE:

When a wheelchair location is positioned in front of a seat on a Class 1 school bus, a restraining barrier must be provided between the seat and the wheelchair location, in order to compartmentalize the passengers in the seat.

Class 2. All requirements under S5(b) of FMVSS 222. The requirements under S5(b) specify that these vehicles must also meet the requirements of FMVSSs 207, 208, 209, 210 as they apply to multipurpose passenger vehicles. The requirements of standards 208 and 210 shall be met at all seating positions in a bench seat as determined per S4.1. Class 2 vehicles must also meet all the requirements under S5 of FMVSS 222 except:

S5.2 Restraining Barrier

S5.2.1 Barrier Seat Separation

S5.2.2 Barrier Position and Rear Surface Area

S5.2.3 Barrier Performance Forward

METRIC SYSTEM OF MEASUREMENT

Section 5164 of the Omnibus Trade and Competitiveness Act (Pub. L. 100-418) establishes that the metric system of measurement is the preferred system of weights and measures for trade and commerce in the United States. Executive Order 12770 directs Federal agencies to comply with the Act by converting regulatory standards to the

metric system after September 30, 1992. In a final rule published on March 15, 1990 (60 FR 13639), NHTSA completed the first phase of metrication, converting English measurements in several regulatory standards to the metric system. Since then, metrication has been applied to other regulatory standards (63 FR 28912).

Accordingly, the OVSC laboratory test procedures include revisions to comply with governmental directives in using the metric system. Regulatory standards converted to metric units are required to use metric measurements in the test procedures, whereas standards using English units are allowed to use English measurements or to use English measurements in combination with metric equivalents in parentheses.

All final compliance test reports are required to include metric measurements for standards using metrication.

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

3. SECURITY

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

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

NOTE: No individuals, other than contractor personnel directly involved in the compliance testing program or OVSC personnel, shall be allowed to witness any vehicle or equipment item compliance test or test dummy calibration unless specifically authorized by the COTR.

4. GOOD HOUSEKEEPING

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

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to conducting the first compliance test. Tests shall be completed at intervals as required in the contract. If not

specified, the first test shall be conducted within 6 weeks after receiving the first delivered unit. Subsequent tests shall be completed in no longer that 1 week intervals unless otherwise specified by the COTR.

Scheduling of tests shall be adjusted to permit vehicles (or equipment, whichever applies) to be tested to other FMVSSs as may be required by the OVSC. All compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired. The contractor shall submit a monthly test status report and a vehicle status report (if applicable) to the COTR. The vehicle status report shall be submitted until all vehicles are disposed of. The status report forms are provided in the forms section.

6. TEST DATA DISPOSITION

The Contractor shall make all preliminary compliance test data available to the COTR on location within 30 minutes after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be available to the COTR in accordance with the contract schedule or if not specified within two working days. Additionally, the Contractor shall analyze the preliminary test results as directed by the COTR.

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

The contractor shall protect and segregate the data that evolves from compliance testing before and after each test.

TEST DATA LOSS

A. INVALID TEST DESCRIPTION

An invalid compliance test is one, which does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

B. INVALID TEST NOTIFICATION

The Contractor shall notify NHTSA of any test not meeting all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test, by telephone, within 24 hours of the test and send written notice to the COTR within 48 hours or the test completion.

C. RETEST NOTIFICATION

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the Contractor that a retest is required. The retest shall be completed within 2 weeks after receipt of notification by the Contracting Officer that a retest is required.

D. WAIVER OF RETEST

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

E. TEST VEHICLE

NHTSA shall furnish only one vehicle for each test ordered. The Contractor shall furnish the test vehicle required for the retest. The retest vehicle shall be equipped as the original vehicle. The original vehicle used in the invalid test shall remain the property of NHTSA, and the retest vehicle shall remain the property of the Contractor. The Contractor shall retain the retest vehicle for a period not exceeding 180 days if it fails the test. If the retest vehicle passes the test, the Contractor may dispose of it upon notification from the COTR that the test report has been accepted.

F. TEST REPORT

No test report is required for any test that is determined to be invalid unless NHTSA specifically decides, in writing, to require the Contractor to submit such report. The test data from the invalid test must be safeguarded until the data from the retest has been accepted by the COTR. The report and other required deliverables for the retest vehicle are required to be submitted to the COTR within 3 weeks after completion of the retest.

G. DEFAULT

The Contractor is subject to the default and subsequent reprocurement costs for nondelivery of valid or conforming test (pursuant to the Termination For Default clause in the contract).

H. NHTSA'S RIGHTS

None of the requirements herein stated shall diminish or modify the rights of NHTSA to determine that any test submitted by the Contractor does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

GFP consists of test vehicles. The handling and disposition of GFP is governed by contractual agreement. The Contractor is responsible for the following:

A. ACCEPTANCE OF VEHICLE

The Contractor has the responsibility of accepting the test vehicle from either a dealer or a vehicle transporter. In both instances, the contractor acts in the

OVSC's behalf when signing an acceptance of the test vehicle. If the vehicle is delivered by a dealer, the contractor must check to verify the following:

1. Tires and wheel rims are new and the same as listed.

2. There are no dents or other interior or exterior flaws in the vehicle body.

3. The vehicle has been properly prepared and is in running condition.

4. An owner's manual, warranty document, consumer information, and extra set of keys are included with the vehicle.

5. Proper fuel filler cap is supplied on the test vehicle.

6. Spare tire, jack, lug wrench and tool kit (if applicable) is included with the vehicle.

7. The VIN (vehicle identification number) on the vehicle matches that supplied by the COTR.

8. Seats and, if applicable, restraining barriers are not deformed.

9. The vehicle is equipped as specified by the COTR.

A Vehicle Condition form will be supplied to the Contractor by the COTR when the test vehicle is transferred from a new vehicle dealership or between test contracts. The upper half of the form is used to describe the vehicle as initially accepted. The lower half of the Vehicle Condition form provides space for a detailed description of the post-test condition. The contractor must complete a Vehicle Condition form for each vehicle and deliver it to the COTR with the Final Test Report or the report will NOT be accepted for payment.

If the test vehicle is delivered by a government contracted transporter, the contractor should check for damage which may have occurred during transit. GFP vehicle(s) shall not be driven by the contractor on public roadways unless authorized by the COTR.

B. NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a vehicle (and/or equipment item) has been delivered. In addition, if any discrepancy or damage is found at the time of delivery, a copy of the Vehicle Condition form shall be sent to the COTR immediately.

8. CALIBRATION OF TEST INSTRUMENTS

Before the Contractor initiates the vehicle safety compliance test program, a test instrumentation calibration system must be implemented and maintained in accordance

with established calibration practices. The calibration system shall include the following as a minimum:

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

B. All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 12 months for instruments and 12 months for the calibration standards except for static types of measuring devices such as rulers, weights, etc., which shall be calibrated at periodic intervals not to exceed two years. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

   Accelerometers shall be calibrated every twelve months or after a test failure or after any indication from calibration checks that there may be a problem with the accelerometer whichever occurs sooner.

C. All measuring and test equipment and measuring standards shall be labeled with the following information:

   1. Date of calibration

   2. Date of next scheduled calibration

   3. Name of the technician who calibrated the equipment

D. A written calibration procedure shall be provided by the Contractor, which includes as a minimum the following information for all measurement and test equipment:

   1. Type of equipment, manufacturer, model number, etc.

   2. Measurement range

   3. Accuracy

   4. Calibration interval

   5. Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident).

   6. The actual procedures and forms used to perform the calibrations.

E. Records of calibration for all test instrumentation shall be kept by the Contractor in a manner that assures the maintenance of established calibration schedules.

F. All such records shall be readily available for inspection when requested by the COTR. The calibration system shall need the acceptance of the COTR before vehicle safety compliance testing commences.

G. Test equipment shall receive a system functional check out using a known test input immediately before and after the test. This check shall be recorded by the test technician(s) and submitted with the final report.

H. The Contractor may be directed by NHTSA to evaluate its data acquisition system.

Further guidance is provided in the International Standard ISO 10012-1, “Quality Assurance Requirements for Measuring Equipment” and American National Standard ANSI/NCSL Z540-1, “Calibration Laboratories and Measuring and Test Equipment General Requirements.”

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

9. SUGGESTED TEST EQUIPMENT

The following is a list of the minimum suggested test equipment needed to evaluate the minimum performance requirements as outlined in FMVSS 222.

A. Two loading bars in accordance with the requirements given in Section 11, Definitions.

B. A head form conforming to the specifications in accordance with the requirements given in Section 11, Definitions.

(1) An acceleration sensing device whose output is recorded in a data channel that conforms to the requirements for a 1,000 Hz channel class as specified in SAE Recommended Practice J211a, Dec 1971. (S6.6.2)

(2) A stroking device constructed such that the direction of travel of the head form is not affected by impact with the surface being tested at the force levels called for in FMVSS 222. (S6.6.3)

(3) The acceleration sensing device will be oriented so that its axis of acceleration coincides with the straight line connecting the center points of the two hemispherical outer surfaces which constitute the head form shape. (S6.6.2)

C. A knee form conforming to the specifications in accordance with the requirements given in Section 11, Definitions.

(1) An acceleration sensing device whose output is recorded in a data channel that conforms to the requirements of a 600 Hz channel class as specified in the SAE Recommended Practice J211a, Dec 1971. (S6.7.2)

(2) A stroking device constructed such that the direction of travel of the knee form is not affected by impact with the surface being tested at the force levels called for in FMVSS 222. (S6.7.3)

(3) The axis of the acceleration sensing device is aligned to measure acceleration along the centerline of the cylindrical knee form. (S6.7.1)

D. Data recording equipment that have a sufficient number of channels available for recording the required loads. Each data channel is comprised of a sensor, signal conditioner, data acquisition device and all interconnecting cables. The knee and head impact data shall be collected by computer and be in a Windows PC compatible format.

E. An instrument calibration system capable of performing individual tests of all data channels used in acquiring all force, deflection and acceleration data. The calibration system must conform to the appropriate section of SAE J211.

F. A recorder to provide preliminary acceleration and force data prior to data reduction.

G. (1) A fixture or apparatus for mounting the head form and knee form in the various positions required by the test procedure.

(2) A test fixture for mounting the loading bars in the positions required by the test procedure. The test fixture shall be mounted securely to the bus such that when the loading bar is at any test position, the pivot point will not be deflected more than 25 mm when subjected to separate lateral, longitudinal, and vertical loads of 17,792 newtons at the pivot point (S6.5.1).

The contractor must evaluate his entire test equipment system and provide the NHTSA COTR with the overall plus or minus tolerances for approval before testing can be started.

H. Measuring devices to locate impact points and distances.

I. Device or speed trap for calibrating and measuring speed at impact.

J. Method, procedure and equipment for measuring the contact area of the head and knee forms with the seat or other padding.

10. PHOTOGRAPHIC DOCUMENTATION

DIGITAL PHOTOGRAPHS

The contractor shall take digital photographs of the test execution procedures. Photographs shall be taken in color and contain clear images. A tag, label or placard identifying the test item, NHTSA number (if applicable) and date shall appear in each photograph and must be legible. Each photograph shall be labeled as to the subject matter. The required resolution for digital photographs is a minimum of 1,600 x 1,200 pixels. Digital photographs are required to be created in color and in a JPG format. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs.

The test reports shall include enough photographs to describe the testing in detailed and shall be organized in a logical succession of consecutive pictures. The digital photographs should be included in the test report as 203 mm x 254 mm or 215.9 mm x 279 mm (8 x 10 or 8½ x 11 inch) pictures (or for equipment testing -- 125 mm x 175 mm (5 x 7 inch) pictures). All photographs are required to be included in the test report in the event of a test failure. Any failure must be photographed at various angles to assure complete coverage. Upon request, the photographs shall be sent to the COTR on a CD or DVD and saved in a “read only” format to ensure that the digital photographs are the exact pictures taken during testing and have not been altered from the original condition.

PHOTOGRAPHIC VIEWS

As a minimum the following test photographs shall be included in each vehicle final test report, submitted by the contractor:

A. Left side view of school bus

B. Right side view of school bus

C. 3/4 frontal view from left side of school bus

D. 3/4 rear view from right side of school bus

E. Closeup view of the vehicle's certification label including the chassis manufacturers label if applicable.

F. Closeup view of vehicle's tire information label

G. Views of vehicle's interior, front to rear and rear to front

H. Each test performed on the school bus will include the following:

(1) Pretest equipment setup of the head and knee form impactors, loading bars, and other test fixtures and loading devices.

(2) Pretest and post test condition of each seat, barrier, seat belt anchorage, wheelchair securement anchorage, and wheelchair occupant restraint anchorage that was tested

(3) Fit of seat belt on each applicable test dummy

(4) Additional photographs of any damage or noncompliance condition which cannot be seen in the above photographs

11. DEFINITIONS

11.1 ABSORBED ENERGY *(Interpretation letter to Freedman Seating Company dated Sept. 5th, 2000)*

Total energy minus the recoil energy.

11.2 ATTACHMENT POINT *(Interpretation letter to ExecuWest Consultants dated December 20th, 2006)*

Any point where the seat is fastened to the vehicle floor or side wall. Any point where structural components of the seat frame are joined.

11.3 BUS

Motor vehicle with motive power, except a trailer, designed for carrying more than 10 persons. (571.3)

Note: Carrying capacity is determined by identifying the number of designated seating positions in the vehicle as defined in 49 CFR Part 571.3. In determining vehicle carrying capacity, wheelchair seating positions are not designated seating positions, however wheelchair positions are counted in determining vehicle seating capacity. Designated seating position uses the term person in its definition and a driver is considered a person for both the computation of designated seating positions and vehicle capacity.

11.4 CONTACT AREA

Maximum area bounded by outline curves of the individual contact prints and non-intersecting tangent line segments between contact print outline curves. Contact prints are only those transfers resulting from contact between the head and knee forms and the test surface, as opposed to those transfers resulting from an obvious splatter of the transfer medium.

11.5 CONTACTABLE SURFACE

Any surface that is contactable from any direction by the head form (except any surface on the front of a seat back or restraining barrier 76 mm or more below the top of the seat back or restraining barrier) that is within the zone enclosed by the following planes:

A. Horizontal planes 305 mm and 1,016 mm above the Seating Reference Point (SgRP).

B. A vertical longitudinal plane tangent to the inboard (aisle side) edge of the seat.

C. A vertical longitudinal plane 83 mm inboard of the outboard edge of the seat.

D. Vertical transverse planes through and 762 mm forward of the SgRP. (S4)

11.6 FIXED OCCUPANCY SEAT

A bench seat equipped with Type 2 seat belts that has a permanent configuration regarding the number of seating positions on the seat. The number of seating positions on the bench seat cannot be increased or decreased.

11.7 FLEXIBLE OCCUPANCY SEAT

A bench seat equipped with Type 2 seat belts that can be reconfigured so that the number of seating positions on the seat can change. The seat has a minimum occupancy configuration and maximum occupancy configuration, and the number of passengers capable of being carried in the minimum occupancy configuration must differ from the number of passengers capable of being carried in the maximum occupancy configuration. A flexible occupancy seat in a maximum occupancy configuration may have up to one small occupant seating position. (S4, S4.1(e))

11.8 FMVSS

Federal Motor Vehicle Safety Standard

11.9 FORCE-DEFLECTION ZONE

Limits within which the seat and barrier must perform during the forward force application phase of the test as shown in Figure 1. (Also Figure 1 of 49 CFR Part 571.222)

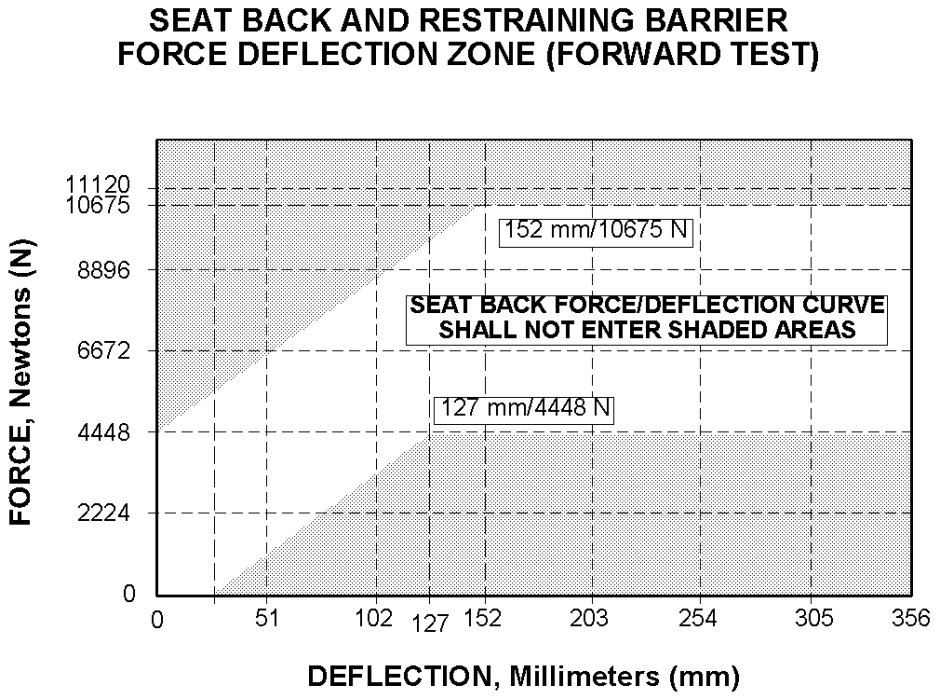


Figure 1

11.10 GROSS VEHICLE WEIGHT RATING (GVWR)

Gross Vehicle Weight Rating means the value specified by the manufacturer as the loaded weight of a single vehicle. (571.3)

11.11 HEAD FORM

Head form, shown in Figure 2, for the measurements of HIC, energy, contact area, and resisting force is a rigid surface comprised of two hemispherical shapes. The total equivalent mass of the two hemispheres and all other attachments is 5.2 kg. The first of the two hemispherical shapes has a diameter of 166 mm. The second of the two hemispherical shapes has a 50 mm diameter and is centered to protrude from the outer surface of the first hemispherical shape. The surface roughness of the hemispherical shapes does not exceed 1.6 µm, root mean square (RMS). (S6.6)

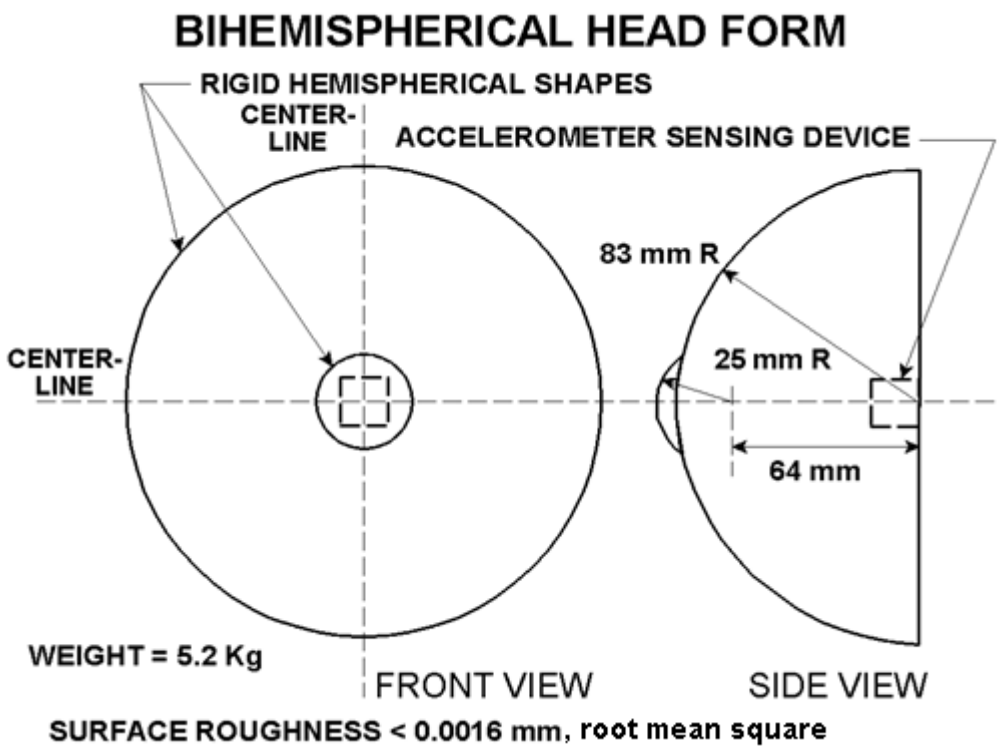


Figure 2

11.12 KNEE FORM

The knee form, as shown in Figure 3, for measurement of force and contact area is a rigid 76 mm-diameter cylinder, with an equivalent weight of 44 N that has one hemispherical end with a 38 mm radius forming a contact surface of the knee form. The hemispherical surface roughness does not exceed 1.6 μm, root mean square (RMS). (S6.7)

KNEE FORM

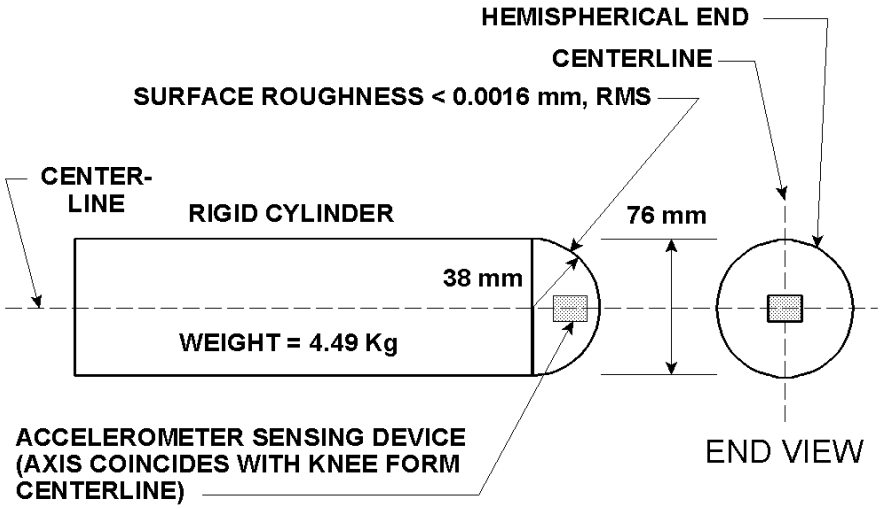


Figure 3

11.13 LOADING BAR

The loading bar is a rigid cylinder, as shown in Figure 4, with an outside diameter of 152 mm that has hemispherical ends with radii of 76 mm and with a surface roughness that does not exceed 1.6 µm, root mean square (RMS). The length of the loading bar is 102 mm less than the width of the seat back in each test. The stroking mechanism applies force through a pivot attachment at the center point of the loading bar which allows the loading bar to rotate in a horizontal plane 30 degrees in either direction from the transverse position. (S6.5)

LOADING BAR

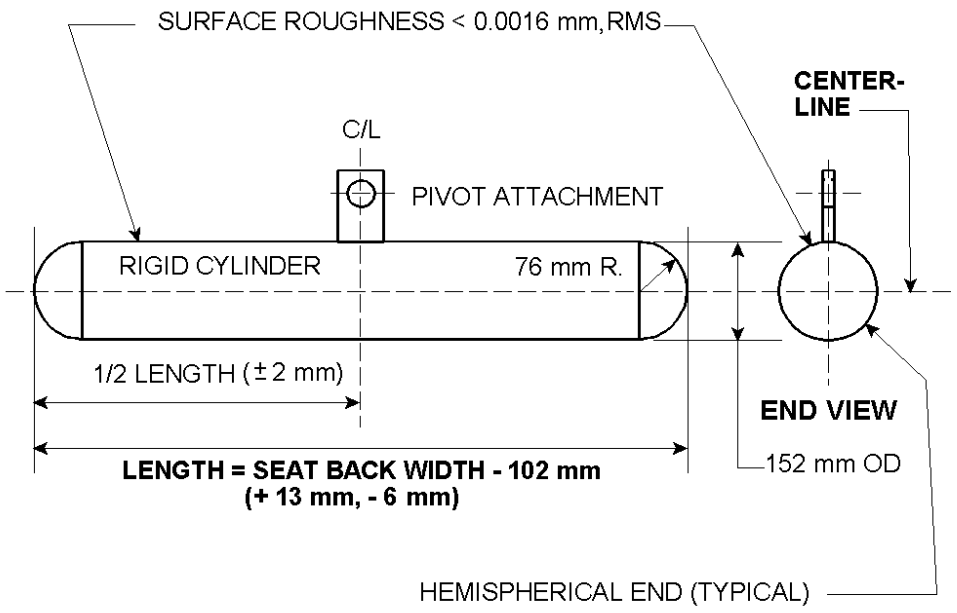


Figure 4

11.14 MAXIMUM OCCUPANCY CONFIGURATION

On a bench seat equipped with Type 2 seat belts, an arrangement whereby the lap belt portion of the Type 2 seat belts is such that the maximum number of occupants can be belted. (S4)

11.15 MINIMUM OCCUPANCY CONFIGURATION

Means, on a bench seat equipped with Type 2 seat belts, an arrangement whereby the lap belt portion of the Type 2 seat belts is such that the minimum number of occupants can be belted. (S4)

11.16 SCHOOL BUS

A bus, as shown in Figure 5, that is sold, or introduced into interstate commerce, for purposes that include carrying students to and from school or related events, but does not include a bus designed and sold for operation as a common carrier in urban transportation. (571.3)

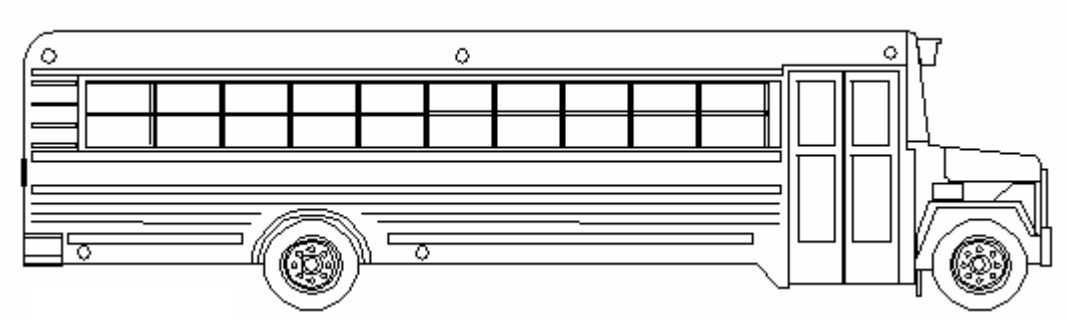


Figure 5

11.17 SCHOOL BUS PASSENGER SEAT

A seat in a school bus, other than the driver's seat. (S4)

11.18 SEAT BELT ANCHORAGE

Any component, other than the webbing or straps, involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure. (571.210)

11.19 SEAT BENCH WIDTH

The maximum transverse width of the bench seat cushion. (S4)

11.20 SEAT CUSHION SELF-LATCHING MECHANISM

A passenger seat cushion attachment device that allows for the seat cushion to be removable without tools or to flip up and is designed to latch the seat cushion to the seat frame when a mass is placed on the top center of the seat cushion with the seat cushion in the down position. (S5.1.5(a))

11.21 SEATING REFERENCE POINT (SgRP)

The unique design H-point, as defined in Society of Automotive Engineers (SAE) Recommended Practice J1100, revised June 1984, “Motor Vehicle Dimensions” (incorporated by reference, see §571.5), which:

(1) Establishes the rearmost normal design driving or riding position of each designated seating position, which includes consideration of all modes of adjustment, horizontal, vertical, and tilt, in a vehicle;

(2) Has X, Y, and Z coordinates, as defined in Society of Automotive Engineers (SAE) Recommended Practice J1100, revised June 1984, “Motor Vehicle

Dimensions" (incorporated by reference, see §571.5), established relative to the designed vehicle structure;

(3) Simulates the position of the pivot center of the human torso and thigh; and

(4) Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in Society of Automotive Engineers (SAE) Standard J826, revised May 1987, "Devices for Use in Defining and Measuring Vehicle Seating Accommodation" (incorporated by reference, see §571.5), or, if the drafting template with the 95th percentile leg cannot be positioned in the seating position, is located with the seat in its most rearward adjustment position. (571.3)

11.22 SMALL OCCUPANT SEATING POSITION

The center seating position on a flexible occupancy seat in a maximum occupancy configuration, if the torso belt portion of the Type 2 seat belt is intended to restrain occupants whose dimensions range from those of a 50^{th} percentile 6 year-old child only to those of a 50^{th} percentile 10 year-old child and the torso belt anchor point cannot achieve a minimum height of 520 mm above the seating reference point, as specified by 4.1.3.2(a) of 49 CFR 571.210. (S4)

11.23 STROKING DEVICE

A method to accelerate the head form or knee form to the desired velocity.

11.24 TORSO BELT ADJUSTED HEIGHT

The vertical height above the SgRP of the point at which the torso belt deviates more than 10 degrees from the horizontal plane when the torso belt is pulled away from the seat by a 20 N force at a location on the webbing approximately 100 mm from the adjustment device and the pulled portion of the webbing is held in a horizontal plane. The procedure for measuring torso belt adjusted height, abbreviated TBAH and shown in Figure 6, is presented in Data Sheet 9. (571.210)

11.25 TORSO BELT ANCHOR POINT

The midpoint of the torso belt width where the torso belt first contacts the uppermost torso belt anchorage. The torso belt anchor point height, abbreviated AH, is shown in Figure 6. (571.210)

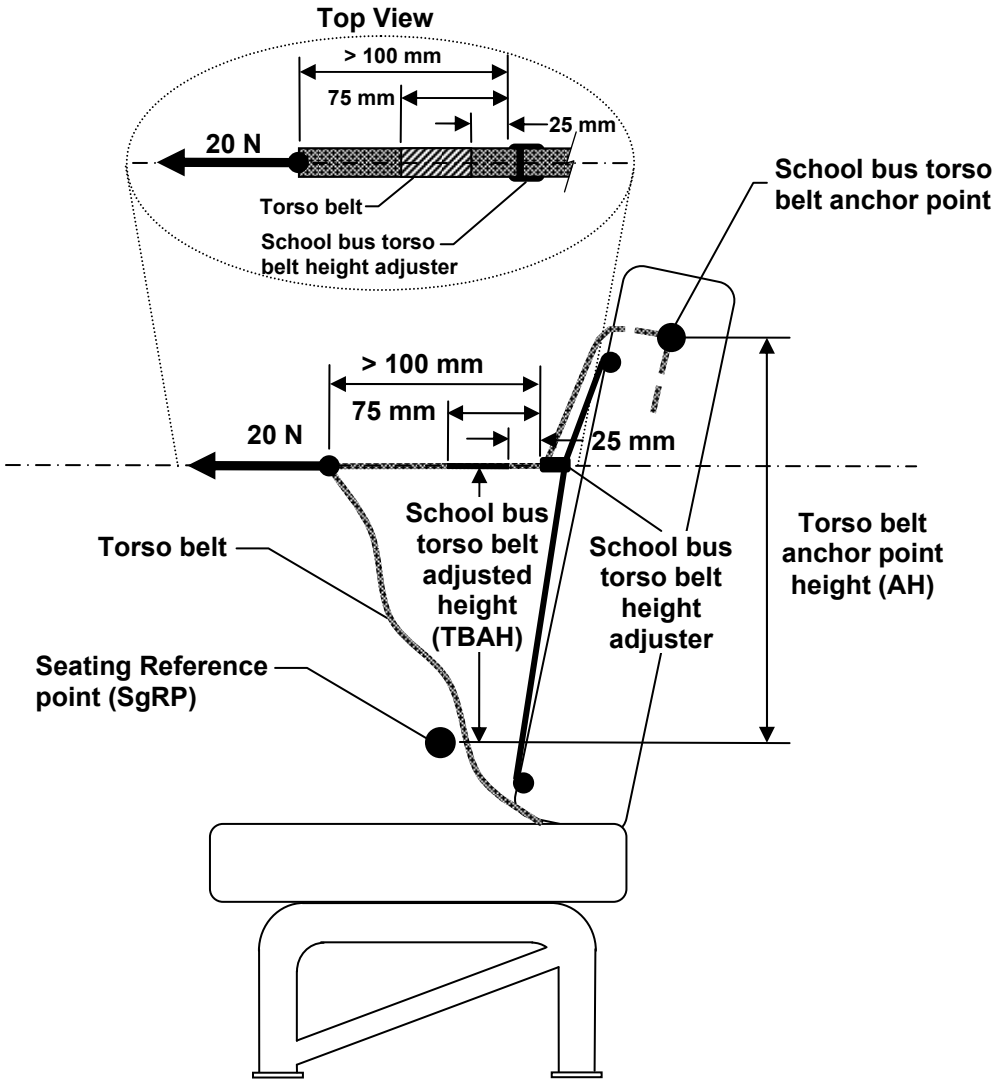


Figure 6

11.26 TORSO BODY BLOCK

The torso body block, as shown in Figure 7, is used to apply load to shoulder belts of Type 2 seat belts and consists of a 203 mm radius block that is 102 mm thick. The block is covered in 25 mm medium density foam rubber and is loaded through the central vertical axis shown in Figure 7. (571.210)

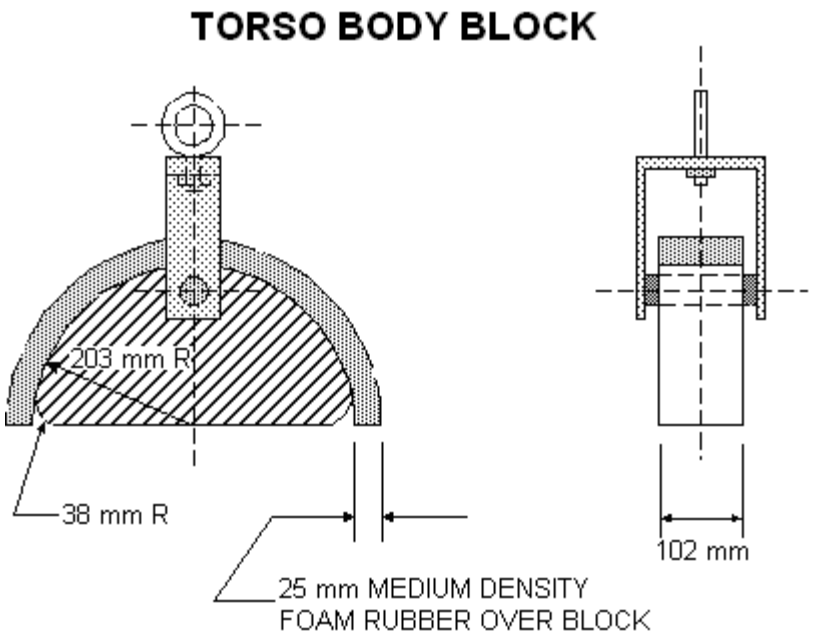


Figure 7

11.27 "W"

The number of seating positions and the number of Type 1 seat belt positions considered to be in a bench seat, and is calculated as the seat bench width in millimeters (mm) divided by 380 and rounded to the nearest whole number. (S4.1 (b))

11.28 WHEELCHAIR

A wheeled seat frame for the support and conveyance of a physically disabled person, comprised of at least a frame, seat, and wheels. (S4)

11.29 WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGE

The provision for transferring wheelchair occupant restraint system loads to the vehicle structure. (S4)

11.30 WHEELCHAIR SECUREMENT ANCHORAGE

The provision for transferring wheelchair securement device loads to the vehicle structure. (S4)

11.31 WHEELCHAIR SECUREMENT DEVICE

A strap, webbing, or other device used for securing a wheelchair to the school bus, including all necessary buckles and other fasteners. (S4)

11.32 "Y"

The number of Type 2 seat belt positions on a flexible occupancy seat in a minimum occupancy configuration or a fixed occupancy, and is calculated as the seat bench width in millimeters divided by 380 and rounded to the next lowest whole number. The minimum seat bench width for a seat equipped with a Type 2 seat belt is 380 mm. (S4.1 (c))

11.33 "Y +1"

The number of Type 2 seat belt positions on a flexible occupancy seat in a maximum occupancy configuration. The minimum seat bench width for this configuration is Y +1 times 330 mm. (S4.1 (d))

12. PRETEST REQUIREMENTS

Prior to conducting a compliance test, the contractor shall:

A. Verify COTR approval of Contractor's in-house test procedure,

B. Verify the training of technicians for performance of this test,

C. Verify the calibration status of test equipment,

D. Review applicable revision of FMVSS 222, 207, 208, and 210,

E. Review vehicle Owner's Manual (or equipment manufacturer instructions), and

F. Set cold tire pressures according to the vehicle manufacturer's recommendations (where applicable).

12.1 DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

Prior to conducting any compliance test, Contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes:

A. A step-by-step description of the methodology to be used.

B. A written Quality Control (QC) Procedure which shall include calibrations, the data review process, report review, and the people assigned to perform QC on each task.

C. A complete listing of test equipment with instrument accuracy and calibration dates.

D. Detailed check off lists to be used during the test and during data review. These lists shall include all test procedure requirements and FMVSS requirements pertaining to the safety standard for which testing is being performed. Each separate check off sheet shall indentify the lab, test date, vehicle and test technicians. These check sheets shall be submitted with the test report.

D.1.1 The following heading information must be at the top of the first page of each check sheet and the vehicle NHTSA No. must be on each page:

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Test Configuration: _____

13. RECEIVING INSPECTION OF THE SCHOOL BUS

A. Wash and clean the vehicle exterior and interior including all seats. Affix a placard displaying the NHTSA number to the inside of the windshield and to the exterior front sides and rear of the bus. This number is the primary identification number and will remain on the vehicle throughout the test program.

B. Place the test vehicle on a level surface.

C. Inflate tires to manufacturer's recommended pressure for the applicable gross vehicle weight rating (GVWR).

D. Ambient test temperature must be maintained between 0°C and 32.2°C inside the bus during testing. Temperature readings should be taken at 3 different locations within the bus interior that are approved by the OVSC COTR.

E. It must be noted that a particular school bus passenger seat, as a test specimen, is not required to meet additional standards after having met the seat back height and surface area and the seat cushion retention requirements, or after having been subjected to either the seat back force/deflection test-forward, the seat back force/deflection test-rearward, the seat back compartmentalization/Type 2 seat belt quasi-static test, or the impact zone tests. The COTR in coordination with the testing laboratory will select the exact location and number of seats to be tested. (S5(a))

F. If the school bus is equipped with adjustable seat backs, the back is placed in the most upright position. (S6.4)

G. Verify that all school bus passenger seats are forward facing. (S5.1)

H. Note that Class 2 buses receive all the same tests as Class 1 buses except the requirements of section S5.2, including sections S5.2.1 through S5.2.3, of FMVSS 222. In addition, Class 2 buses are tested to the seat belt fit requirements of FMVSS 208 and the seat and seat belt anchorage requirements of FMVSS 207 and 210 as shown in Appendices A and B. No testing to FMVSS 209 will be performed. (S5(b))

I. Number each bus seat, including wheelchair locations, in a counter clockwise direction starting at the passenger seat or wheelchair immediately behind the driver's seat as shown in Figure 8. Each passenger seat shall be designated with the letter S followed by the seat number and each wheelchair location shall be designated with the letter W followed by the seat number. Each barrier shall be designated with the letter B followed by the seat number directly rearward of the barrier. Place a schematic of the seat floor plan in the final report for seat identification. Label each seat in the photographs with the number of the seat and by the NHTSA number of the school bus.

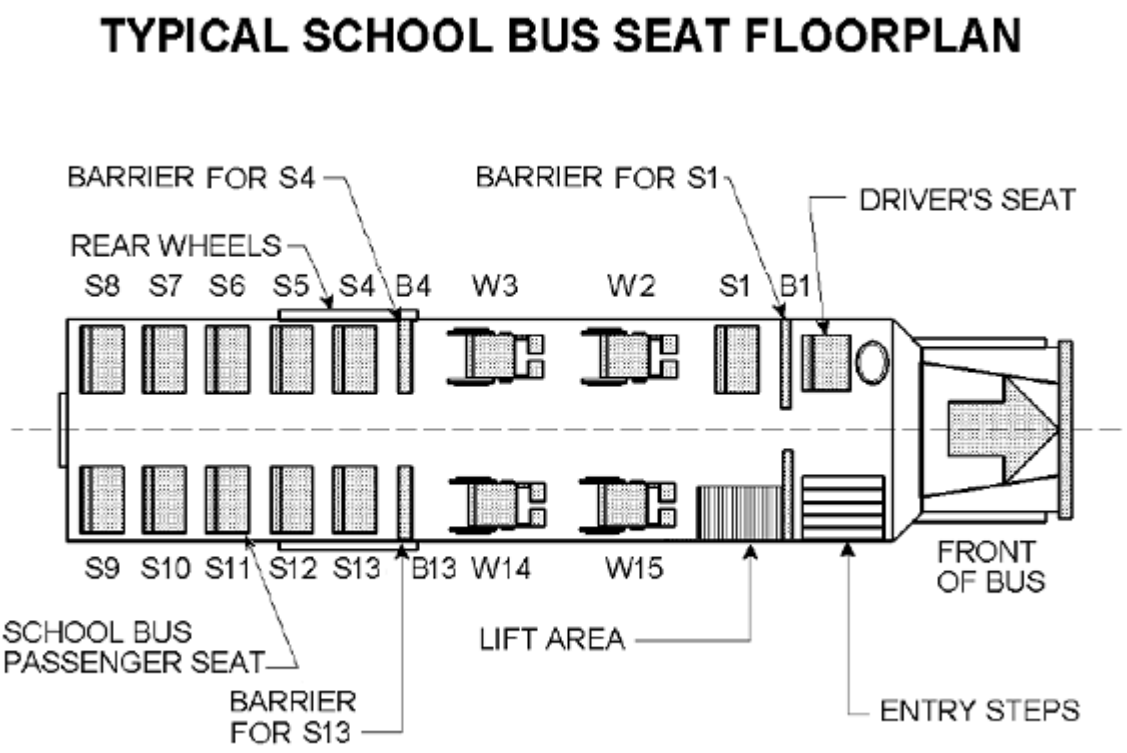


Figure 8

J. For Class 2 buses, the test vehicle's seats (including the operation of any adjustable seats) and restraint systems shall be subjected to a visual inspection to ascertain that the seats and seat belt assemblies are functional. Any damage that could influence the test results shall be recorded on the Vehicle Condition sheet, and any unusual condition shall be reported to the COTR before initiation of testing. The COTR must approve the testing of any unusual test specimen.

K. The vehicle's interior and exterior, including all windows, seats, doors, etc., shall be subjected to visual and manual inspection to ascertain that each system is complete and functional per the manufacturer's recommendations. Any damage, deformation, maladjustments or other conditions that could influence the test results or the purpose of the test program shall be recorded. Report the nature of any abnormal condition to the OVSC COTR prior to test initiation on an abnormal specimen.

L. A small occupant seating position must be permanently and legibly marked or labeled with the phrase: “Do Not Sit In Middle Seat If Over Age 10”. The phrase must be comprised of no more than two lines of text. The label must be placed on the torso belt portion of the Type 2 seat belt. It must be plainly visible and easily readable when the seat belt is in a stored position. The distance from the top edge of the top line of text to the bottom edge of the bottom line of the text must be at least 35 mm. If the label is sewn on, it must be stitched around its entire perimeter.

M. Obtain color photographs of the vehicle's exterior and interior as per Section 10, Photographic Documentation.

N. Record and photograph manufacturer's certification label for the complete vehicle, and, if applicable, for the incomplete vehicle.

O. Record vehicle general data and pretest checkout data on the Administrative Data Sheet.

14. COMPLIANCE TEST EXECUTION

A. Perform general vehicle checks. Follow the steps outlined in the General Data Sheet (Section 17).
B. Measure the seat back height, position, and front surface area (S5.1.2). Follow the steps outlined in Data Sheet 1 to determine the height, width, and surface area.
C. Measure seat-to-seat and/or seat-to-barrier spacing (S5.2, S5.2.1). Follow the steps outlined in Data Sheet 2 to determine the spacing for each seat.
D. Measure restraining barrier height, position, and rear surface area (S5.2.2). Follow the steps outlined in Data Sheet 3 to determine the dimensions of the restraining barrier, and whether the perimeter of the restraining barrier coincides with or lies outside of the perimeter of the minimum seat back area required by S5.1.2 for the seat immediately aft of the restraining barrier. If a seat back surface area exceeds the size required in S5.1.2, the size of the restraining barrier need not coincide as long as it provides rear surface area equal to the minimum specified for the seat back of the seat immediately rearward of the barrier. (*Interpretation letter to The CE White Co. dated November 19th, 2010*)
E. Measure buckle side length limit (S5.1.7). Follow the steps outlined in Data Sheet 4 to determine the buckle/latchplate assembly length.
F. Check for Small Occupant Seat Belt Labeling. Follow steps outlined in Data Sheet 5.
G. Measure head impact protection (S5.3.1). Follow the steps outlined in Data Sheet 6 to determine the head form impact response of the seats.
H. Measure leg impact protection (S5.3.2). Follow the steps outlined in Data Sheet 7 to determine the knee form impact response of the seats.
I. Measure seat cushion latching and retention (S5.1.5). Follow the steps outlined in Data Sheet 8 to measure the seat cushion latching response and the seat cushion retention.
J. Measure quasi-static seat back response (S5.1.6). This test is required for Class 1 vehicles with voluntarily installed Type 2 seat belts and for all Class 2 vehicles. Follow the steps outlined in Data Sheet 9 to measure quasi-static seat back response.
    1) Prepare test fixtures and take seat measurements.
    2) Position the lower loading bar and measure force response.
    3) Position torso body block and measure force/deflection response.
    4) Position upper loading bar and measure force/deflection response.
K. Measure seat back performance, forward (S5.1.3). Follow the steps outlined in Data Sheet 10 to determine the seat back force/deflection performance, forward.
L. Measure restraining barrier performance, forward (S5.2.3). Follow the steps outlined in Data Sheet 11 to determine the restraining barrier force/deflection performance, forward.
M. Measure seat back performance, rearward (S5.1.4). Follow the steps outlined in Data Sheet 12 to determine the seat back force/deflection performance, rearward.

N. Identify and measure seat belt assembly anchorage performance. Follow the steps outlined in Appendix A to identify the anchorage installation types and measure anchorage performance. (571.207 and 571.210)
O. Identify seat belt systems. Follow the steps outlined in Appendix B to identify the seat belt types. (571.208)
P. Conduct wheelchair anchorage testing (S5.4). Consult Appendix C for further instruction.

15. POST TEST REQUIREMENTS

A. Verify all instrumentation, data sheets and photographs are complete.

B. Protect the school bus from further damage.

C. Move the test vehicle to a secure area.

D. Place all original records in a secure and organized file awaiting test data disposition.

16. REPORTS

16.1 MONTHLY STATUS REPORTS

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

16.2 APPARENT NONCOMPLIANCE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). A Notice of Test Failure (see report forms section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included. In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation is required for verification of accuracy. The calibration shall be performed without additional costs to the OVSC.

16.3 FINAL TEST REPORTS

16.3.1 COPIES

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

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

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

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

16.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The contractor should use DETAILED descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much DETAIL as possible in the report.

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

16.3.3 FIRST THREE PAGES

A. FRONT COVER

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

(1) Final Report Number such as 222-ABC-XX-001 where –

222 is the FMVSS tested
ABC are the initials for the laboratory
XX is the last two numbers of the Fiscal Year of the test program
001 is the Group Number (001 for the 1st test)

(2) Final Report Title and Subtitle such as

COMPLIANCE TESTING FOR FMVSS 222
School Bus Seating and Crash Protection
* *

World Motors Corporation
20XX XYZ School Bus
NHTSA No. CX0901

(3) Contractor's Name and Address such as

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

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

(4) Date of Final Report completion

(5) The words "FINAL REPORT"

(6) The sponsoring agency's name and address as follows

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

B. FIRST PAGE AFTER COVER PAGE

When a contract test laboratory is reporting, a disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

This publication is distributed by the National Highway Traffic Safety Administration in the interest of information exchange. Opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof.

If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement.

Prepared By: _____

Approved By: _____ *

Approval Date: _____ *

FINAL REPORT ACCEPTANCE BY OVSC: *

Accepted By: _____

Acceptance Date: _____

* These lines not required when OVSC staff writes the Test Report

C. SECOND PAGE AFTER FRONT COVER

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

Block 1 — REPORT NUMBER

222-ABC-XX-001

Block 2 — GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 — RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 — TITLE AND SUBTITLE

Final Report of FMVSS 222 Compliance Testing of 20XX World XYZ School Bus, NHTSA No. CX0901

Block 5 — REPORT DATE

Month Day, 20XX

Block 6 — PERFORMING ORGANIZATION CODE

ABC

Block 7 — AUTHOR(S)

John Smith, Project Manager
Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070

Block 10 — WORK UNIT NUMBER

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-XX-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

U.S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Ave., SE
Washington, DC 20590

Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Month Day to Month Day, 20XX

Block 14 — SPONSORING AGENCY CODE

NVS-220

Block 15 — SUPPLEMENTARY NOTES

Leave blank

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 20XX World XYZ School Bus in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-222-XX for the determination of FMVSS 222 compliance. Test failures identified were as follows:

None

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

Block 17 — KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 222

Block 18 — DISTRIBUTION STATEMENT

National Highway Traffic Safety Administration
Technical Information Services Division, NPO-411
1200 New Jersey Avenue SE (Room E12-100)
Washington DC 20590

e-mail: tis@nhtsa.dot.gov
FAX: 202-493-2833

Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 — NUMBER OF PAGES

Add appropriate number

Block 22 — PRICE

Leave blank

16.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

Section 1 — Purpose of Compliance Test

Section 2 — Compliance Test Data Summary

Section 3 — Compliance Test Data

Section 4 — Noncompliance Data (if applicable)

Section 5 — Photographs

17. DATA SHEETS

GENERAL TEST DATA SHEET

SCHOOL BUS IDENTIFICATION —

MODEL YEAR/MFR./MAKE/MODEL: _____

WHEELBASE: _____ mm PASSENGER CAPACITY: _____

NHTSA NO.: _____ VIN: _____

CONVENTIONAL OR FORWARD CONTROL: _____

GVWR (From Certification Label): FRONT - _____ kg REAR - _____ kg

TEST CONDITIONS —

DATE(S) OF TEST: _____ TIME OF TEST: _____

AMBIENT TEMPERATURE: _____ °C (REQUIRED TEMP. RANGE = 0°C to 32.2°C)

SEAT IDENTIFICATION —

SEAT MANUFACTURER: _____

MODEL NAME & NUMBER: _____

DESCRIPTION OF SEATS:

EXAMPLE: Backs and cushion are ABC foam construction with 13 mm plywood boards, 995 gram vinyl upholstery. Tubular steel frames of 25.4 mm diameter are wall mounted.

_____

_____

Data Sheet 1
SEAT BACK HEIGHT, POSITION, AND FRONT SURFACE AREA TEST (S5.1.2)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number: _____

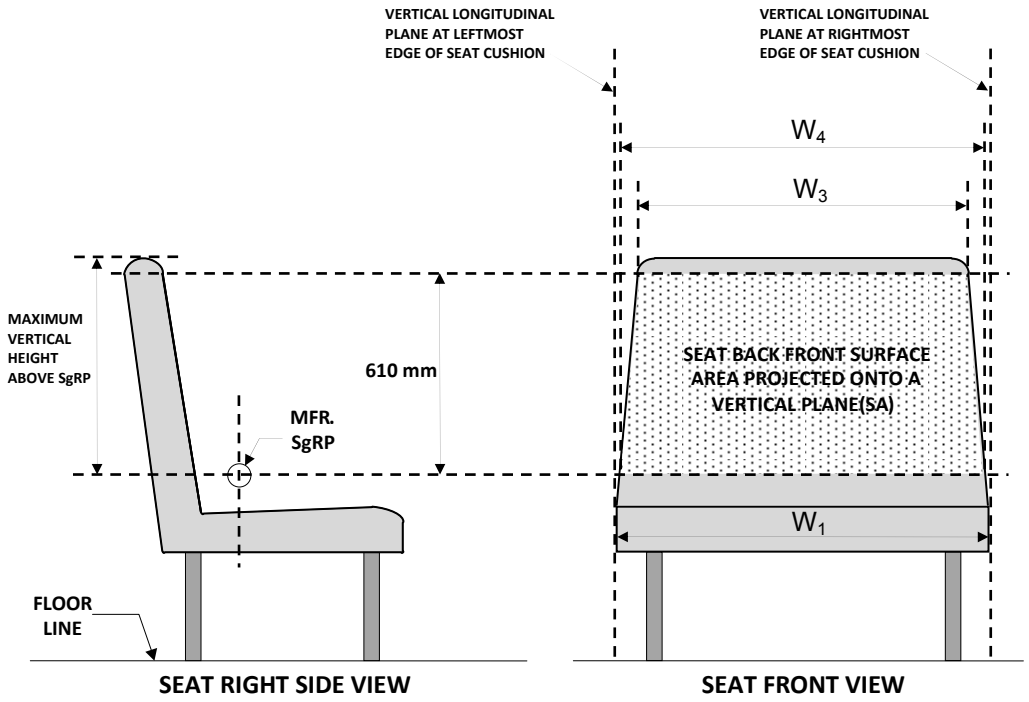


Figure 9

__1. Mark the front surface of the seat back with a horizontal line at the same height above the floor as the SgRP (which is obtained from the COTR). This line represents the lower limit of the minimum required seat back surface area.

__2. Measure and record the maximum vertical height of the seat back above the SgRP.
Maximum vertical height: _____mm

__3. Requirement. The maximum vertical height of the seat back recorded in item 2 must be greater than or equal to 610 mm above the SgRP. (S5.1.2 (b))
_____Yes – Pass _____No – Fail

__4. Mark the front surface of the seat back with a second horizontal line at 610 mm above the line marked in item 1. This line represents the upper limit of the minimum required seat back surface area.

__5. Locate the vertical longitudinal planes at the left most and right most edges of the seat bench. Mark vertical lines where these planes intersect the front surface of the seat back. These lines represent the left and right limits of the required seat back surface area.

__6. Seat back width measurement.
__6.1 Measure and record the maximum seat bench width, W_1.
W_1 = ____mm

__6.2 Determine the minimum required seat back width, W_2, at the upper limit by multiplying the seat bench width, W_1, by 0.75.
$W_2 = 0.75 \times W_1 =$ ____mm

__6.3 Measure and record the total seat back width at 610 mm above the SgRP that falls between the planes located in item 5, W_3. Gaps on the seat surface such as those between bucket type seat backs are not to be included in the total width measurement.
$W_3 =$ ____ mm

__7. Requirement. The minimum total width of the seat back at 610 mm above the SgRP (W_3) shall be 75 percent of the maximum width of the seat bench (W_2). (S5.1.2(b))
$W_3 \geq W_2$: _____Yes – Pass _____ No – Fail

__8. Seat back front surface area measurement.

__8.1. Project the front surface area of the seat back onto a vertical transverse plane as shown in Figure 9. Measure the projected surface area that falls between:

(a) A horizontal plane that passes through the SgRP and a horizontal plane 610 mm above the SgRP; and

(b) A vertical longitudinal plane that passes through the leftmost point of the seat bench and a vertical longitudinal plane that passes through the rightmost point of the seat bench.

__8.1.1 Measure and record seat back width at 610 mm above the SgRP (W_3 from item 6 above shown in Figure 9)
$W_3 =$ ____ mm

__8.1.2 Measure and record seat back width at the SgRP height, W_4 (shown in Figure 9)
$W_4 =$ ____ mm

__8.1.3 Calculate the surface area, SA, using the following formula for a trapezoid:
$SA = 1/2 (W_3 + W_4) \times 610 \text{ mm} =$ _____ mm^2

NOTE: For a seat back area that is not trapezoidal in shape, has a large radius at the corner(s), or has gaps on the surface such as those between bucket style seats backs, the above described measuring method must be modified as required to obtain accurate area measurements. Include any additional measurements and calculations required to determine the surface area under REMARKS.

__8.2. Calculate the minimum required surface area, SB.
$SB = 0.90 \times W_1 \times 610 \text{ mm} =$ _____ mm^2

__9. Requirement. The front surface area, SA, of the seat back projected onto the vertical plane must be not less than 90 percent of the seat bench width, W_1, in millimeters multiplied by 610 (SB). (S5.1.2(b))
SA ≥ SB: _____Yes – Pass _____ No – Fail

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet 2
SEAT TO SEAT/BARRIER SPACING (S5.2, S5.2.1)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____

__1. Seat to seat/barrier spacing measurement.
__1.1. Measure in a horizontal longitudinal line forward from the SgRP to the rear surface of the seat back or barrier in front of it (labeled X in Figure 10).

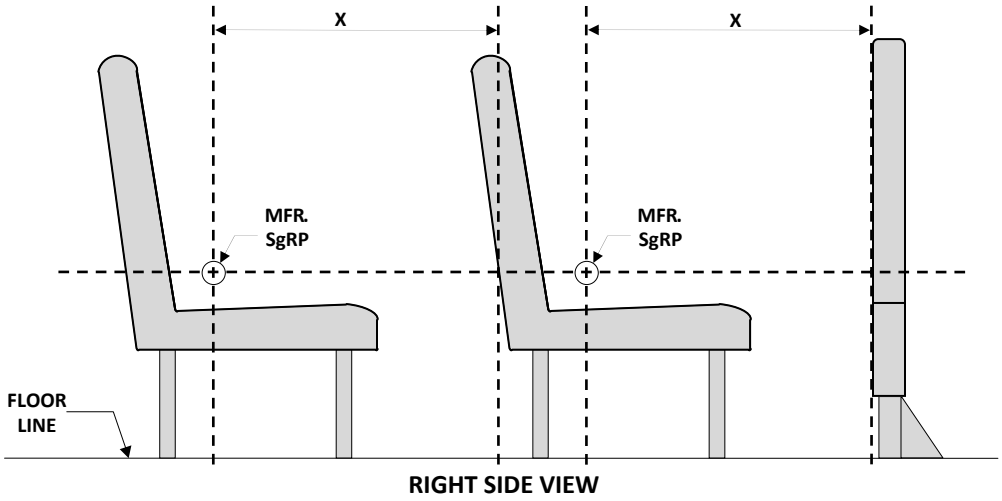


Figure 10

__1.2. Repeat the measurement for each seat and record in Table 1.

__2. Requirement. Each vehicle shall be equipped with a restraining barrier forward of any designated seating position that does not have a rear surface of another school bus passenger seat within 610 mm of its SgRP. The horizontal distance between the restraining barrier's rear surface and the SgRP of the seat in front of which the barrier is required shall not be more than 610 mm. (S5.2, S5.2.1)
Record whether each seat to seat/barrier spacing meets the requirement of item 2 in Table 1.

Table 1

SEAT NUMBER	MEASUREMENT OF SPACING FROM SgRP FORWARD TO SEAT/BARRIER (X) (mm)	REQUIREMENT X ≤ 610 mm (CLASS I BUSES)	
		YES - PASS	NO – FAIL
S1			
S2			
S3			
S4			
S5			
S6			
S7			
S8			

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 3
RESTRAINING BARRIER HEIGHT, POSITION, AND REAR SURFACE AREA (S5.2.2)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number: _____ Barrier Number:_____

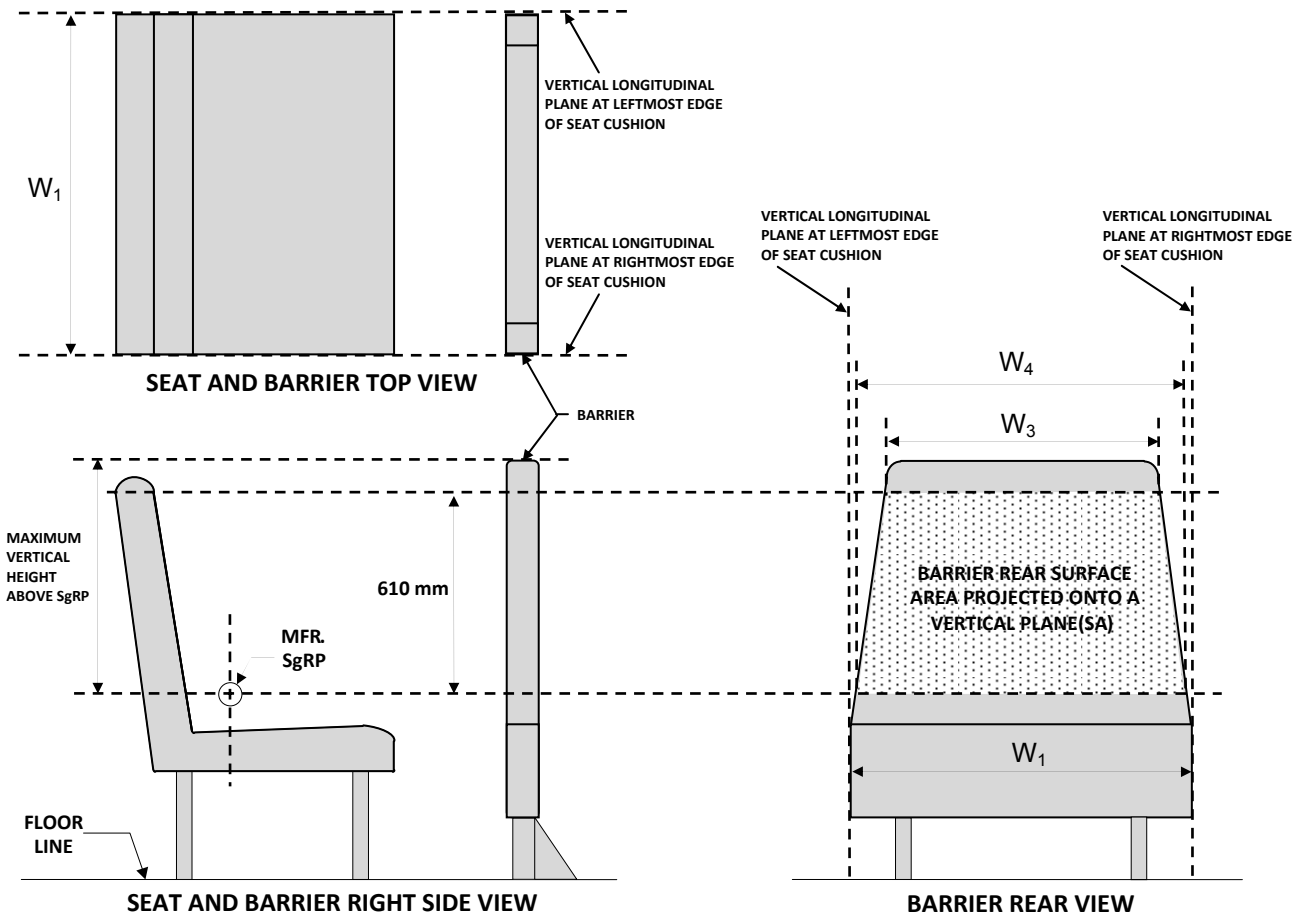


Figure 11

__1. Mark the rear surface of the barrier with a horizontal line at the same height above the floor as the SgRP of the seat immediately aft of the barrier. This line represents the lower limit of the minimum required barrier surface area.

__2. Measure and record the maximum vertical height of the barrier above the line marked in item 1.
Maximum vertical height: ____mm

__3. Requirement. The maximum vertical height of the barrier recorded in item 2 must be greater than or equal to 610 mm above the SgRP of the seat immediately aft of the barrier. (S5.2.2, S5.1.2 and *Interpretation letter to The CE White Co. dated November 19th, 2010*)
_____Yes – Pass _____No – Fail

__4. Mark the rear surface of the barrier with a second horizontal line at 610 mm above the line marked in item 1. This line represents the upper limit of the minimum required barrier surface area.

__5. Locate the vertical longitudinal planes at the left most and right most edges of the seat bench immediately aft of the barrier. Mark vertical lines where these planes intersect the rear surface of the barrier. The specific method of projection shall be approved by the COTR prior to test execution. These lines represent the left and right limits of the required barrier surface area.

__6. Barrier width measurement.

__6.1 Measure and record the maximum bench width, W_1, of the seat immediately aft of the barrier.
W_1 = ____ mm

__6.2 Determine the minimum required barrier width, W_2, at the upper limit by multiplying the seat bench width, W_1, by 0.75.
$W_2 = W_1 \times 0.75$ = ____ mm

__6.3 Measure and record the total barrier width at 610 mm above the SgRP that falls between the planes located in item 5, W_3.
W_3 = ____ mm

__7. Requirement. The minimum total width of the barrier at 610 mm above the SgRP (W_3) shall be 75 percent of the maximum width of the seat bench (W_2). (S5.2.2, S5.1.2 and *Interpretation letter to The CE White Co. dated November 19th, 2010*)
$W_3 \geq W_2$: _____Yes – Pass _____ No – Fail

__8. Barrier rear surface area measurement.

__8.1 Project the rear surface area of the barrier onto a vertical transverse plane as shown in Figure 11. The specific method of projection shall be approved by the COTR prior to test execution. Measure the projected surface area that falls between:

(a) A horizontal plane that passes through the SgRP and a horizontal plane 610 mm above the SgRP; and

(b) A vertical longitudinal plane that passes through the leftmost point of the seat bench and a vertical longitudinal plane that passes through the rightmost point of the seat bench.

__8.1.1 Measure and record the barrier width at 610 mm above the SgRP (W_3 from item 6 above, shown in Figure 11)
W_3 = ____ mm

__8.1.2 Measure and record barrier width at the SgRP height, W_4 (shown in Figure 11)
W_4 = ____ mm

__8.1.3 Calculate the surface area, SA, using the following formula for a trapezoid:
$SA = 1/2 (W_3 + W_4) \times 610$ mm = _____ mm^2

NOTE: For a barrier that is not trapezoidal in shape or has a large radius at the corner(s), the above described measuring method (items 8.1.1 - 8.1.3) must be modified as required to obtain accurate area measurements. Include any additional measurements and calculations required to determine the surface area under REMARKS.

__8.1.4 Calculate the minimum required surface area, SB.
$SB = 0.90 \times W_1 \times 610$ mm = _____ mm^2

__9. Requirement. The rear surface area, SA, of the barrier projected onto the vertical plane must be not less than 90 percent of the seat bench width, W_1, in millimeters of the seat immediately aft of the barrier multiplied by 610 (SB). (S5.2.2, S5.1.2 and *Interpretation letter to The CE White Co. dated November 19th, 2010*)
SA ≥ SB: _____Yes – Pass _____ No – Fail

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet 4
BUCKLE SIDE LENGTH LIMIT (S5.1.7)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
SEAT NUMBER: _____

__1. Determine the number of unique passenger seat designs installed in the school bus. Number of unique seat designs: _____

__2. For each unique seat design, establish a transverse limit plane 65 mm from the SgRP that is perpendicular to a transverse plane that passes through the SgRP at an angle of 50 degrees to the horizontal (as shown in Figure 12).

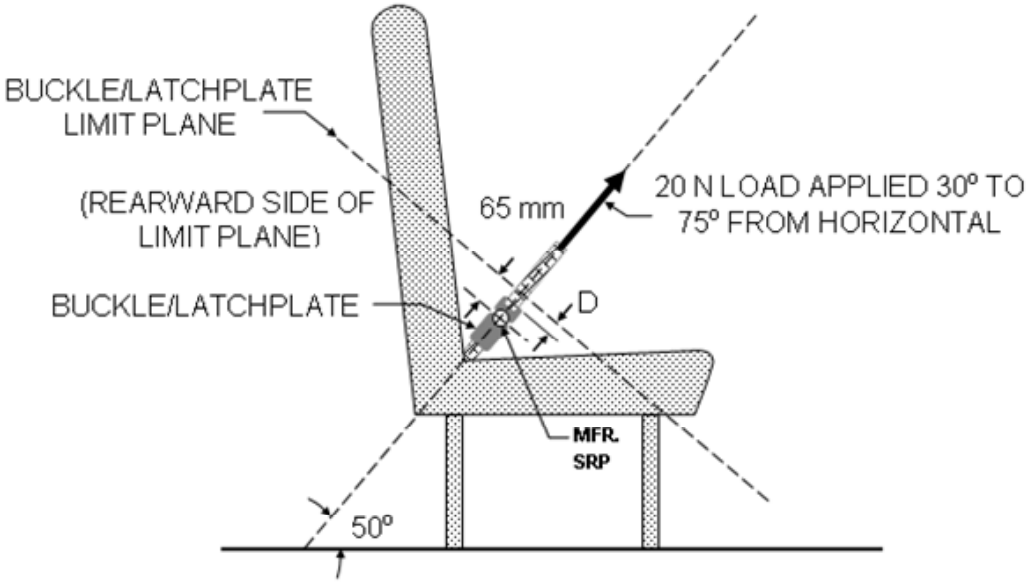


Figure 12

__3. Apply a test load to each seatbelt buckle/latchplate on each unique seat design as follows (S5.1.7.2):
- __3.1. Insert the seat belt latchplate into the seat belt buckle.
- __3.2. Apply a 20 N load to the buckle/latchplate assembly whose vector is in a vertical longitudinal plane.
- __3.3. Apply the load along the centerline of the webbing attached to the latchplate at least 100 mm from the nearest point on the latchplate.
- __3.4. Apply the load at any angle in the range of 30 to 75 degrees from horizontal. Record the test angle in Table 2.

__4. Determine the shortest dimension (D) from the buckle/latchplate assembly to the transverse limit plane. Record the results in Table 2.

__5. Requirement. All portions of the buckle/ latchplate assembly must remain rearward of the limit plane. (S5.1.7)

Table 2

Seat #	Seat Position (inboard/ outboard)	Angle of Applied Load (deg)	D (mm)	D >0	
				Yes – Pass	No – Fail
S1					
S2					
S3					
S4					

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 5
SMALL OCCUPANT SEAT BELT LABELING (S5.5)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number: _____

__1. Small occupant seat position permanently and legibly marked or labeled: **"Do Not Sit In Middle Seat If Over Age 10"**?
____ Yes – Pass ___ No - Fail

__2. Phrase comprised of no more than two lines of text?
____ Yes – Pass ___ No - Fail

__3. Label placed on the torso belt portion of the Type 2 seat belt?
____ Yes – Pass ___ No - Fail

__4. Plainly visible and easily readable when the seat belt is in a stored position?
____ Yes – Pass ___ No - Fail

__5. Distance from the top edge of the top line of text to the bottom edge of the bottom line of the text is at least 35 mm?
____ Yes – Pass ___ No - Fail

__6. If the label is sewn on, is it stitched around its entire perimeter?
____ Yes – Pass ___ No - Fail

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet 6
HEAD PROTECTION REQUIREMENTS (S5.3.1)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s): _____
Seat Number: _____

__1. Identify the head protection zone.

__1.1. Using the SgRP of the seat aft of the test seat or barrier as the reference point, mark the areas of the seat back, driver's seat, walls, barriers, stanchions, or other locations which fall into the head protection zone shown in Figure 13 and described below:

(a) Horizontal planes 305 mm [+6/ -0] and 1016 mm [+0/ -6] above the SgRP. (S5.3.1.1(a))

(b) A vertical longitudinal plane tangent to the inboard (aisle side) edge of the seat [+0/ -6]. (S5.3.1.1(b))

(c) A vertical longitudinal plane 83 mm [+6/ -0], inboard of the outboard edge of the seat. (S5.3.1.1(c))

(d) Vertical transverse planes through the SgRP [+6/ -0] and 762 mm [+0/ -6], forward of the SgRP, except any surface on the front of a seat back or restraining barrier 76 mm or more below the top of the seat back or restraining barrier. (S5.3.1.1(d) & S4)

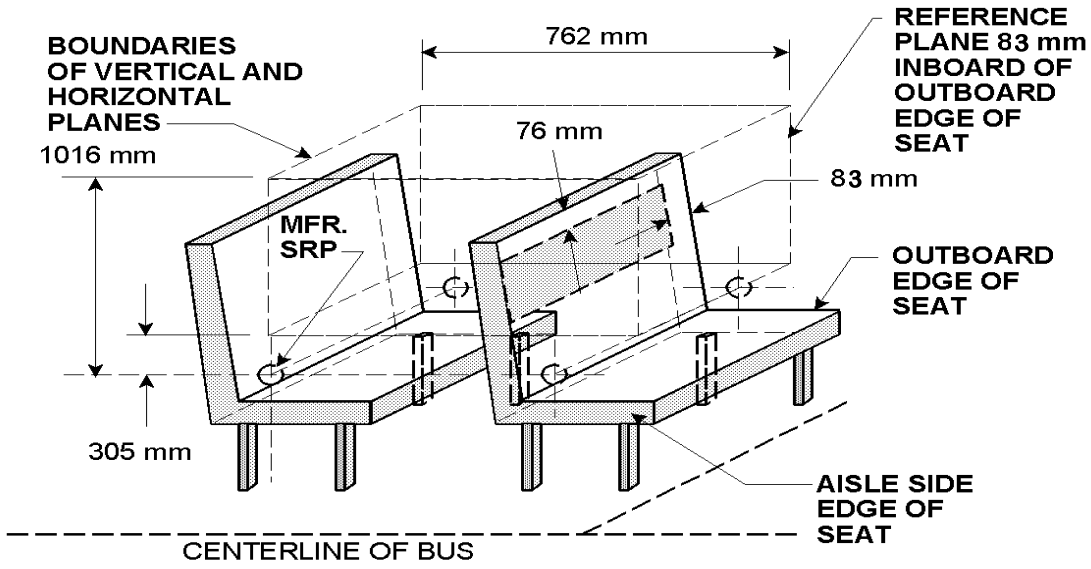


Figure 13

__1.2. Determine all surfaces that are located within the head impact zones. Any surface in the impact zone that is not a seat back, sidewall, window or door structure must be reported to the COTR. The COTR will decide whether any non-seat back surfaces shall be tested for compliance with head impact requirements. (S5.3.1.1)

__2. Conduct head form contact area test.

__ 2.1. Remove the seat(s) aft of the test seat or barrier and install a test fixture containing the head form in the same wall and/or floor mounting holes, if possible.

A diagram of one type of head form stroking device is shown in Figure 14. The contracted laboratory may use any type of stroking device which will accomplish the objective.

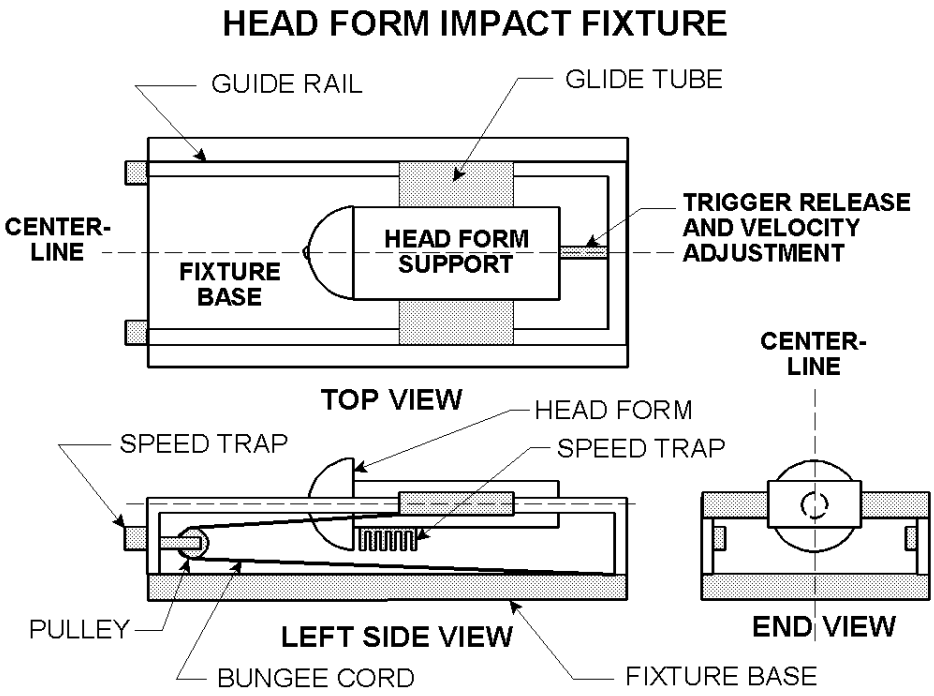


Figure 14

__ 2.2. Select 7 impact locations and impact angles within the head protection zone. **NOTE**: Stripping a previously tested seat to examine the padding, structure and metal frame location may be helpful in selecting the most suitable impact points.

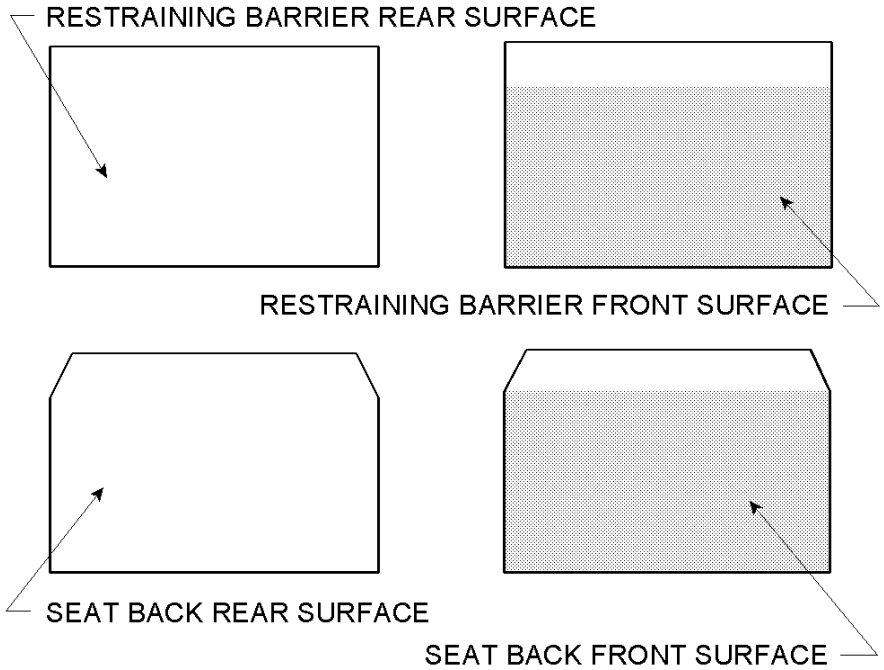


Figure 15

__2.2.1. Specify an x-y reference point on Figure 15 for the head form impact locations.

__2.2.2. Record the x-y description of each impact location with respect to the reference point in Table 3 and on Figure 15 by placing H1, H2, H3, H4, H5, H6 and H7 in the appropriate location.

__2.2.3. Record the impact angle of each impact location with respect to a defined reference plane in Table 3. No two locations in the same plane may be within a 102 mm radius of each other.

__2.2.4. Describe in writing the common reference point location and impact angle reference plane:

_____

_____

_____

__2.3. Coat the head form surface with a lipstick, Drum Beat Red, made by L'Oreal which will adhere to the seat cover fabric when the head form contacts it. The lipstick must be applied so that splatter is not recorded as contacted area. Equivalent contact mediums may be used in place of L'Oreal upon approval by the COTR.

__2.4. Impact the 7 locations with the head form traveling at a constant speed of 1.5 meters per second (m/s) [+0.08/ -0]. Record in Table 3, the velocity from the speed trap mounted on the stroking device.

__2.5. Digitally record the acceleration data from the time the head form begins moving. Attach plots of the acceleration versus time graphs for each impact to the test report.

__2.6. Integrate the acceleration to derive the velocity at impact and record the derived velocity in Table 3. Attach plots of the derived velocity versus time graphs for each impact to the test report.

__2.7. After each impact, blot the struck area with Keuffel & Esser No. 460862 graph paper, or equivalent, to record the contact print of the impact. Collect as much of the transfer medium on the paper as possible.

__2.8. Draw straight line connections around complete contact prints. The lines will connect the outer most extremities of the contact prints as shown in Figure 16.

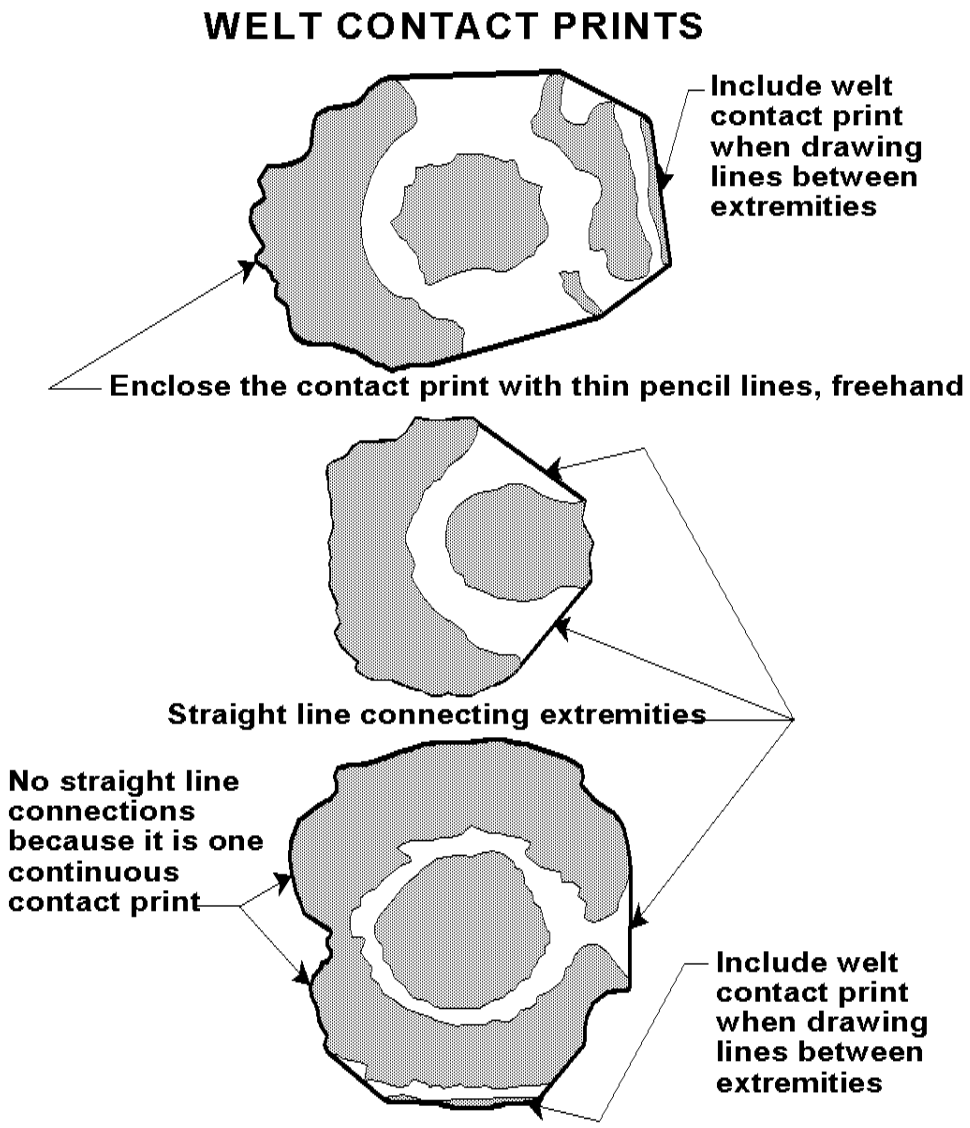


Figure 16

__2.9. Measure the encompassed area with a planimeter or an equivalent tool and record the area in Table 3.

__2.10. Attach each contact area print to the test report.

__3. Requirement. When any contactable surface within such zones as described by S5.3.1.1 is impacted from any direction at 1.5 m/s, the contact area on the head form shall be not less than 1,935 mm^2. Determine whether the contact area meets the minimum requirement for each impact location and record in Table 3. (S5.3.1.3)

Table 3

(1)	(2)			(3)	(4)	(5)	(6)	(7)
HEAD IMPACT	LOCATION			SPEED TRAP IMPACT SPEED (m/s)	DERIVED SPEED (m/s)	CONTACT AREA (CA) (mm2)	CA ≥ 1935 mm^2	
	X (mm)	Y (mm)	ANGLE (deg)				YES - PASS	NO - FAIL
H1								
H2								
H3								
H4								
H5								
H6								
H7								

__4. Conduct head form impact energy test.

__ 4.1 Select an additional 7 locations and impact angles in the head protection zone which are suitable with respect to the impact requirements (If necessary use another seat of the same design).

NOTE: Stripping a previously tested seat to examine the padding, structure and metal locations may be helpful in selecting the impact locations.

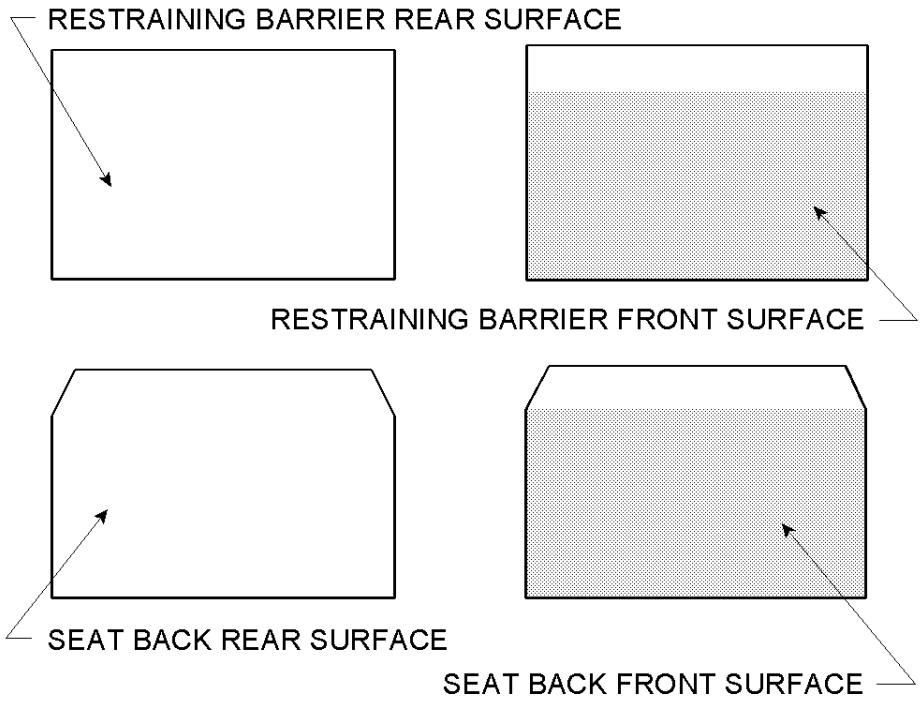


Figure 17

__4.1.1. Record the x-y description of each impact location with respect to the reference point (from item 2.3.1) in Table 4 and on Figure 17 by placing F1, F2, F3, F4, F5, F6 and F7 in the appropriate locations.

__4.1.2. Record the impact angle of each impact location with respect to a defined reference plane in Table 4. No two locations in the same plane may be within a 102 mm radius of each other.

__ 4.2 Impact the 7 locations with the instrumented head form at a constant speed (zero acceleration) of 6.7 m/s [+0/ -0.08], at the instant of impact. Record in Table 4, the velocity from the speed trap mounted on the stroking device.

__ 4.3 For each impact location, determine the velocity versus time plot using the acceleration versus time data. Verify velocity is constant prior to impact for both the area and impact/force distribution requirements. Verify the impact velocity from the plot within 0.61 m/s of the velocity as measured by the speed trap.

__ 4.4 Digitally record the acceleration data from the time the head form begins moving.

__ 4.5 Process the acceleration versus time data recorded from the head form accelerometer. Acceleration versus time plots, velocity versus time plots, and force versus time plots derived from acceleration data shall be included in the test reports.

__4.5.1. For each impact location, determine the maximum HIC value which can be calculated from the following expression by repetitive calculation using all possible t_1 and t_2 values on the acceleration versus time curve:

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

where "a" is the axial acceleration expressed as a multiple of "g" (acceleration due to gravity = 9.81 meters per second per second~~,~~ (m/s^2)). The algorithm for this calculation will be supplied by the COTR. (S5.3.1.2) Record these values in Table 4.

__4.5.2. For each impact location, determine the force vs. time plot using the acceleration vs. time plot. Attach this plot to the test report.

__4.5.3. Mark the point on the plot at which force reaches 667 newtons (N). Integrate the area under the curve to that point. Using the calculated quantity of the change in momentum, solve for v_F in the equation below:

$$\int_{t_0}^{t_f} F\,dt = m\,(v_F - v_0)$$

where,
F = the force on the head form at any point in time during impact
m = mass of head form = (51 N / 9.81 m/s^2) = 5.20 kg
v_0 = initial velocity = 6.7 m/s
v_F = final velocity (when F = 667 N)

t_0 = time at impact
t_F = time at force requirement (when F = 667 N)

__4.5.4. Using the final velocity value, v_F, found above, calculate the energy required to deflect the impacted surface material with the equation below:

$$\text{Energy} = \tfrac{1}{2}\, m\, (v_F^2 - v_0^2)$$

__4.5.5. Record this value for each impact location in Table 4. Show all calculations in the test report.

__5. Requirement. When any contactable surface of the vehicle within the zones specified in S5.3.1.1 is impacted from any direction at 6.7 m/s by the head form described in S6.6, the HIC shall not exceed 1,000. Determine whether the maximum HIC meets the minimum criteria for each impact location and record in Table 4. (S5.3.1.2)

__6. Requirement. When any contactable surface of the vehicle within the zones specified in S5.3.1.1 is impacted from any direction at 6.7 m/s by the head form described in S6.6, the energy necessary to deflect the impacted material shall not be less than 4.5 joules before the force level on the head form exceeds 667 N. Determine whether the required energy meets the minimum criteria for each impact location and record in Table 4. (S5.3.1.3)

Table 4

(1)	(2)			(3)		(4)	(5)	(6)	(7)		(8)	
HEAD IMPACT	LOCATION			SPEED TRAP IMPACT SPEED (m/s)	REQUIRED SPEED (m/s)	DERIVED SPEED (m/s)	MAX HIC	ENGY REQD (J)	MAX HIC < 1000		ENERGY REQUIRED > 4.5 J	
	X (mm)	Y (mm)	ANGLE (degrees)						YES - PASS	NO - FAIL	YES - PASS	NO - FAIL
F1												
F2												
F3												
F4												
F5												
F6												
F7												

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 7
KNEE FORM IMPACT TEST (S5.3.2)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number: _____ Barrier Number:_____

__1. Determine the leg protection zone. Mark the areas of the seat back or barrier which lies within a horizontal plane 305 mm [+0/ -6] above and 102 mm [+0/ -6] below the SgRP of the seat immediately aft of the test specimen as shown in Figure 18. (S5.3.2.1)

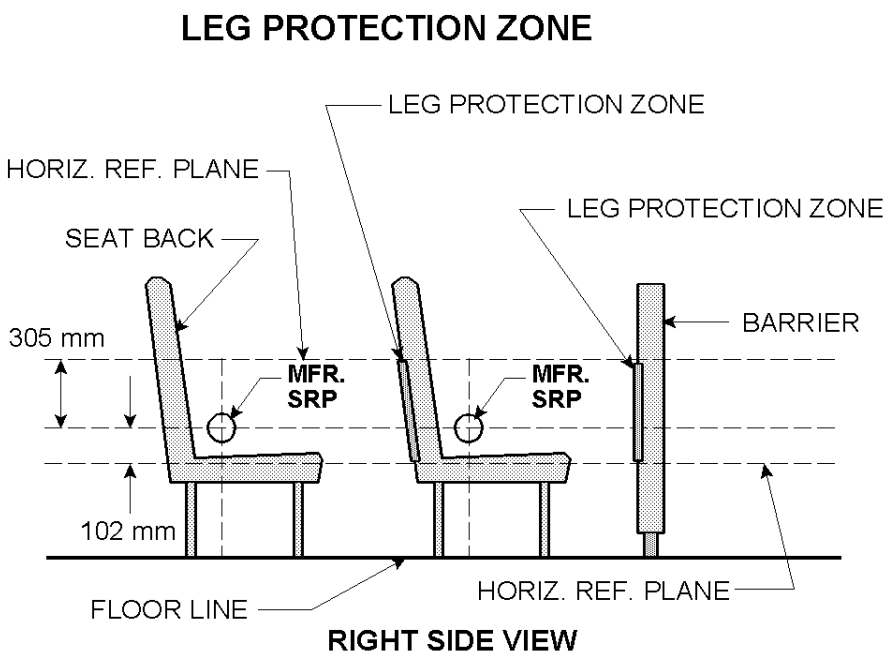


Figure 18

__2. Conduct knee form impact test.
__2.1. Remove the seat(s) aft of the test seat or restraining barrier and install the impact fixture containing the instrumented knee form.
__2.2. Select 8 impact locations and impact angles in this zone which are suitable with respect to the impact requirements.

NOTE: Stripping a previously tested seat to examine the padding, structure and metal locations may be helpful in selecting the impact points.
Record the x-y description of each location with respect to a common reference point.

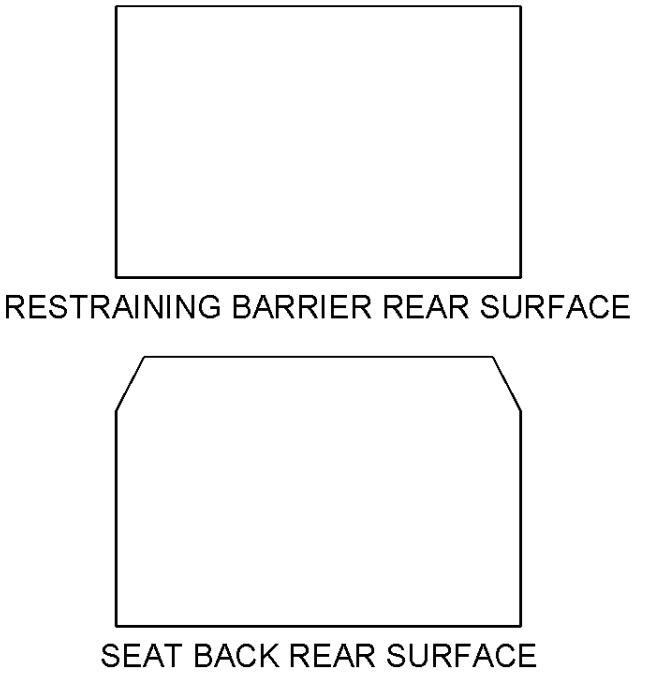


Figure 19

__2.2.1. Specify an x-y reference point on Figure 19 for the knee form impact locations.

__2.2.2. Record the x-y description of each impact location with respect to the reference point in Table 5 and on Figure 19 by placing K1, K2, K3, K4, K5, K6, K7, and K8 in the appropriate location.

__2.2.3. Record the impact angle of each impact location with respect to a defined reference plane in Table 5. No two locations in the same plane may be within a 102 mm radius of each other.

__2.2.4. Describe in writing the common reference point location and impact angle reference plane:

_____

_____

_____

__2.3. Coat the knee form with the same substance used to define contact area for the head form test (lipstick made by L'Oreal — Drum Beat Red) insuring that "splatter" will be negligible at impact.

__2.4. Impact locations K1 through K4 of the selected locations at a constant speed (zero acceleration) of 4.9 m/s [+0.08/ -0] to check the contact area. Impact the remaining locations K5 though K8 at 4.9 m/s [+0/ -0.08] to check the resistive force. Record the impact velocity from the speed trap in Table 5 for each impact.

__2.5. Digitally record the acceleration data from the time the knee form begins moving.

__2.6. Integrate the acceleration to derive the velocity at impact and record the derived velocity in Table 5. Using the velocity versus time plot, verify the velocity is constant prior to impact for both the area and impact/force

distribution requirements. Verify the impact velocity from the plot within 0.61 m/s of the velocity as measured by the speed trap.

__2.7. Measure contact area using the procedure described in the head form impact test (items 2.7 through 2.10 of 0) and record each contact area measurement in Table 5. Attach each contact area print to the test report.

__2.8. Produce a force versus time plot from the recorded acceleration versus time curve. Use this plot to determine the peak resistive force. Record the resistive force for each impact in Table 5.

__2.9. Acceleration versus time plots, velocity versus time plots, and force versus time plots derived from acceleration data for each impact shall be included in the test reports.

__3. Requirement. When any point on the rear surface of a seat back or restraining barrier within any zone specified in S5.3.2.1 is impacted from any direction at 4.9 m/s by the knee form specified in S6.7, the resisting force of the impacted material shall not exceed 2,669 N and the contact area of the knee form surface shall not be less than 1,935 mm^2.

Table 5

(1)	(2)			(3)		(4)	(5)	(6)	(7)		(8)	
KNEE IMPACT	LOCATION			SPEED TRAP IMPACT SPEED (m/s)	REQ'D SPEED (m/s)	DERIVED SPEED (m/s)	CONT. AREA mm^2	RESIST FORCE (N)	CONTACT AREA > 1935 mm^2		RESISTIVE FORCE < 2669 N	
	X (mm)	Y (mm)	ANGLE (degrees)						Yes - Pass	No - Fail	Yes - Pass	No - Fail
K1												
K2												
K3												
K4												
K5												
K6												
K7												
K8												

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 8
SEAT CUSHION LATCHING AND RETENTION TEST (S5.1.5)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number: _____

__1. Evaluate seat cushion latching.
  __1.1. Is the passenger seat cushion designed to be removable without tools or to flip up?
    ____ Yes – Complete items 1.2 though 1.5 ____ No – Go to item 2
  __1.2. Is the seat equipped with a self-latching mechanism? (S5.1.5 (a))
    ____ Yes – Pass ____ No – Fail
  __1.3. Release the seat cushion self-latching mechanism. Lift the seat cushion then place the seat cushion back in the down position without activating the self-latching mechanism, if possible.
  __1.4. Apply a downward force of 216 N [+10/ -0] using a force distribution pad of 102 mm radius (or a rectangular pad of equivalent area in cases where the circular pad cannot be used), to the center of the top of the seat cushion. The downward force shall be applied in any period of not less than 1 and not more than 5 seconds, and maintained for 5 seconds [+1.0/ -0.0].
  __1.5. After application of the downward force, proceed directly to item 2.
__2. Assess seat cushion retention.
  __2.1 Measure and record the seat cushion weight, C (measured from a different seat of the same design as the test seat).
    C = _____ kg
  __2.2 Multiply the cushion weight, C, by five to calculate the retention test force, F.
    F = C x 5 x 9.81 m/s^2= _____ N
  __2.3 Using the upward load fixture with a force distribution pad of 102 mm radius (or a rectangular pad of equivalent area in cases where the circular pad cannot be used), apply an upward force, F [+0/ -10] (calculated above), to the center of the bottom of the seat cushion. The upward force shall be applied in any period of not less than 1 and not more than 5 seconds, and maintained for 5 seconds [+1.0/ -0.0].
__3. Requirement. A seat cushion that is equipped with a self-latching mechanism shall not separate from the seat at any attachment point when subjected to the conditions specified in item 1 followed by those in item 2. (S5.1.5 (a)) A seat cushion that is removable only with the use of tools shall not separate from the seat at any attachment point when subjected to the conditions specified in item 2. (S5.1.5 (b)) Did the seat cushion separate at any attachment point?
  ____ No – Pass ____ Yes – Fail
__4. Describe the seat cushion attachments:_____

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet 9
SEAT BACK QUASI-STATIC TEST (S5.1.6)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number(s): _____ Seat Type and Test Configuration: _____

Quasi-Static Test – Seat Preparation and Measurements

__1. Select a passenger seat in the bus that has another seat located behind it. Remove the seat(s) rearward of the test seat and install the loading fixture (a typical seat back loading fixture is shown in Figure 20) in place using the same floor and/or wall mounting holes, if possible.

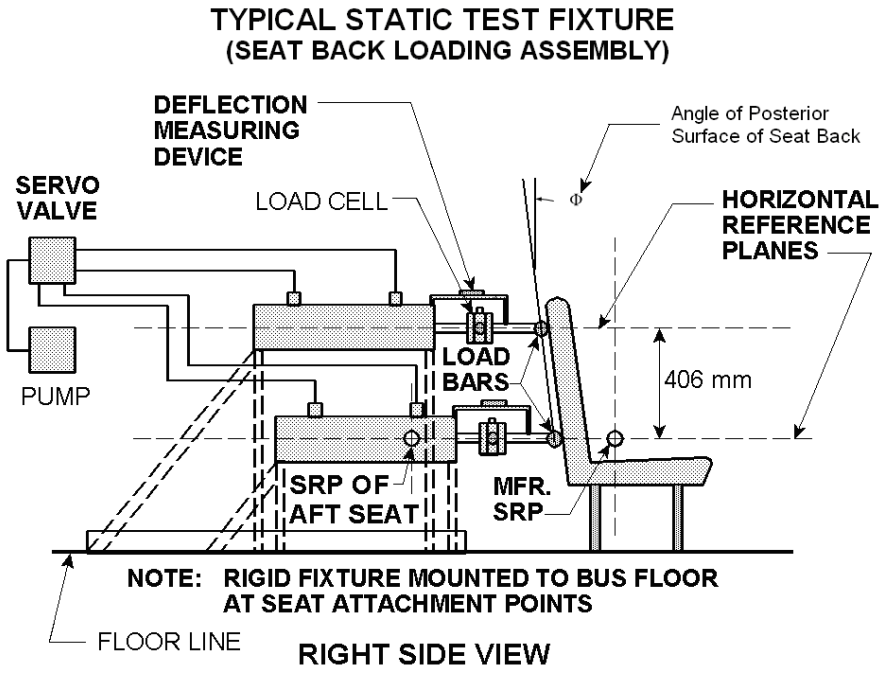


Figure 20

__2. Remove the seat(s) and/or barrier forward of the test seat and install the loading fixture (a typical torso belt loading fixture is shown in Figure 21) in place using the same floor and/or wall mounting holes, if possible.

__3. Record all instrument settings, equipment serial numbers, and zero and calibration checks.

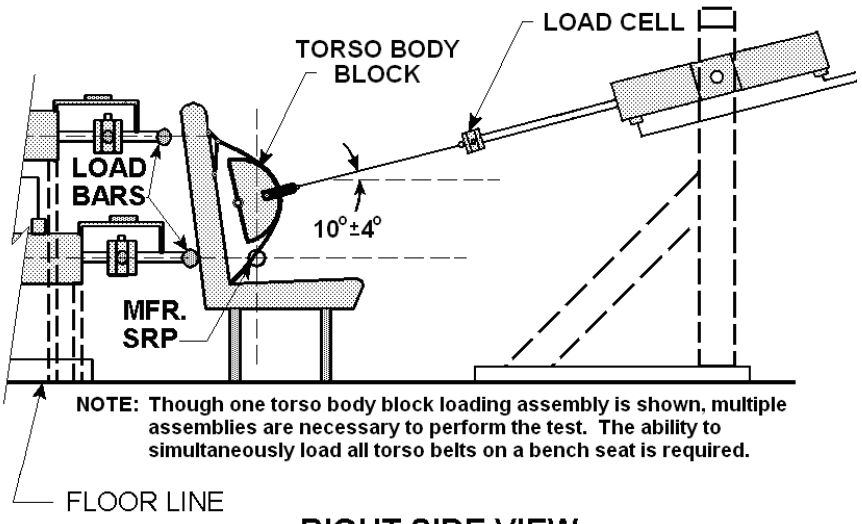
_____

_____

_____

_____

TYPICAL STATIC TEST FIXTURE
(TORSO BELT LOADING ASSEMBLY)



RIGHT SIDE VIEW

Figure 21

__4. Measure and record the maximum transverse seat bench width, X.
X = ____ mm

__ 4.1. Determine the number of seating positions, W. (S4.1(b))
W = X / 380 (round to the nearest whole number) = ____

__ 4.2. Determine the required number of Type 2 seat belt positions, Y, on a flexible occupancy seat in a minimum occupancy configuration or a fixed occupancy seat. (S4.1(c))
Y = X / 380 (round to the next lowest whole number) = ____

__5. Is the seat a flexible occupancy seat according to the definition in section 11.7?
____ Yes – Complete 5.1 through 5.3 ____ No – Go to Item 6

__5.1. Choose a second seat of the same design to be tested so that both the minimum and maximum occupancy configurations can be evaluated. If there are not enough seats in the bus to perform both quasi-static tests in addition to the other tests specified in this procedure, the COTR will determine which tests will be conducted.

__5.2. Determine the minimum seat bench width, Z, for the maximum occupancy configuration. (S4.1(d))
Z = (Y+1)(330) = ____ mm

__5.3. Is maximum seat bench width, X, greater than or equal to the minimum required seat bench width, Z, for a flexible occupancy seat?
X ≥ Z: ____ Yes - Pass ____ No – Fail

__6. Give a written description of the Seating Reference Point (SgRP) location as provided by the manufacturer:

_____

_____

_____

__7. Determine whether the seat back inclination is adjustable.

_____ Yes – Complete 7.1 through 7.3 _____ No – Go to Item 8

__7.1. If the seat back inclination is adjustable, notify the COTR prior to testing the seat.

__7.2. Place the adjustable seat back in the manufacturer's normal design riding position. If the seat back inclination is not specified, place the seat back in the most upright position. (S5.1.6.3)

__7.3. Describe the positioning of the adjustable seat back to be used for the test:

_____

_____

_____

__8. Measure and record the torso belt anchor point height(s), **AH**, relative to the SgRP. Refer to Figure 6 for a visual depiction of the anchor point height, **AH**. If adjustable, measure the height with the anchor point in its highest position and maintain this position throughout the test.

	Occupant Position		
	Left	Center	Right
Anchor point height, **AH** (mm)			

Locate and mark a point on the posterior of the seat back horizontally rearward of each torso belt anchor point. These points transferred to the posterior of the seat back will be referred to as seat back points. (S5.1.6.1)

__9. Is the torso belt adjusted height for any seating position achieved by a method other than an adjustable anchor point?

_____ Yes – Complete 9.1 through 9.4 _____ No – Go to Item 10

__9.1. Give a written description of the torso belt height adjuster assembly and operation:

_____

_____

_____

__9.2. For each torso belt height adjuster other than an adjustable anchor point, initially place the torso belt adjusted height at its highest position then move the adjustment device 38 mm [± 6] downward with respect to its webbing or guide material. Measure and record the distance from its highest position. Leave the adjusters in this position for the remainder of the test. (S5.1.6.5.1)

	Occupant Position		
	Left	Center	Right
Torso belt adjuster distance from highest position (mm)			

__9.3. Measure and record the torso belt adjusted height, TBAH, relative to the SgRP.

__ 9.3.1. Extend the torso portion of the seat belt until the retractor stop is reached. Apply a 20 N load to the webbing in the forward horizontal direction. The load shall be applied at least 100 mm forward of the torso belt adjustment device and slack shall remain in the portion of the belt between its bottom anchorage and the point of force application.

__ 9.3.2. While maintaining the 20 N load, measure and record the vertical torso belt adjusted height (TBAH) from the SgRP to a point on the webbing that lies within 25 to 75 mm forward of the adjustment device. This height is illustrated in Figure 6.

	Occupant Position		
	Left	Center	Right
Torso belt adjusted height (TBAH) relative to the SgRP (mm)			

__9.4. Clearly mark the torso belt adjuster position on the webbing or guide material so slippage can be detected and measured.

__10. Establish a transverse vertical reference plane forward of the seat and a transverse vertical reference plane rearward of the seat. Measure the longitudinal distance from the SgRP to the front reference plane (FRP) and from the SgRP to the rear reference plane (RRP).

__10.1. Measure and record the distance from the SgRP to the FRP. ____ mm

__10.2. Measure and record the distance from the SgRP to the RRP. ____ mm

__11. Position the lower loading bar so that it is centered laterally behind the seatback and the pivot and stroking device are in a horizontal plane through the SgRP, ± 6 mm. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] less than the width of the seat back at the loading bar height.

__11.1. Measure and record the vertical distance from the center of the lower loading bar to the SgRP (use [+] for values above and [–] for values below the SgRP)
____ mm

__11.2. Measure and record the length of lower loading bar.
____ mm

__11.3. Measure and record the width of seat back at the lower loading bar height .
____ mm

__11.4. Apply and maintain a load of 44 N [+4/ -0] through the lower loading bar. Record the applied load.
____ N

__12. Position the upper loading bar so that it is centered laterally along the seat back and the pivot attachment point and stroking device are in a horizontal plane 406 mm [± 6 mm] above the SgRP (as shown in Figure 20). Adjust the length of the loading bar such that it is 102 mm [+13/ -6] less than the width of the seat back at the loading bar height.

__12.1. Measure and record the vertical distance from the center of upper loading bar to the SgRP.
____ mm

__12.2. Measure and record the length of upper loading bar.
____ mm

__12.3. Measure and record the width of seat back at the upper loading bar height.
____ mm

__12.4. Apply and maintain a load of 44 N [+4/ -0] through the upper loading bar. Record the applied load.
____ N

__13. While maintaining the loads in items 11 and 12, measure the initial seat back angle, the initial torso belt anchor point distance relative to the FRP, and the initial seat back point distance to the RRP.

__13.1. Measure and record the angle from vertical of a line that passes through the geometric center of each loading bar (see Figure 20). Record this value as seat back angle **Φ**.
Φ = ____ degrees from vertical

__13.2. Measure and record the longitudinal distance from the torso belt anchor points to the FRP.

	Occupant Position		
	Left	Center	Right
Torso belt anchor point to FRP (mm, horizontal)			

__13.3. Measure and record the longitudinal distance from the seat back transferred points to the RRP.

	Occupant Position		
	Left	Center	Right
Seat back point to RRP (mm, horizontal)			

__14. Remove the load and back both loading bars away from the seat back.

__15. Establish torso belt anchor and seat back point displacement limits. (S5.1.6.1)

__15.1. Select the appropriate torso belt anchor point displacement limit equation for the school bus class.
____ Class 1 Limit = (**AH** + 100)(tan**Φ** + 0.242/cos**Φ**)
____ Class 2 Limit = (**AH** + 100)(tan**Φ** + 0.356/cos**Φ**)

__15.2. For each tested occupant position, calculate the displacement limit from anchor point height (**AH** from item 8 above) and seat back angle (**Φ** from item 13.1 above) using the equation selected in item 15.1 above.

	Occupant Position		
	Left	Center	Right
Torso belt anchor point displacement limit (mm)			

__15.3. Select the appropriate seat back point displacement limit equation for the school bus class.
____ Class 1 Limit = (**AH** + 100)(tan**Φ** + 0.174/cos**Φ**)
____ Class 2 Limit = (**AH** + 100)(tan**Φ** + 0.259/cos**Φ**)

__15.4. For each tested occupant position, calculate the displacement limit from the anchor point height (**AH**) and seat back angle (**Φ**) using the equation selected in Item 15.3 above.

	Occupant Position		
	Left	Center	Right
Seat back point displacement limit (mm)			

Quasi-Static Test - Lower Loading Bar Positioning and Force Application

__16. Position the lower loading bar such that it is centered laterally behind the seatback and the pivot and stroking device are in a horizontal plane which is located in a vertical zone between 102 mm [+0 / -6] above and 102 mm [+0 / -6] below the SgRP of the seat aft of the test seat. (See Figure 22 for lower load bar position.) (S5.1.6.5.2) Measure and record the vertical distance from the center of the lower loading bar to the SgRP (use [+] for values above and [–] for values below the SgRP).
____ mm

__17. Apply a load through the lower loading bar.

__17.1. Apply a load through the lower loading bar pivot point equal to 3,114W N [+44/ -89] (the number of seating positions, W, from item 4.1, multiplied by 3,114).
Record the applied load: _____ N

__17.2. Reach this load in not less than 5 seconds and not more than 30 seconds. Hold the load for 1 to 3 seconds, after which, drop the load to 1,557W N [+0/ -44]. (See Figure 23 for a sample force/time trace)
Record the reduced load: _____ N

__17.3. Lock the stroking device in place at this time to maintain the displacement. (S5.1.6.5.3)

__17.4. Include the plot of the Force versus Time trace in the test report.

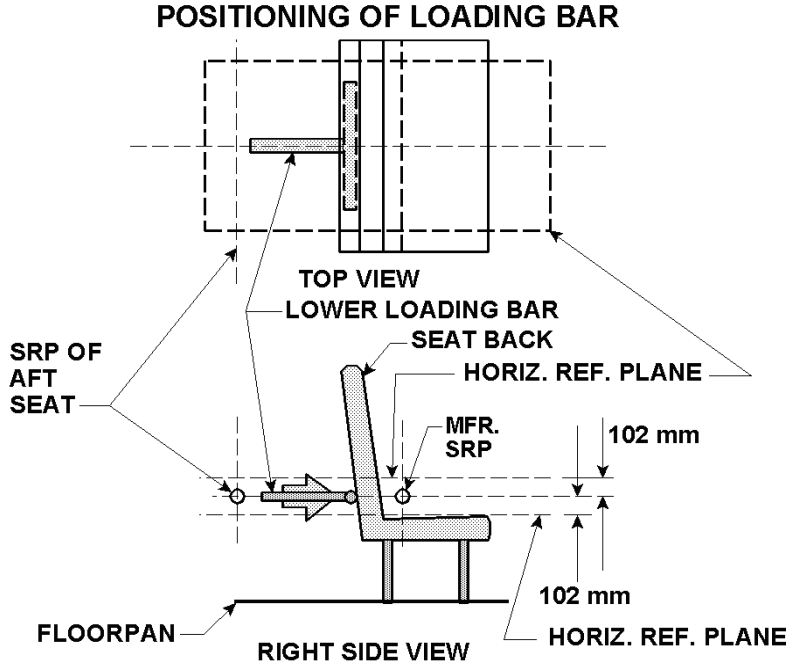


Figure 22

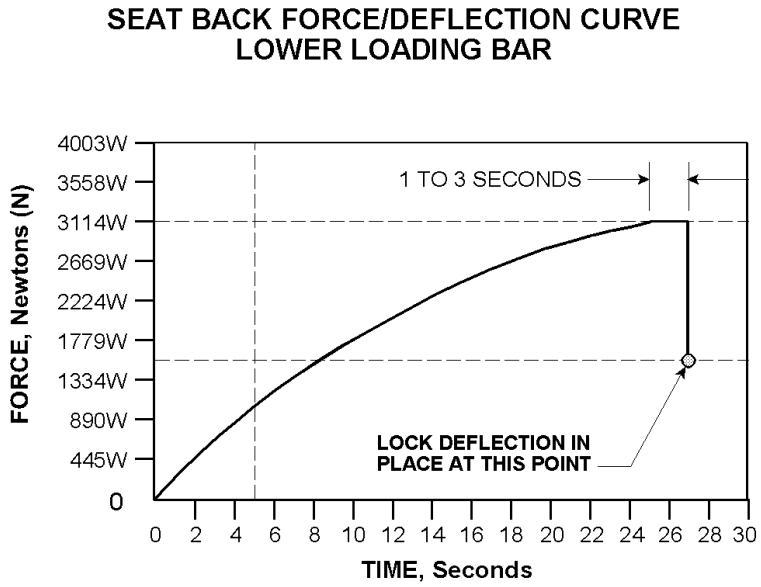


Figure 23

Quasi-Static Test - Torso Block Positioning and Force Application

__18. Position a torso body block under each of the Type 2 seat belts appropriate for the seat type and configuration. Record the size of the body block used. For a fixed occupancy seat, Y seat belt positions will be loaded. For a flexible occupancy seat, Y or Y+1 seat belt positions (at the discretion of the COTR) will be loaded. Record the test configuration below. Attach the load cells to the body block load application cables and connect the load application device to the load cells. The load application devices shall be positioned such that the angle of pull is 10° [± 4] above the horizontal. The plane of load application in the plan view shall be parallel to the test vehicle centerline [± 3°]. (See Figure 24 for torso block positioning).
Test configuration (Y or Y+1): _____

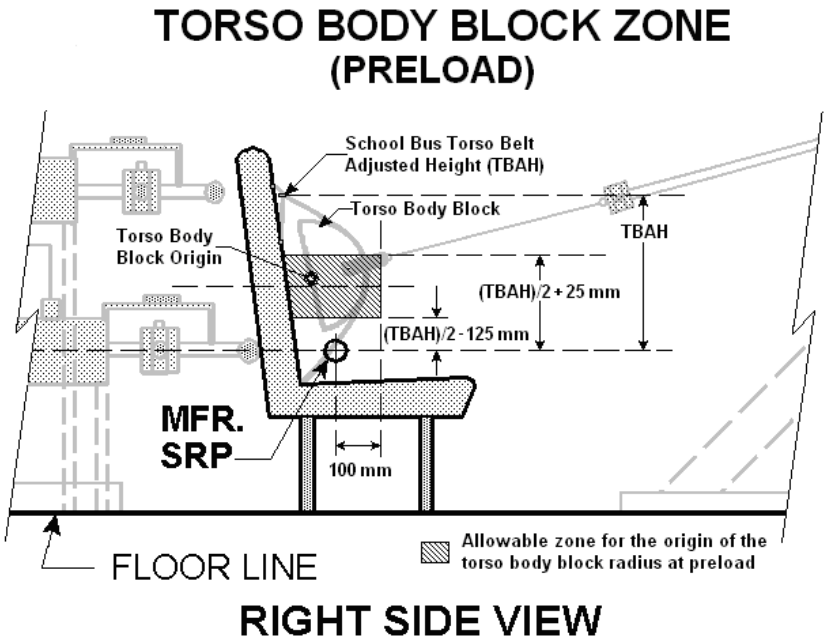


Figure 24

__19. Apply a preload of 600 N [± 50] to each torso body block. Measure and record the load application angle. (S5.1.6.5.4)

	Occupant Position		
	Left	Center	Right
Torso body block load application angle (degrees)			

__20. Requirement. After preload application is complete, the origin of the 203 mm body block radius at any point across the 102 mm body block thickness shall lie within the zone defined as:

(a) At or rearward of a transverse vertical plane of the vehicle located 100 mm longitudinally forward of the SgRP.

(b) Within 75 mm of the horizontal plane located midway between the horizontal plane passing through the school bus torso belt adjusted height (TBAH), and the horizontal plane 100 mm below the SgRP. (See Figure 24)

Does the origin for each torso body block fall within the prescribed zone? (S5.1.6.5.4)

____ Yes – Continue to item 21 ____ No – Notify the COTR

__21. For fixed occupancy seats or flexible occupancy seats in the minimum occupancy configuration (Y occupants), continue to item 21.1. For flexible occupancy seats in the maximum occupancy configuration (Y+1 occupants), go to item 22.

__21.1. Determine the torso block force which is appropriate for the school bus GVWR, seat type and seat configuration.

__21.1.1. Determine the check value, T, from the seat bench width (X) from item 4 and the number of seating positions (Y) from item 5 to be used in the true expression.

T = X – 380Y = _____

__21.1.2. Determine the appropriate torso block force required from Table 6 and record below:
Applicable torso block test load: _____ N

Table 6

School Bus Gross Vehicle Weight Rating	True Expression	Applied Force
Class 1 (GVWR > 4,536 kg)	T ≤ 25	3,300 N
Class 1 (GVWR > 4,536 kg)	T > 25	5,000 N
Class 2 (GVWR ≤ 4,536 kg)	T ≤ 25	5,000 N
Class 2 (GVWR ≤ 4,536 kg)	T > 25	7,500 N

For school buses with the gross vehicle weight rating shown in the first column, if the expression in the second column is true, simultaneously apply the force listed in the third column to each body block.

__22. For flexible occupancy seats in the maximum occupancy configuration (Y+1 occupants), continue to item 22.1. For all other seats, go to item 23.

__22.1. Determine the appropriate torso block force for the school bus GVWR from Table 7 and record below:
Applicable torso block test load: _____ N

Table 7

School Bus Gross Vehicle Weight Rating	Applied Force
Class 1 (GVWR > 4,536 kg)	3,300 N
Class 2 (GVWR ≤ 4,536 kg)	5,000 N

For school buses with the gross vehicle weight rating shown in the first column, simultaneously apply the force listed in the second column to each body block.

__23. Simultaneously apply the applicable torso block test load [-50/ -100] to each body block in not less than 5 and not more than 30 seconds. Maintain the applied load and complete items 23.1 to 23.4 below. (S5.1.6.5.5 & S5.1.6.5.6):

__23.1. Record the applied test loads below :

	Occupant Position		
	Left	Center	Right
Torso block test load applied (N)			

__23.2. Measure and record the longitudinal distance from the torso belt anchor points to the FRP.

	Occupant Position		
	Left	Center	Right
Torso belt anchor point to FRP (mm, horizontal)			

__23.3. Measure and record the longitudinal distance from the seat back transferred points to the RRP.

	Occupant Position		
	Left	Center	Right
Seat back point to RRP (mm, horizontal)			

__23.4. Measure and record the slippage of the height adjusters on their webbing or guide material.

	Occupant Position		
	Left	Center	Right
Torso belt height adjuster slippage (mm)			

__24. Release the body block loads and remove the body blocks from the seat.

__25. Requirement. Any school bus torso belt anchor point must not displace horizontally forward from its initial position (when **Φ** was determined) more than the value in millimeters calculated in item 15.2. (S5.1.6.1(a))

__25.1. For each tested occupant position, subtract the values in item 23.2 from those in the same column in item 13.2 and record below:

	Occupant Position		
	Left	Center	Right
Torso belt anchor point displacement (mm)			

__25.2. Is the value for each occupant position in Item 25.1 less than or equal to the limit calculated in item 15.2?

____ Yes – Pass ____ No – Fail

__26. Requirement. Any point directly rearward of any school bus torso belt anchor point on the rear facing surface of the seat back (seat back point) must not displace horizontally forward from its initial position (when **Φ** was determined) more than the value in millimeters calculated in item 15.4. (S5.1.6.1(b))

__26.1. For each tested occupant test position, subtract the values in Item 13.3 from those in the same column of Item 23.3 and record below:

	Occupant Position		
	Left	Center	Right
Seat back point displacement (mm)			

__26.2. Is the value for each occupant test position in Item 26.1 less than or equal to that in Item 15.4?

____ Yes – Pass ____ No – Fail

__27. Requirement. If the torso belt adjusted height is achieved without the use of an adjustable torso belt anchorage, the adjustment device must not slip more than 25 mm along the webbing or guide material upon which it moves for the purpose of adjusting the torso belt height. (S5.1.6.2)

Is the value for each occupant test position in item 23.4 less than or equal to 25 mm?

___ Yes – Pass ____ No – Fail

__28. Was a failure recorded in any of items 25.2, 26.2, or 27.1?
____ YES – **Halt testing Notify the COTR** ____ NO – Go to Item 29

Quasi-Static Test - Upper Loading Bar Positioning and Force Application

__29. Position the upper loading bar so that it is centered laterally along the seat back and the pivot attachment point and stroking device are in a horizontal plane 406 mm [± 6] above the SgRP. (S5.1.6.5.7)
Measure and record the vertical distance from the upper loading bar to the SgRP.
____ mm

__30. Apply a preload of 44 N [+4/ -0] through the upper loading bar. (S5.1.6.5.7)
Record the applied preload: _____ N

__31. Deflect the seat back.

__31.1. The contractor's test engineer shall pick an amount of time between 5 and 30 seconds in which the seat back will be deflected. Using this time limit the test engineer will determine a movement rate (mm per second) for the upper loading bar. (S5.1.6.5.7)
Selected movement rate: _____ mm/s

__31.2. Deflect the seat back at the rate determined above until one of the following conditions is met:
a. The maximum allowable deflection of 356 mm [+6/ -0] is reached; or
b. The force exceeds the upper bound of the force vs. deflection zone shown in Figure 25 by 50 N [-0/ +50] or.
Record which condition was met first: _____

__31.3. When one of the conditions of item 31.2 is met, stop deflecting the seat back, maintain the load for 5 to 10 seconds and then immediately back the loading bar away from the seat back at the selected movement rate from item 31.1. Inspect attachment points and component joints for separations. (S5.1.6.5.7)

__31.4. Record the post test zero and calibration check.

_____

_____

__31.5. Show the force versus deflection for the upper loading bar on an x-y plot.

__31.6. Using a planimeter or an equivalent tool, measure the area bounded by the force/ deflection curve (energy) and record below. This is the energy absorbed by the seat back.
____ N-m

__31.7. Determine the energy absorption limit of the seat back by multiplying 452 joules by the number of seating positions, W.
452 J x W = _____ J

__32. Requirement. The seat back must absorb at least 452W joules of energy within the first 356 mm of displacement as measured from the position at which the initial application of 44 N of force is attained. The maximum load must stay below the upper boundary of the force/-deflection zone of Figure 25 throughout the displacement. (S5.1.6.5.7)

__32.1. Does the energy absorbed by the seat back, measured in item 31.6, meet or exceed the energy absorption limit calculated in item 31.7?
____ Yes – Pass ____ No – Fail

__32.2. Does the force/deflection curve fall within the upper boundary shown in Figure 25?

____ Yes – Pass ____ No – Consult COTR

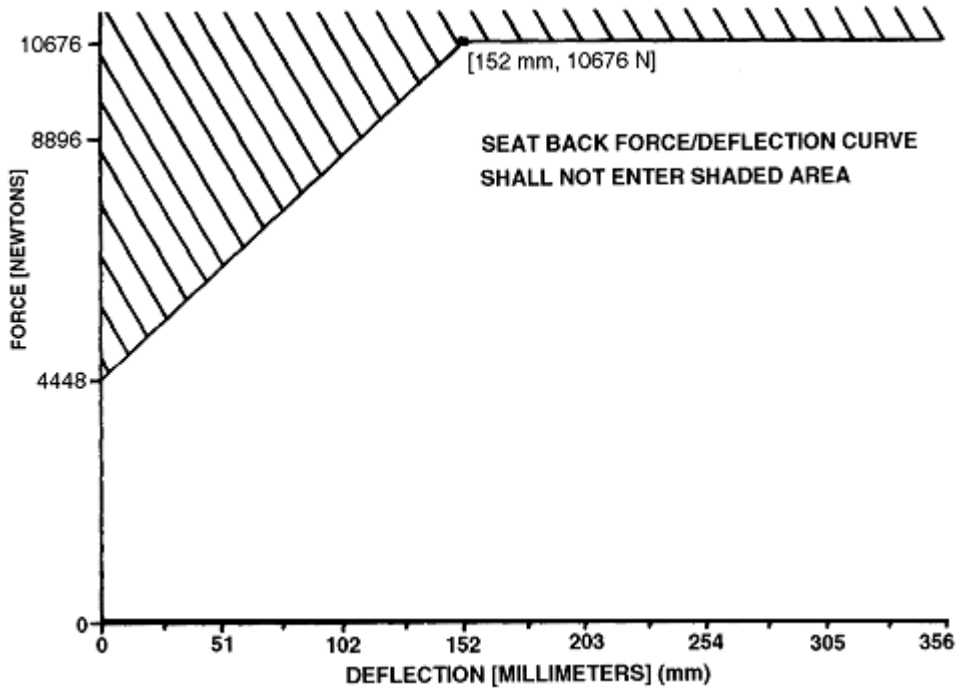


Figure 25

__32.3. Include the x-y plot of deflection versus time, as well as force versus deflection for the upper loading bar with the boundaries of Figure 25 superimposed.

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 10
SEAT BACK FORCE DEFLECTION TEST – FORWARD (S5.1.3)

School Bus NHTSA No._____ Test Date:_____
Laboratory:_____ Test Technician(s):_____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Select a passenger seat (test seat) in the bus that has another passenger seat located behind it.

__2. Measure the seat dimensions of the seat aft of the test seat.

__2.1. Measure and record the maximum transverse seat bench width, X.
X = ____ mm

__2.2. Determine the number of seating positions, W.
W = X / 380 (round to nearest whole number) = _____

__3. Give a written description of the Seating Reference Point (SgRP) location of the seat aft of the test seat as provided by the manufacturer:

_____

_____

__4. Mark a horizontal line across the rear surface of the test seat at the same vertical height as the SgRP of the seat aft of the test seat.

__5. Remove the seat(s) rearward of the test seat and install the loading fixture in its place using the same floor and/or wall mounting holes, if possible. A suggested loading bar test device is shown in Figure 20.

__6. Record all instrument settings, equipment serial numbers, and zero and calibration checks.

_____

_____

__7. Position the lower loading bar such that it is centered laterally behind the seat back and the pivot and stroking device are in a horizontal plane that is located in a vertical zone between 102 mm [+0 / -6] above and 102 mm [+6 / -0] below the SgRP of the seat aft of the test seat. The lower loading bar positioning is illustrated in Figure 22. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] less than the width of the seat back at the loading bar height. (S5.1.3.1)
Measure and record the vertical distance from the center of the lower loading bar to the SgRP (use [+] for values above and [–] for values below the SgRP). ____ mm

__8. Apply a load through the lower loading bar.

__8.1. Apply a load through the lower loading bar pivot point equal to 3,114W newtons [+44/ -89] (the number of seating positions, W, from item 2.2, multiplied by 3,114). (S5.1.3.2)
Record the applied load: _____ N

__8.2. Reach this load in not less than 5 seconds and not more than 30 seconds. Hold the load for 1 to 3 seconds then reduce the load to 1,557W N [+0/ -44]. (S5.1.3.3)
Record the reduced load: _____ N

__8.3. Lock the stroking device in place to maintain the displacement.

__9. Position the upper loading bar so that it is centered laterally along the seat back and the pivot attachment point and stroking device are in a horizontal plane 406 mm [± 6]

above the SgRP. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] shorter than the width of the seat back at the loading bar height. (S5.1.3.3)

__9.1. Measure and record the vertical distance from the upper loading bar to the SgRP. ____ mm

__9.2. Apply a preload of 44 N [+4/ -0] through the upper loading bar. (S5.1.3.3)

__10. Deflect the seat back.

__10.1. The contractor's test engineer shall pick an amount of time between 5 and 30 seconds in which the seat back will be deflected. Using this time limit the test engineer will determine a movement rate (mm per second) for the upper loading bar. (S5.1.3.4)

Selected movement rate: _____ mm/s

__10.2. Deflect the seat back at the rate determined above until one of the following conditions is met:

a. The maximum allowable deflection of 356 mm [+6/ -0] is reached; or,
b. The force exceeds the upper bound of the force vs. deflection zone shown in Figure 27 by 50 N [-0/ +50]; or,
c. The distance from the test seat to any part of another school bus passenger seat or restraining barrier in its originally installed position, shown as D in Figure 26 closes to 102 mm [+0/ -6]; or,
d. Separation of the seat attachment points occurs.

Record which condition was met first: _____

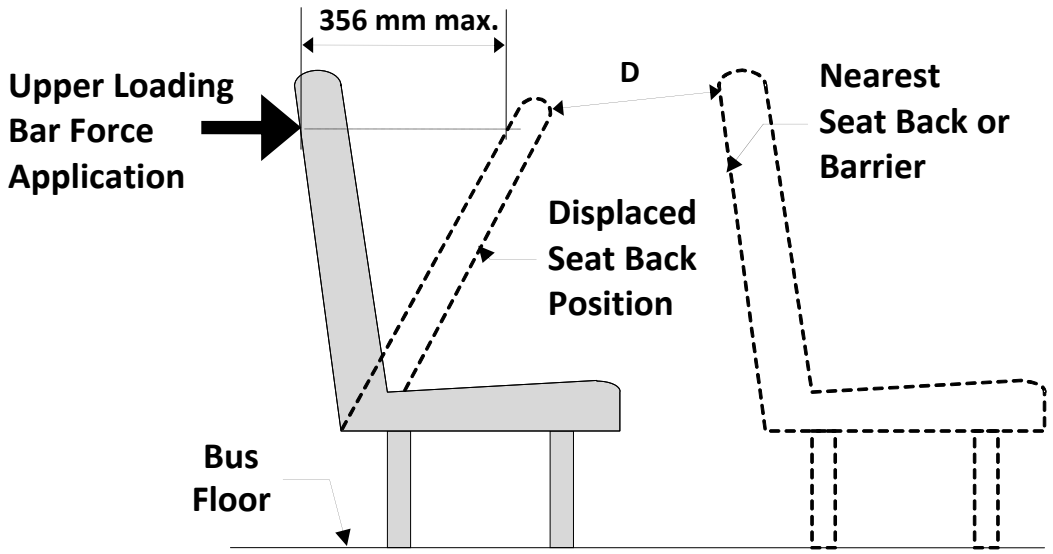


Figure 26

__10.3. When any one of the conditions of item 10.2 is met, stop deflecting the seat back, maintain the load for 5 to 10 seconds and then immediately back the loading bar away from the seat back at the selected moving rate from item 10.1. Inspect attachment points and component joints for separations. (S5.1.6.5.7)

__10.4. Record the post test zero and calibration check.

__10.5. Show the force versus deflection for the upper loading bar on an x-y plot.
__10.6. Using a planimeter or an equivalent tool, measure the area bounded by the force/ deflection curve (energy) and record below. This is the energy absorbed by the seat back.
____ N-m
__10.7. Determine the energy absorption limit of the seat back by multiplying 452 joules by the number of seating positions, W, for the seat aft of the test seat.
452 J x W = _____ J

__11. Requirement. The seat back must absorb at least 452W joules of energy within the first 356 mm of displacement, as measured from the position at which the initial application of 44 N of force is attained, and before any part of the seat moves to within 102 mm of any part of another school bus passenger seat or restraining barrier in its originally installed position. The seat shall not separate from the vehicle at any attachment point and seat components shall not separate at any attachment point. The seat back force/deflection curve shall fall within the zone specified in Figure 27(S5.1.3).

__11.1. Does the energy absorbed by the seat back, measured in item 10.6, meet or exceed the energy absorption limit calculated in item 10.7?
____ Yes – Pass ____ No – Fail
__11.2. Does the force/deflection curve fall completely within the zone of Figure 27?
____ Yes – Pass ____ No – Contact COTR
__11.3. Did the seat remain at least 102 mm [+0/ -6] from any part of another school bus passenger seat or restraining barrier in its originally installed position during the entire the test?
____ Yes – Pass ____ No – Contact COTR
__11.4. Did all attachment points remain secure during the test?
____ Yes – Pass ____ No – Contact COTR

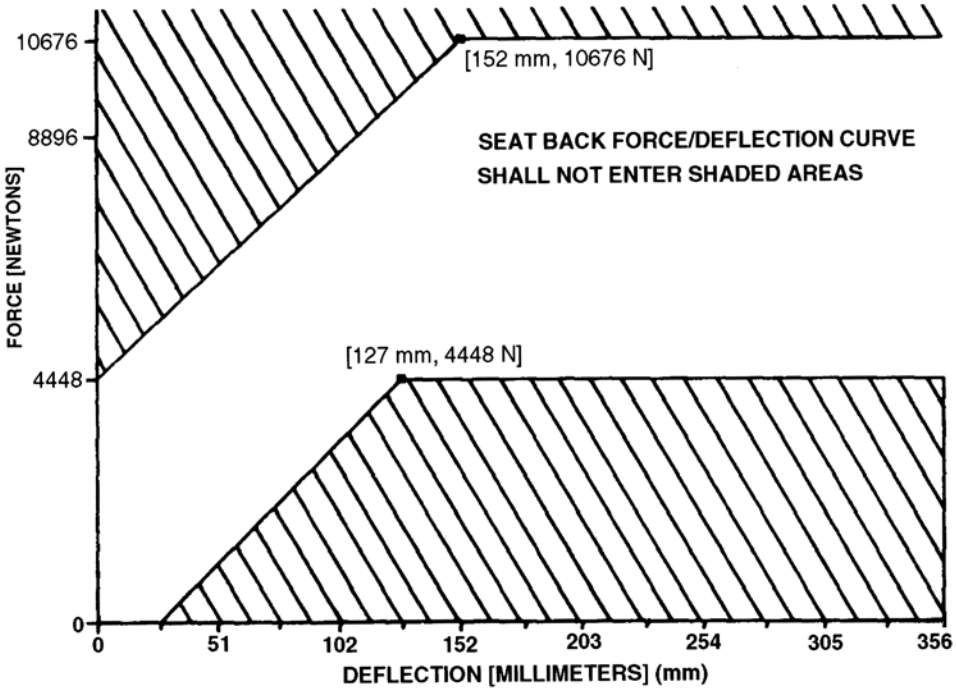


Figure 27

__11.5. Include the x-y plot of deflection versus time, as well as force versus deflection for the upper loading bar with the boundaries of Figure 27 superimposed.

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 11
RESTRAINING BARRIER FORCE/DEFLECTION TEST (S5.2.3)

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Barrier Number: _____

__1. Select a restraining barrier in the bus that has a passenger seat located behind it.
__2. Measure the seat dimensions of the seat aft of the restraining barrier.
__2.1. Measure and record the maximum transverse seat bench width, X.
X = ____ mm
__2.2. Use the seat bench width to determine the number of seating positions, W.
W = X / 380 (round to nearest whole number) = _____
__3. Give a written description of the Seating Reference Point (SgRP) location as provided by the manufacturer:

_____

_____

__4. Mark a horizontal line across the rear surface of the restraining barrier at the same vertical height as the SgRP of the seat aft of the barrier.
__5. Remove the seat(s) rearward of the restraining barrier and install the loading fixture in its place using the same wall and/or floor mounting holes, if possible. A suggested loading bar test device is shown in Figure 20. If the barrier is behind the driver's seat, place the driver's seat in the mid-position of horizontal and vertical travel. Document the effect of the testing on the driver's seat in the remarks.
__6. Record all instrument settings, equipment serial numbers, and zero and calibration checks.

_____

_____

__7. Position the lower loading bar such that it is centered laterally behind the barrier and the pivot and stroking device are in a horizontal plane which is located in a vertical zone between 102 mm [+0 / -6] above and 102 mm [+6 / -0] below the SgRP of the seat aft of the barrier. The lower loading bar positioning is illustrated in Figure 22. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] shorter than the width of the barrier at the loading bar height. (S5.1.3.1)
Measure and record the vertical distance from the center of the lower loading bar to the SgRP (use [+] for values above and [–] for values below the SgRP). ____ mm
__8. Apply a load through the lower loading bar.
__8.1 Apply a load through the lower loading bar pivot point equal to 3,114W N [+44/ -89] (the number of seating positions, W, from item 2.2, multiplied by 3,114). (S5.1.3.2)
Record the applied load: _____ N
__8.2 Reach this load in not less than 5 seconds and not more than 30 seconds. Hold the load for 1 to 3 seconds then reduce the load to 1,557W N [+0/ -44]. (S5.1.3.3)
Record the reduced load: _____ N
__8.3 Lock the stroking device in place to maintain the displacement.

__9. Position the upper loading bar so that it is centered laterally along the barrier and the pivot attachment point and stroking device are in a horizontal plane 406 mm [± 6] above the SgRP. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] less than the width of the barrier at the loading bar height. (S5.1.3.3)

__9.1. Measure and record the distance from the upper loading bar to the SgRP.
____ mm

__9.2. Apply a preload of 44.48 N [+4/ -0] through the upper loading bar.(S5.1.3.3)

__10. Deflect the barrier.

__10.1. The contractor's test engineer shall pick an amount of time between 5 and 30 seconds in which the barrier will be deflected. Using this time limit the test engineer will determine a movement rate (mm per second) for the upper loading bar. (S5.1.3.4)
Selected movement rate: _____ mm/s

__10.2. Deflect the barrier at the rate determined above until one of the following conditions is met:

a. The maximum allowable deflection of 356 mm [+6/ -0] is reached; or,
b. The force exceeds the upper bound of the force vs. deflection zone shown in Figure 28 by 50 N [-0/ +50]; or,
c. The barrier is deflected to a point at which it interferes with normal door operation; or,
d. Separation of the barrier attachment points occurs.

Record which condition was met first: _____

__10.3. When any one of the conditions of item 10.2 is met, stop deflecting the barrier, maintain the load for 5 to 10 seconds and then immediately back the loading bar away from the barrier at the selected moving rate from item 10.1. Inspect attachment points and component joints for separations. (S5.1.6.5.7)

__10.4. Record the post test zero and calibration check.

_____

_____

__10.5. Show the force versus deflection for the upper loading bar on an x-y plot.

__10.6. Using a planimeter or an equivalent tool, measure the area bounded by the force/ deflection curve (energy) and record below. This is the energy absorbed by the barrier.
____ N-m

__10.7. Determine the energy absorption limit of the barrier by multiplying 452 joules by the number of seating positions, W, for the seat aft of the barrier.
452 J x W = _____ J

__11. Requirement. The restraining barrier must absorb at least 452W joules of energy within the first 356 mm of displacement, as measured from the position at which the initial application of 44 N of force is attained, and the barrier deflection shall not interfere with normal door operation. The restraining barrier shall not separate from the vehicle at any attachment point and restraining barrier components shall not separate at any attachment point. The restraining barrier force/deflection curve shall fall within the zone specified in Figure 28. (S5.2.3)

__11.1. Does the energy absorbed by the barrier, measured in item 10.6, meet or exceed the energy absorption limit calculated in item 10.7?
____ Yes – Pass ____ No – Fail

__11.2. Does the force/deflection curve fall completely within the zone of Figure 28?
____ Yes – Pass ____ No – Contact COTR

__11.3. Do all doors operate in a normal manner after the barrier has been deflected?
____ Yes – Pass ____ No – Contact COTR

__11.4. Did all attachment points remain secure during the test?
____ Yes – Pass ____ No – Contact COTR

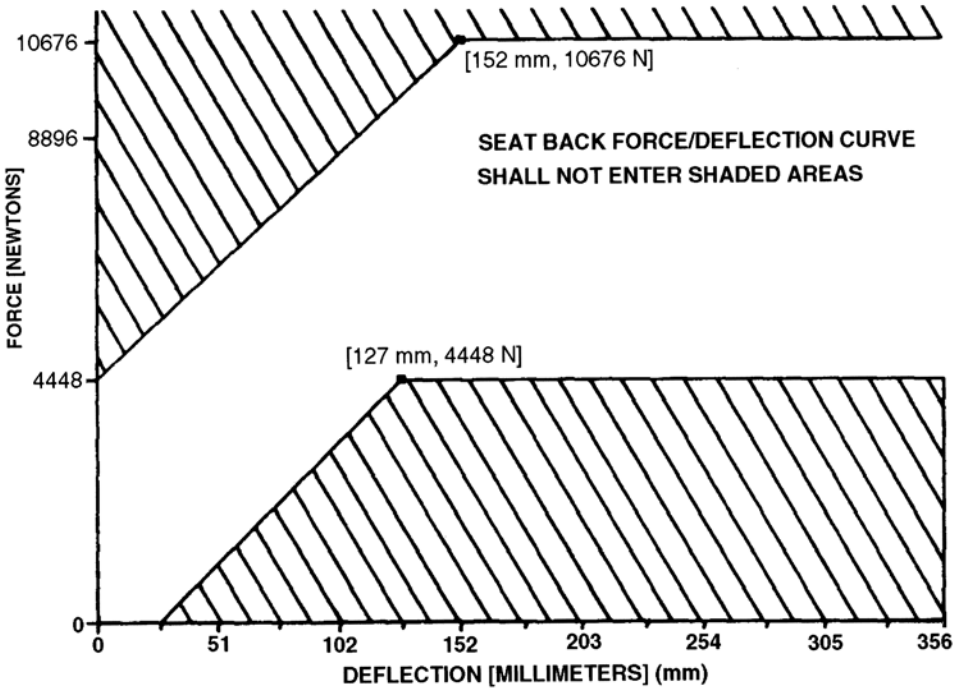


Figure 28

__11.5. Include the x-y plot of deflection versus time, as well as force vs. deflection for the upper loading bar with the boundaries of Figure 28 superimposed.
____ Yes – Pass ____ No – Contact COTR

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet 12
SEAT BACK FORCE DEFLECTION TEST – REARWARD (S5.1.4)

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Select a passenger seat (test seat) that has another seat located in front of and behind it.
__2. Measure the seat dimensions of the test seat.
  __2.1 Measure and record seat bench width:
  X = ____ mm
  __2.2 Determine the number of seating positions, W.
  W = X / 380 (round to nearest whole number) = _____
__3. Give a written description of the Seating Reference Point (SgRP) location of the test seat as provided by the manufacturer:

_____

_____

__4. Mark a horizontal line across the front surface of the seat back at the same vertical height as the SgRP.
__5. Remove the forward seat(s) and install the loading fixture in its place using the same wall and/or floor mounting holes, if possible.
__6. Record all instrument settings, equipment serial numbers, and zero and calibration checks.

_____

_____

__7. Position the loading bar such that it is centered laterally on the front of the seat back with the stroking bar in a horizontal plane 343 mm [+6/ -0] above the SgRP and parallel with the plane of the floor. See Figure 29 for load bar position. Adjust the length of the loading bar such that it is 102 mm [+13/ -6] less than the width of the seat back at the loading bar height. (S5.1.4.1)
  __7.1. Measure and record the vertical distance from the center of the loading bar to the SgRP (use [+] for values above and [–] for values below the SgRP).
  ____ mm
  __7.2. Move the loading bar rearward to preload the seat back to 222 N [+44/ -0]. (S5.1.4.1)

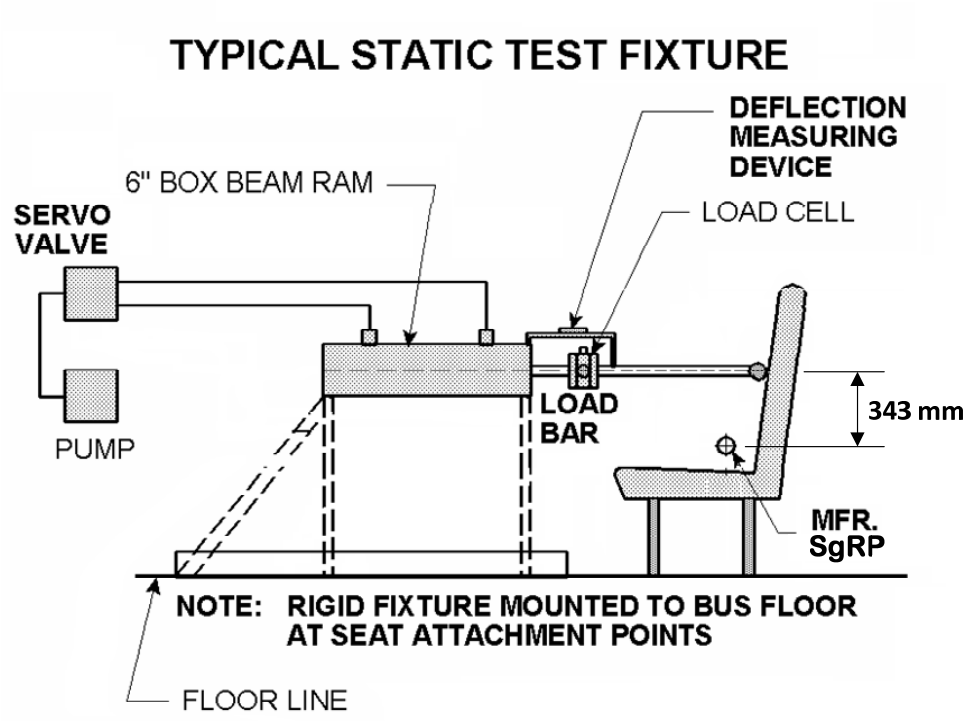


Figure 29

__8. Deflect the seat back.

__8.1. The contractor's test engineer shall pick an amount of time between 5 and 30 seconds in which the seat back will be deflected. Using this time limit the test engineer will determine a movement rate (mm per second) for the upper loading bar. (S5.1.3.4)

Selected movement rate: _____ mm/s

__8.2. Deflect the seat back at the rate determined above until one of the following conditions is met:

a. The maximum allowable deflection of 254 mm [+6/ -0] is reached; or,

b. The force exceeds the upper bound of the force vs. deflection zone shown in Figure 31 by 50 N [+0/ +50]; or,

c. The distance from the test seat to any part of another school bus passenger seat in its originally installed position, shown as D in Figure 30, closes to 102 mm [+6/ -0]; or,

d. Separation of the seat attachment points occurs.

Record which condition was met first: _____

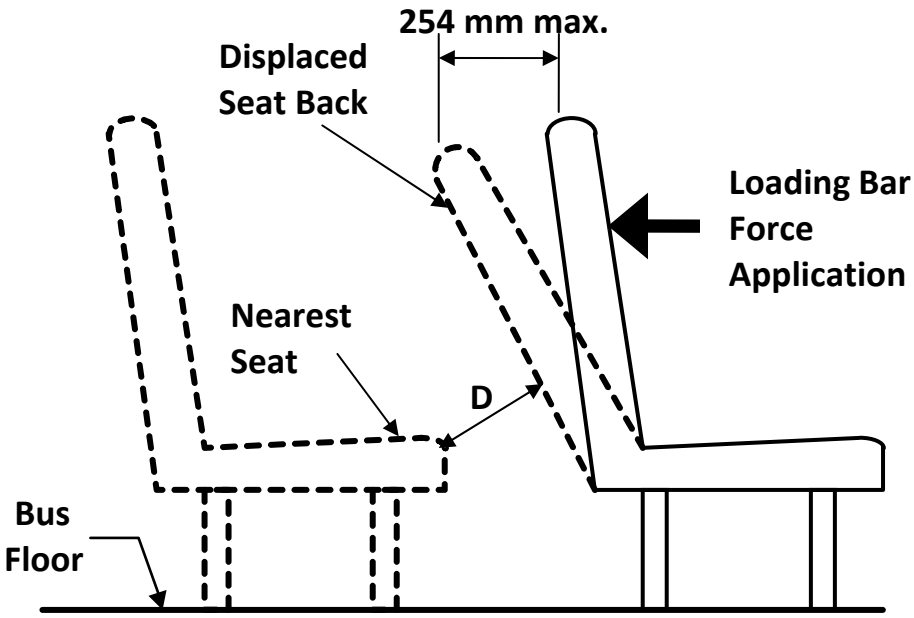


Figure 30

__8.3. When any one of the conditions of item 8.2 is met, stop deflecting the seat back, maintain the load for 5 to 10 seconds and then immediately back the loading bar away from the seat back at the selected moving rate from item 8.1. Inspect attachment points and component joints for separations. (S5.1.6.5.7)

__8.4. Record the post test zero and calibration check.

__8.5. Show the force versus deflection for the upper loading bar on an x-y plot.

__8.6. Using a planimeter or an equivalent tool, measure the area bounded by the force/ deflection curve (energy) and record below. This is the energy absorbed by the seat back.
____ N-m

__8.7. Determine the energy absorption limit of the seat back by multiplying 316 joules by the number of seating positions, W.
316 J x W = _____ J

__9. Requirement. The seat back must absorb at least 316W joules of energy within the first 254 mm of displacement, as measured from the position at which the initial application of 44 N of force is attained, and before any part of the seat moves to within 102 mm of any part of another school bus passenger seat in its originally installed position. The seat shall not separate from the vehicle at any attachment point and seat components shall not separate at any attachment point. The seat back force/deflection curve shall fall within the limits specified in Figure 31. (S5.1.4)

__9.1. Does the energy absorbed by the seat back, measured in item 8.6, meet or exceed the energy absorption limit calculated in item 8.7?
____ Yes- Pass ____ No – Fail

__9.2. Does the force/deflection curve lie within the limits specified in Figure 31?
____ Yes- Pass ____ No – Contact COTR

__9.3. Did the seat remain at least 102 mm [+0/ -6] from any part of another school bus passenger seat in its originally installed position during the entire the test?

____ Yes- Pass ____ No – Contact COTR

__9.4. Did all attachment points remain secured during the test?

____ Yes- Pass ____ No – Contact COTR

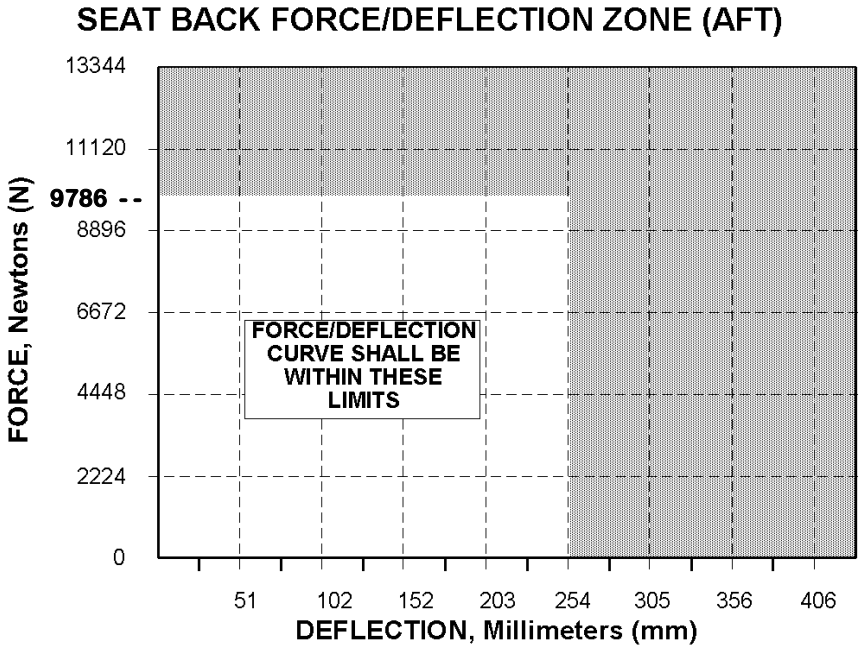


Figure 31

__9.5. Include the x-y plot of deflection versus time, as well as force versus deflection for the loading bar with the boundaries of Figure 31 superimposed.

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet 13
ADMINISTRATIVE DATA SHEET

TESTED FOR: U.S. Department of Transportation
National Highway Traffic Safety Administration

CONTRACT NO.: DTNH22-_____ ; TESTING CLASSIFICATION: Compliance

DESCRIPTION OF TEST VEHICLE:

A. Incomplete Vehicle (if applicable)
   1 - Manufacturer
   2 - Model
   3 - Vehicle Identification Number (VIN)
   4 - Build Date
   5 - Certification Date

B. Completed Vehicle
   1 - Model Year/Make/Model
   2 - Vehicle Body Style
   3 - Vehicle Identification Number (VIN)
   4 - NHTSA number
   5 - Color
   6 - GVWR
   7 - Manufacturer
   8 - Build Date
   9 - Certification Date

DATES:
   1 - Vehicle Receipt
   2 - Start of Test
   3 - Completion of Test

TEST VEHICLE DISPOSITION:

TEST: All tests were performed in accordance with the references outlined in FMVSS 222 as published in the Federal Register, Volume 41, No. 19, Jan 28, 1976, and as amended in 41FR28528, Jul 12, 1976; 41FR36027, Aug 26, 1976; 41FR54945, Dec 16, 1976; 42FR64120, Dec 23, 1977; 43FR9150, Mar 6, 1978; 44FR18675, Mar 29, 1979; and 48FR12386, Mar 24, 1983.

THE ABOVE NOTED ADMINISTRATIVE DATA SHEET IS TO BE INCLUDED IN THE FRONT OF THE FINAL REPORT ALONG WITH THE STANDARD TITLE PAGE.

18. FORMS

LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS: 222 TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____ DELV. ORDER NO.: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

SCHOOL BUS DESCRIPTION: _____

_____

BUS NHTSA NO.: _____ VIN: _____

MFR: _____

TEST FAILURE DESCRIPTION: _____

_____

_____

_____

FMVSS REQUIREMENT, PARAGRAPH S ___ :_____

_____

_____

_____

NOTIFICATION TO OVSC (COTR): _____

DATE: _____ BY: _____

REMARKS:

MONTHLY TEST STATUS REPORT
FMVSS 222
DATE OF REPORT: _____

No.	SCHOOL BUS NHTSA No., MAKE & MODEL	COMPLIANCE TEST DATE	PASS/ FAIL	DATE REPORT SUBMITTED	DATE INVOICE SUBMITTED	INVOICE PAYMENT DATE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

MONTHLY VEHICLE STATUS REPORT
FMVSS 222
DATE OF REPORT:_____

No.	SCHOOL BUS NHTSA No., MAKE & MODEL	DATE OF DELIVERY	ODOMETER READING	TEST COMPLETE DATE	VEHICLE SHIPMENT DATE	ODOMETER READING
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

APPENDIX A
FMVSS 207 – SEATING SYSTEMS
FMVSS 210 – SEAT BELT ASSEMBLY ANCHORAGES FOR CLASS 2 SCHOOL BUSES

APPENDIX A- TABLE OF CONTENTS

A1. CALIBRATION OF TEST INSTRUMENTS……..... 2

A2. DEFINITIONS……... 3

A3. COMPLIANCE TEST EXECUTION……..... 5

A3.1 GENERAL STATEMENT OF REQUIREMENTS……5

A3.2 TEST EQUIPMENT DESCRIPTION……5

A3.3 SEQUENCE FOR SEAT BELT ASSEMBLY ANCHORAGE TESTS…… 8

A3.4 DIMENSIONAL MEASUREMENTS…… 8

A3.5 STATIC LOAD TESTING OF SEAT BELT ASSEMBLY ANCHORAGES……9

A4. DATA SHEETS……..... 12

DATA SHEET A1- TEST VEHICLE RECEIVING INSPECTION…… 12

DATA SHEET A2- SEAT BELT ASSEMBLY ANCHORAGE INSTALLATION TYPES…… 13

DATA SHEET A3- LATERAL AND VERTICAL SPACING OF SEAT BELT ASSEMBLY ANCHORAGES……14

DATA SHEET A4- SEAT BELT ANGLES…….. 16

DATA SHEET A5- LAP AND SHOULDER BELT ASSEMBLY ANCHORAGE LOADINGS…… 19

A1. CALIBRATION OF TEST INSTRUMENTS

TEST EQUIPMENT ACCURACY

EQUIPMENT	RANGE	ACCURACY
Hydraulic Rams (5 Req'd)	0-120% of Specified Load	N/A
Load Cells (5 Req'd)	0-120% of Readout Capability	± 0.5%
Strip Chart Recorder	Readout Capability of 3% of Maximum Load	± 1.0%
Hydraulic Pump	Approx. 14.4 liters/min.	N/A
DC Power Supply	Adequate for Load Cells Used	Line Reg. of 0.05% (105 to 125 v) Load Reg. of 0.05% (0 to Full) Ripple: 5 mv P/P Stability: 0.1%
Digital Voltmeter or Equivalent Used to Monitor Load Cell Outputs	4 Digit Readout	± 0.1%
Signal Conditioning and Calibration Units	Adequate for Load Cells Used	± 0.5%
H-Point Machine	N/A	N/A
Steel Scale	914 mm Minimum	± 2.54 mm

A2. DEFINITIONS

A2.1. CURB WEIGHT

Weight of a motor vehicle with standard equipment; maximum capacity of engine fuel, oil and coolant; and, if so equipped, air conditioning and additional weight optional engine. (571.3)

A2.2. DESIGNATED SEATING POSITION (DSP)

(1) For vehicles manufactured prior to September 1, 2011, any plan view location capable of accommodating a person at least as large as a 5th percentile adult female, if the overall seat configuration and design and vehicle design is such that the position is likely to be used as a seating position while the vehicle is in moving, except for auxiliary seating accommodations such as temporary or folding jump seats.
(2) For vehicles manufactured on and after September 1, 2011, designated seating position means a seat location that has a seating surface width, as described in CFR 571.10(b).

For the sole purpose of determining the classification of any vehicle sold or introduced into interstate commerce for purposes that include carrying students to securement of an occupied wheelchair during vehicle operation shall be regarded as four designated seating positions. (571.3)

A2.3. H-POINT

Mechanically hinged hip point of a manikin which simulates the actual pivot center of the human torso and thigh, described in SAE J826 (Figure A. 1). (571.3)

H-POINT TEMPLATE

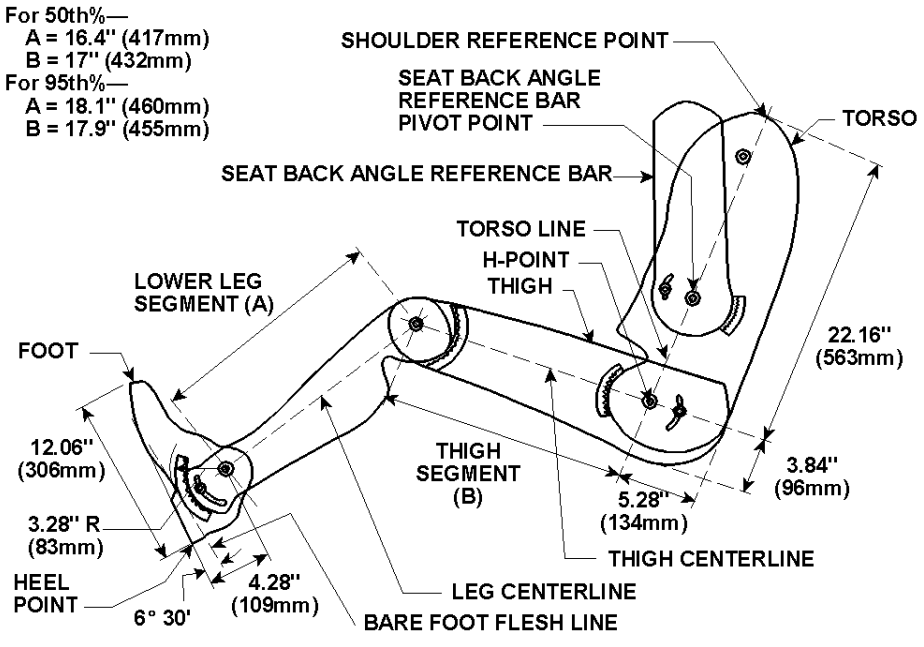


Figure A. 1

A2.4. OCCUPANT SEAT

A seat that provides at least one designated seating position (DSP). (571.207(S3)).

A2.5. SEAT BELT ASSEMBLY

Any strap, webbing or similar device designed to secure a person in a motor vehicle in order to mitigate the results of any accident, including all necessary buckles and other fasteners, and all hardware designed for installing such seat belt assembly in a motor vehicle. (571.209(S3))

A2.6. SEAT BELT ASSEMBLY ANCHORAGE

Provision for transferring seat belt assembly loads to the vehicle structure. (571.210 (S3))

A2.7. SEATING REFERENCE POINT (SgRP)

Manufacturer's Design Reference Point which –

A. Establishes the rearmost normal design driving or riding position of each DSP in a vehicle;

B. Has coordinates established relative to the designed vehicle structure;

C. Simulates the position of the center pivot of the human torso and thigh; and

D. Is the reference point employed to position the 2 dimensional templates described in SAE Recommended Practice J826, Manikins for use In Defining Vehicle Seating Accommodation. (571.3)

A2.8. SHOULDER REFERENCE POINT (SHRP)

A point 563 mm above the H-Point along the torso centerline of the 2 dimensional drafting template described in SAE J383 -- IT DOES NOT DESCRIBE A SHOULDER JOINT

A2.9. TORSO LINE

Line connecting the H-Point and the SHRP as defined in SAE Recommended Practice J383, Motor Vehicle Seat Belt Anchorage. (571.3)

A2.10. TYPE 1 SEAT BELT ASSEMBLY

Lap belt assembly for occupants pelvic or lower body restraint. (571.209(S3))

A2.11. TYPE 2 SEAT BELT ASSEMBLY

A combination of pelvic (lap belt) and upper torso (shoulder belt) restraints. (571.209(S3))

A3. COMPLIANCE TEST EXECUTION

A3.1. GENERAL STATEMENT OF REQUIREMENTS

Establishes requirements for Seating Systems and Seat Belt Assembly Anchorages. Those requirements are detailed in Title 49 Code of Federal Regulations Part 571.207 and 571.210 (571.207 and 571.210).

A3.2. TEST EQUIPMENT DESCRIPTION

A. A test loading, monitoring, and control system which shall consist of a maximum of five load cells, with one load cell mounted on each body block measuring the force applied. Force control shall be derived from a closed loop programmable force generator and shall be capable of simultaneously supplying loads to a maximum of five separate body blocks and two seats at a constant rate. In addition, if any seat belts or cables used in lieu of seat belts fail during the test, the change in the rate of loading on the remaining anchorages shall be minimal.

Recorded data shall include preload, loading, and unloading of the anchorages at the end of the holding period. The measured force at each body block shall be applied and controlled at a rate less than the maximum rate specified (222,411 newtons/second for Type 1 belts and 133,447 newtons/second for Type 2 belts) in S210. If all loading devices are not connected to the same load source, the application rate difference shall not exceed five percent. The maximum force, maintained for the time interval specified, shall be within -44.5, -222 newtons of the standard's specified maximum value. The loading apparatus shall be mounted so that it is sturdy enough to adequately withstand the loads applied and so that it will load the anchorages at the required angles.

NOTE: IT IS IMPORTANT TO NOTE THAT A MAXIMUM OF 5 SEPARATE LOADING DEVICES ARE REQUIRED AND A PLOT OF LOAD VERSUS TIME MUST BE GENERATED DURING THE TEST OR FROM REAL TIME CONTINUOUS MEASUREMENTS RECORDED AND STORED DURING THE TEST.

B. Three (3) lap belt blocks shown in Figure A. 2 and two (2) shoulder belt blocks (for Type 2 seat belt assembly) shown in Figure A. 3.

NOTE: LAP BELT BODY BOCK WILL BE COVERED BY 1" MEDIUM DENSITY CANVAS COVERED FOAN RUBER WHERE LAB BELT CONTACTS BODY BLOCK.

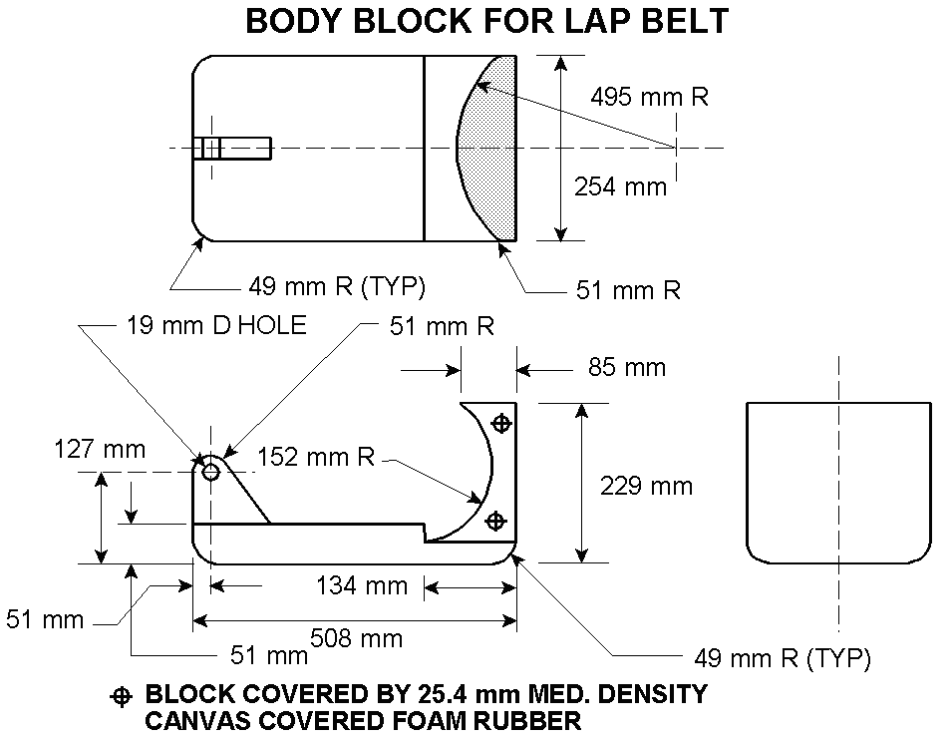


Figure A. 2

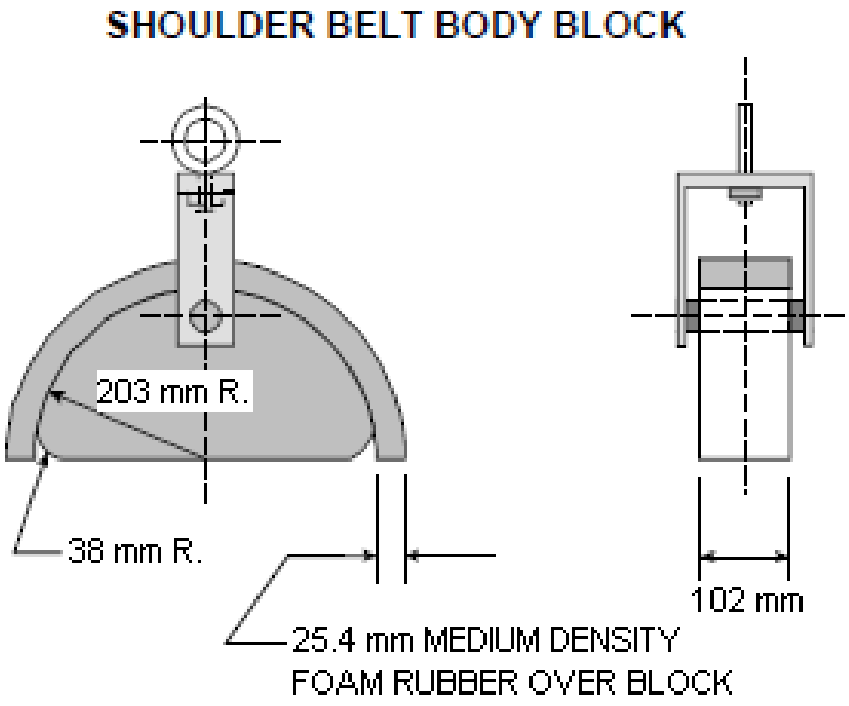


Figure A. 3

C. Appropriate angle, length, width, height, etc. measuring devices.

D. Restraining device or fixture to completely tie-down and immobilize the test vehicle when applying the required anchorage loads.

E. System to raise and hold the test vehicle at least 25.4 mm above the floor level, if the loading device is mounted outside the bus.

F. A SAE two dimensional manikin or equivalent device to determine the shoulder belt reference point -- SHRP
(see SAE J826, Figure A. 1).

G. A camera to provide pertinent still photographs, which as a minimum, should include the photographs listed in this procedure.

A3.3. SEQUENCE FOR SEAT BELT ASSEMBLY ANCHORAGE TESTS

The test vehicles shall be subjected to the tests in the order shown below:

A. Dimensional measurements

B. Static load testing of seat belt assembly anchorages

A3.4. DIMENSIONAL MEASUREMENTS

1. Determine the number of Designated Seating Positions (DSP) specified on the test vehicle's tire information label or placard. Also determine the number of seat belt systems in the vehicle compared with this figure. Record these figures on Data Sheet A2.

2. Determine the type of seat belt system installed at each DSP for each unique seating configuration to ensure it uses the correct belt type (571.210 S4.1.3.1). Follow Data Sheet A2 to record the type of seatbelt assembly.

3. Measure the lateral spacing of the anchorages for individual seat belt assemblies, and the vertical distance from the seating reference point to the torso belt anchor point (571.210 S4.3.1.4, S4.1.3.2). Follow the steps outlined in Data Sheet A3 to determine the spacing and distance.

4. Measure the angle from the SgRP to the belt attachment hardware (571.210 S4.3.1). Follow the instructions outlined in Data Sheet A4 to measure the angles for the inboard and outboard anchorages at each uniquely arranged DSP. Seat back angle and SgRP data for each test vehicle will be obtained by the COTR from each manufacturer.

5. Determine if each outboard DSP shoulder belt anchorage is located with respect to the shoulder reference point. Follow steps outlined in Data Sheet A4 to measure the angle depicted in Figure A.5.

6. Identify the template’s “H” point and torso line (571.210 S4.3.2). Follow the steps provided in Data Sheet A4 to determine the “H” point at full rearward and full downward position and the if the torso line is at the same angle from the vertical as the seat back.

7. Visually inspect the lap belt portion of each assembly to determine if the belt remains on the pelvis of a 5th percentile female dummy and a 95th percentile male dummy when the seat is adjusted to its rearward and forward most positions. Note the results on Data Sheet A4.

A3.5. STATIC LOAD TESTING OF SEAT BELT ASSEMBLY ANCHORAGES

A. PREPARATION OF TEST VEHICLE

1. MODIFICATIONS MADE TO THE VEHICLE IN ORDER TO PERFORM THE TEST SHALL BE KEPT TO A MINIMUM. The test laboratory shall notify and obtain approval from the COTR for any required structural cutting or structural removal required on test vehicles prior to the conduct of such actions by the test laboratory.

2. If the seat back and the seat bench are attached to the vehicle by the same attachments, secure a strut on each side of the seat from a point on the outside of the seat frame in the horizontal plane of the seat's center of gravity (CG) to a point on the frame as far forward as possible of the seat anchorages. Between the upper ends of the struts place a rigid cross-member behind the seat back frame for forward loading.

3. If the seat back and the seat bench are attached to the vehicle by different attachments, attach to each component a fixture capable of transmitting a force to that component.

4. Attach seat belts around the body block(s). If necessary, replace the seat belt webbing in the area of the body blocks with wire rope (COTR must first give permission to use wire rope).

    (A) Position the seat belts around the body blocks

    (B) Mark the seat belts at the length necessary to position the body blocks

    (C) Replace the safety belt webbing in the areas that will come into contact with the body block. Remove the buckles that will incur side loading from the body blocks. Retain all hardware which attaches the safety belt webbing to the anchorages. Attach wire rope securely to the remaining webbing and buckle hardware.

5. Raise the test vehicle until all four (4) wheels are approximately 25.4 mm off the test surface and at its curb weight attitude. Secure the test vehicle to prevent lateral and longitudinal movement during belt anchorage load application.

6. Attach the load cells to the body block load application cables, and connect the load application device to the load cells. The load application devices shall be positioned such that the angle of pull is 10° ± 5° above the horizontal. The plane of load

application in the plan view shall be adjusted parallel to the test vehicle centerline ± 3°.

7. Perform and record pretest zero and calibration settings on instrumentation prior to testing, and document for inclusion in the final report. Provide tolerance range indicators on the tracings, chart, or data paper, and provide tolerance range indicators on instruments so that if the test is videotaped it shall be apparent that the test was conducted within the test procedure requirements. Identify each recording with date, time, vehicle, test technicians, NHTSA Number, chart speed, if applicable, FMVSS Number, X and Y axes names, units of measure and instrument settings. Record the serial numbers of equipment used for each specific load application location.

B. TEST PERFORMANCE

1. Apply forces equal to 20 times the weight of the seat horizontally through the center of gravity (CG). If the seat back and the seat bench are attached to the vehicle by different attachments, forces will be applied horizontally through the center of gravity (CG) of the seat back and through the center of gravity (CG) of the seat bench. See OVSC TP-207 for detailed instructions.

   1.1 Perform tests for forward loading only. (Rearward and moment loads are NOT required).

   1.2 If the seat belt assembly is attached to the seat, loads must be simultaneously applied to those from item B.2.

2. The torso portion of each seat belt assembly and the pelvic portion of a Type 2 seat belt assembly shall be loaded to 13,345 newtons. The pelvic portion of Type 1 seat belt assemblies shall be loaded to 22,241 newtons. The load tolerance for each shall be -44.5 to -222 newtons. A seat with three DSP's shall have **all three belt systems loaded simultaneously**. Follow steps detailed on Data Sheet A5 to complete these measurements.

3. Two seats shall have the seat belt assembly anchorages load tested. Remove seat(s), if necessary to allow access to the test seats.

4. For each belt load application, all forces shall be adjusted to 10% of target load. While at this load level, photographs and measurements of the load application angles shall be taken. The load application angles shall be recorded on Data Sheet A4. The load shall then be increased to 100% of the target load. After holding the load for a minimum of 10 seconds (load application time from 10% of load cannot exceed 30 seconds), the test loads

shall be released, anchorages inspected, and all post test photographs taken.

5. Perform and record post test zero and calibration checks.

6. Descriptions of test vehicle damage resulting from the anchorage loadings shall be recorded on the Report of Vehicle Condition at the Completion of Testing form and included in the final report. Permanent deformation, including rupture or breakage, of any anchorage or surrounding area may not constitute a failure. Any anomalies shall be reported immediately to the COTR prior to the next step in testing.

7. If the seat belt webbing at a particular DSP breaks during the test, the anchorage test for that DSP is terminated at that point and so noted on the data sheet. This would also apply to failed webbing hardware such as buckles and latch plates. Testing of unbroken belts at the other DSPs shall continue to completion.

8. Where requirements are not specified, testing shall be performed using good engineering judgment.

Data Sheet A1
TEST VEHICLE RECEIVING-INSPECTION

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Without disturbing the integrity of each seat belt and anchorage, verify that each seat belt is attached to the anchorage.
___ Yes- No Problems ___ No- Problems

__2. For seat belts that are attached to the seat, also verify the seats are attached to the seat anchors and the seat anchors are attached to the vehicle.
___ Yes- No Problems ___ No- Problems

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet A2
SEAT BELT ASSEMBLY ANCHORAGE INSTALLATION TYPES

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Identify the number of DSPs in Test Vehicle as Stated on Tire Label using Figures for Maximum Vehicle Loading: _____
__2. Identify the number of seat belt systems in the vehicle:_____
__3. Choose one seat for each unique type of seating configuration. Determine the type of seat belt anchorage (Type 1 or 2) for each unique seating position based on the requirement and record them in Table A.1.

Table A.1

SEAT NUMBER	SEATING POSITION	OBSERVED ANCHORAGE
		Type __
		Type __
		Type __
		Type __
		Type __
		Type __

REQUIRED ANCHORAGE:
GVWR ≤ 4,536 Kg – Type 2
GVWR > 4,536 Kg – Type 1/Type 2

__4. Do seats have the required anchorages?
___ Yes-Pass ___ No- Fail
__5. Seats <u>with no other seats behind them:</u>
Seat belt anchorages on school buses manufactured on or after October 21, 2011 must be attached to the school bus seat structure and the seat belt shall be Type 1 or Type 2. Do seats meet this requirement?
___ Yes- Pass ___ No- Fail

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet A3
LATERAL AND VERTICAL SPACING OF SEAT BELT ASSEMBLY ANCHORAGES

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Measure the lateral spacing of the anchorages for individual seat belt assemblies and record the measure spacing in Table A.2.

__1.1. Requirement:

TYPE 1 SEAT BELT ASSEMBLY ANCHORAGES (571.210 S4.3.1.4)
The spacing for an individual seat belt assembly anchorage shall be at least 165 mm apart as measured between the vertical centerlines of the bolt holes.

TYPE 2 SEAT BELT ASSEMBLY ANCHORAGES (571.210 S4.1.3.2 (i))
The lateral distance between the vertical centerline of the bolt holes or the centroid of any other means of attachment to the school bus structure must be:

(i) 280 mm for seating positions in a flexible occupancy seat in a maximum occupancy configuration, as defined in FMVSS No. 222; and
(ii) 330 mm for all other seating positions.

__1.2. Does the lateral spacing for each seat belt assembly anchorage meet the specified requirements?
____ Yes- Pass ____ No- Fail

Table A.2

SEAT NUMBER	FLEXIBLE OCCUPANCY?	ANCHORAGE LOCATION	REQUIRED SPACING (mm)	MEASURED SPACING (mm)
	YES / NO	Left Outer - Left Inner		
	YES / NO	Center Left - Center Right		
	YES / NO	Right Inner - Right Outer		
	YES / NO	Left Outer - Left Inner		
	YES / NO	Center Left - Center Right		
	YES / NO	Right Inner - Right Outer		

__1.3. Measure the vertical distance from the SgRP to the school bus torso belt anchor point, as shown in Figure A.4. Is it fixed or adjustable to at least 400 mm for a small occupant seating position of a flexible occupancy seat, and 520 mm for all other seating positions?
____Yes- Pass ____No- Fail

__2. Measure the adjusted height of the torso belt as shown in Figure A.4.
Does it adjust to within 280 mm of SgRP?
____ Yes- Pass ____ No- Fail

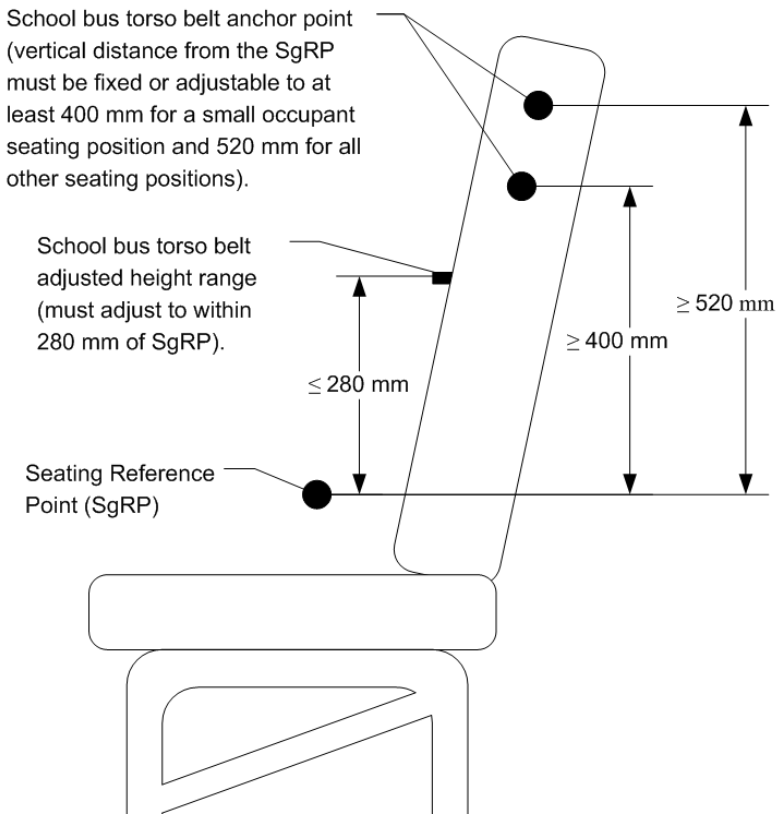


Figure A.4

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet A4
SEAT BELT ANGLES

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Measure the angle from the SgRP to the belt attachment hardware using the sketch shown in Figure A.5 as a guide for the inboard and outboard anchorages at each DSP (571.210 S4.3.1).
__2. Record the measured angle for the lap inboard and outboard anchorages in

Table A. 3.
Are the measured angles within the specified angle range?
___ Yes- Pass ___ No- Fail

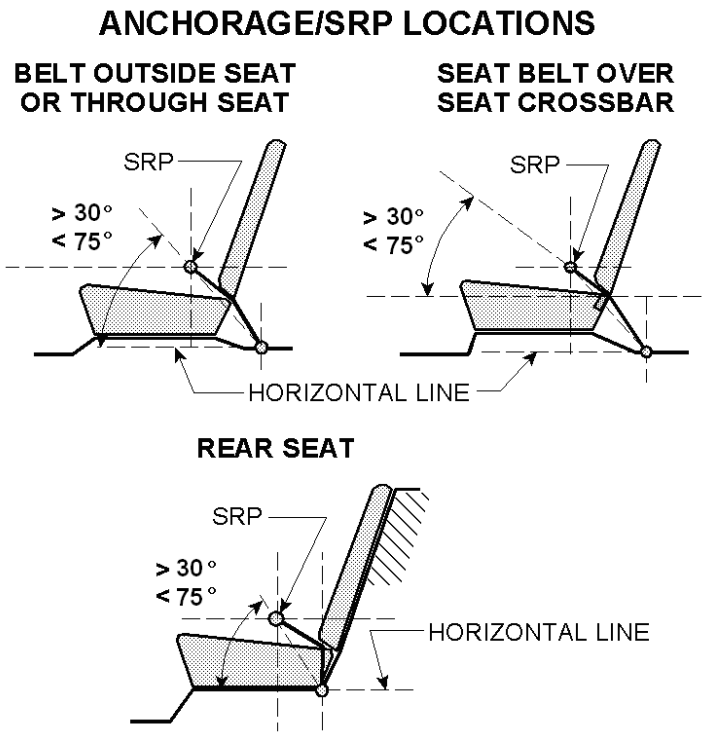


Figure A.5

__3. Place the seats in the full rearward and downward position with the seat back(s) in the most upright position.

__4. Measure the angle from the horizontal of a line projected from the SHRP to the shoulder belt anchorages as shown in Figure A. 6. Record the measured angle in Table A. 4.
Are the shoulder belt anchorages located with respect to the shoulder reference point?
___ Yes- Pass ___ No- Fail

Table A. 3

SEAT NUMBER	SEATING POSITION	SPECIFIED ANGLE RANGE ABOVE HORIZONTAL	MEASURED ANGLE	
			Inboard	Outboard
	Left	30 to 75 degrees		
	Center	30 to 75 degrees		
	Right	30 to 75 degrees		
	Left	30 to 75 degrees		
	Center	30 to 75 degrees		
	Right	30 to 75 degrees		

Table A. 4

SEAT NUMBER	SEATING POSITION	SPECIFIED ANGLE RANGE ABOVE HORIZONTAL	MEASURED ANGLE
	Left	0-80 degrees above	
		0-40 degrees below	
	Center	0-80 degrees above	
		0-40 degrees below	
	Right	0-80 degrees above	
		0-40 degrees below	
	Left	0-80 degrees above	
		0-40 degrees below	
	Center	0-80 degrees above	
		0-40 degrees below	
	Right	0-80 degrees above	
		0-40 degrees below	

__5. Identify the template's “H” point at full rearward and full downward position as shown in Figure A. 6.
Is the “H” point of the template at the design “H” point of the seat?
___ Yes- Pass ___ No- Fail

__6. Identify the template's torso line as shown in Figure A. 6.
Is the template’s torso line at the same angle from the vertical as the seat back?
___ Yes- Pass ___ No- Fail

__7. Inspect the lap belt portion of each assembly.
__7.1. Does the belt remain on the pelvis of a 5th percentile female dummy when the seat is adjusted to its rearward and forward most positions?
___ Yes- Pass ___ No- Fail

__7.2. Does the belt remain on the pelvis of a 95th percentile male dummy when the seat is adjusted to its rearward and forward most positions?
___ Yes- Pass ___ No- Fail

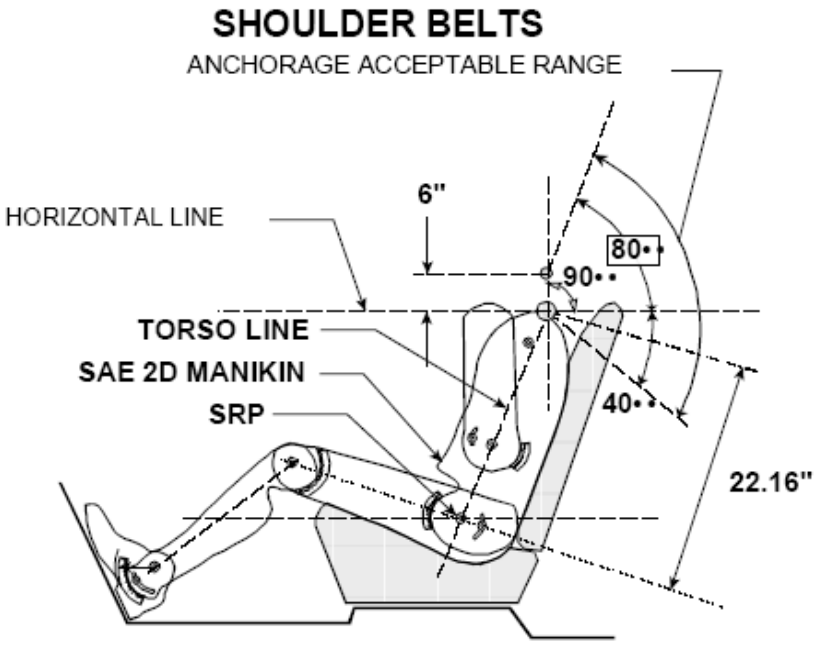


Figure A. 6

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

Data Sheet A5
LAP AND SHOULDER BELT ASSEMBLY ANCHORAGE LOADINGS

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Identify two (2) seats to have the seat belt assembly anchorages load tested.
__2. Identify the seat belt assembly as either a type 1 or type 2 assembly.
    __2.1 If the assembly is Type 1: Load the pelvic portion of the belt to 22,241 newtons.
    __2.2 If the assembly is Type 2: Load the torso and pelvic portion of the belt to 13,345 newtons.

NOTE: If a seat has three (3) DSP's all three belt systems must be loaded simultaneously.

__3. Apply the required load in the direction in which the seat faces.
    __3.1. For type 1 apply at rate no greater than 222,411 newtons/second.
    __3.2. For type 2 apply at rate no greater than 133,447 newtons/second.
__4. Apply 10% of the target load.
    __4.1. Measure the load application angle, which should be at least 5 degrees but not to exceed 15 degrees. Record measurement in Table A.6.
    __4.2. Take photographs of the load application angle.
__5. Increase load to 100% of target value. Record applied load in Table A.5. Hold for a minimum of 10 seconds

NOTE: Load application time from 10% of load cannot exceed 30 seconds.

__6. Release loads, inspect anchorages and take post test photographs.

Table A.5

SEAT BELT	BELT ASSEMBLY TESTED	MAXIMUM LOAD REQUIREMENT	APPLIED LOAD
TYPE 1	Left Lap	22,241N, -44.5, -222	N
	Right Lap	22,241N, -44.5, -222	N
	Center Lap	22,241N, -44.5, -222	N
TYPE 2	Left Lap	13,345N, -44.5, -222	N
	Left Shoulder	13,345N, -44.5, -222	N
	Right Lap	13,345N, -44.5, -222	N
	Right Shoulder	13,345N, -44.5, -222	N
	Center Lap	13,345N, -44.5, -222	N
	Center Shoulder	13,345N, -44.5, -222	N

Table A.6

	TYPE (1 or 2)	ANGLE MEASURED	ANGLE REFERENCE	ANGLE AT 10% LOAD (degrees)					
				LEFT DSP		CNTR DSP		RIGHT DSP	
				SEAT #	SEAT #	SEAT #	SEAT #	SEAT #	SEAT #
LAP BELT		Load Application Angle (degrees)	From Side View Horizontal 10° ± 5°						
			From Plan View Vehicle Centerline 0° ± 3°						
SHOULDER BELT		Load Application Angle (degrees)	From Side View Horizontal 10° ± 5°						
			From Plan View Vehicle Centerline 0° ± 3°						

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

APPENDIX B
FMVSS 208, OCCUPANT CRASH PROTECTION FOR CLASS 2 SCHOOL BUSES

TABLE OF CONTENTS

B1. PHOTOGRAPHIC DOCUMENTATION..... 2

B2. DATA SHEETS..... 3

DATA SHEET B1- SEAT BELT CHECK..... 3

DATA SHEET B2- SEAT BELT WARNING SYSTEM CHECK..... 7

DATA SHEET B3- LAP BELT LOCKABILITY (571.208 S7.1.1.5)..... 8

B1. PHOTOGRAPHIC DOCUMENTATION

1. Front Seat, Driver Side - 95%M dummy with seat forward

2. Front Seat, Driver Side - 95%M dummy with seat rearward

3. Front Seat, Driver Side - 5%F dummy with seat forward

4. Front Seat, Driver Side - 5%F dummy with seat rearward

5. Front Seat, Passenger Side - 95%M dummy with seat forward

6. Front Seat, Passenger Side - 95%M dummy with seat rearward

7. Front Seat, Passenger Side - 50%C dummy with seat forward
   (lap belt usage only)

8. Front Seat, Passenger Side - 50%C dummy with seat rearward
   (lap belt usage only)

9. Rear Seat, Outboard Position - 95%M dummy

10. Rear Seat, Outboard Position - 50%C dummy
    (lap belt only)

Data Sheet B1
SEAT BELT CHECK

School Bus NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

1. No. of designated seating positions (DSP) = _____

2. Type of seat belt at each passenger DSP (571.208 S4.1.2.1, S4.1.2.2, S4.1.2.3)

BELT TYPE (TYPE 1 OR 2 REQUIRED)								
SEAT NO.								
DSP #1								
DSP #2								
DSP #3								
DSP #4								

3. Type of retractor at each passenger DSP (571.208 S7.1.1.2)

RETRACTOR TYPE (MANUAL, ALR, ELR)								
SEAT NO.								
DSP #1								
DSP #2								
DSP #3								
DSP #4								

4. Single point, push-button, accessible latch release at each passenger DSP (571.208 S7.2(c))

   PASS = single point push-button FAIL = not single point push-button

SEAT NO.								
DSP #1								
DSP #2								
DSP #3								
DSP #4								

5. Latch plate and buckle must not pass through conduit or guide between seat cushion and seat back at each passenger DSP. (571.208 S7.4.6)

   PASS = latch plate and/or buckle will not fit through conduit or guide

   FAIL = latch plate and/or buckle will fit through conduit or guide

SEAT NO.								
DSP #1								
DSP #2								
DSP #3								
DSP #4								

6. Either the latchplate, buckle, or webbing must stay on top or above the seat when the seat belt is unbuckled and the remaining two parts must stay accessible at each passenger DSP. (571.208 S7.4.6)

   PASS = the seat belt meets the above requirements

   FAIL = the seat belt does not meet the above requirements

SEAT NO.								
DSP #1								
DSP #2								
DSP #3								
DSP #4								

7. Seat Belt Fit Test Dummies

		MANUFACTURER	SERIAL NUMBER
7.1	50% 6-YEAR OLD CHILD		
7.2	5% ADULT FEMALE		
7.3	50% ADULT MALE		
7.4	95% ADULT MALE		

8. Seat belt must fit persons whose dimensions range from those of a 50th percentile 6-year old child to those of a 95th percentile adult male. (571.208 S7.1.1)

Two seats checked

PASS = snug fitting seat belt FAIL = loose fitting seat belt

SEAT NUMBER			
DSP #1	50% C		
	95% AM		
DSP #2	50% C		
	95% AM		
DSP #3	50% C		
	95% AM		
DSP #4	50% C		
	95% AM		

9. Driver's Seat (Not part of FMVSS 222)

1 Belt Type: ___ - 1 ___ - 2

2 Automatic Restraint: ___ - Yes ___ - No

3 Type of Automatic Restraint (if applicable) _____

4 PASS = snug fitting seat belt (571.208 S7.1.1.1)

FAIL = loose fitting seat belt

5%AF

95%AM

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet B2
SEAT BELT WARNING SYSTEM CHECK

School Bus NHTSA No. _____ Test Date: _____

Laboratory: _____ Test Technician(s): _____

Complete the following to determine which seat belt warning system option (S7.3(a)(1) or S7.3(a)(2)) is used. (Manufacturers may use either option.)

__1. With occupant in driver's position and lap belt in stowed position and ignition switch placed in "Start/On" position:

__1.1. S7.3(a)(1)

Time duration of audible warning signal = _____ seconds
(4 to 8 seconds)

Time duration of reminder light operation = _____ seconds
(no less than 60 seconds)

__1.2. S7.3(a)(2)

Time duration of audible warning signal = _____ seconds
(4 to 8 seconds)(see 49 USCS @ 30124)

Time duration of reminder light operation = _____ seconds
(4 to 8 seconds)

__2. With occupant in drivers position and lap belt in use and the ignition switch placed in "Start/On" position:

__2.1. S7.3(a)(1)

Time duration of audible warning signal= _____ seconds
(audible warning not required)

Time duration of reminder light operation= _____ seconds
(reminder light not required)

__2.2. B.2 S7.3(a)(2)

Time duration of audible warning signal = _____ seconds
(audible warning not required)

Time duration of reminder light operation = _____ seconds
(4 to 8 seconds)

__3. Note wording of visual warning:

Fasten Seat Belt _____

Fasten Belt _____

Symbol 101 _____

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

Data Sheet B3
LAP BELT LOCKABILITY (571.208 S7.1.1.5)

Complete one of these forms for **each** designated seating position that is a forward-facing seat, other than the driver's seat (571.208 S7.1.1.5(a), **and** that has seat belt retractors that are not solely automatic locking retractors. (571.208 S7.1.1.5(c))

School Bus NHTSA No. _____ Test Date: _____

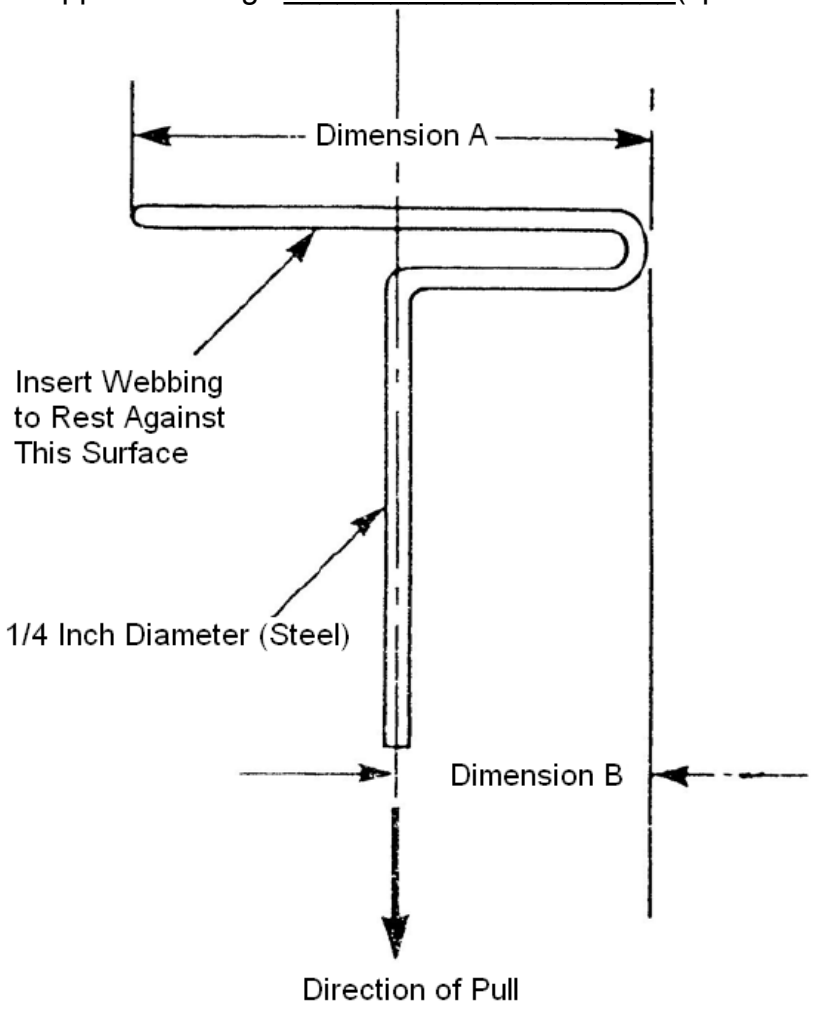
Laboratory: _____ Test Technician(s): _____

DESIGNATED SEATING POSITION: _____

__N/A – No retractor is at this position
__N/A – The retractor is an automatic locking retractor ONLY

__1. Record test fore-aft seat position. _____
(571.208 S7.1.1.5 (c)(1))(Any position is acceptable.)
__2. Does the lap belt portion of the seat belt consist of a locking device that does **NOT** have to be attached by the vehicle user to the seat belt webbing, retractor, or any other part of the vehicle? (571.208 S7.1.1.5 (a)) __Yes-Pass; __**No-FAIL**
__3. Does the lap belt portion of the seat belt consist of a locking device that does **NOT** require inverting, twisting or deforming of the belt webbing? (571.208 S7.1.1.5 (a))
__Yes-Pass; __**No-FAIL**
__4. Place any adjustable seat belt anchorage in the lowest adjustment position.
__N/A The anchorage is not adjustable.
__5. Buckle the seat belt. (571.208 S7.1.1.5(c)(1))
__6. Locate a reference point A on the seat belt buckle using Figure B.1 as a reference (571.208 S7.1.1.5(c)(2)).
__7. Locate a reference point B (Figure B.1) on the attachment hardware or retractor assembly at the other end of the lap belt or lap belt portion of the seat belt assembly. (571.208 S7.1.1.5(c)(2))
__8. Does the vehicle user need to take some action to activate the locking feature on the lap belt portion of the seat belt?
__Yes; __No (If yes, go to 8.1. If no, go to 9.)
__8.1 Does the vehicle owner's manual include a description in words and/or diagrams describing how to activate the locking feature so that the seat belt assembly can tightly secure a child restraint system and how to deactivate the locking feature to remove the child restraint system? (571.208 S7.1.1.5(b)) __Yes-Pass; __**No-FAIL**
__9. Adjust the lap belt or lap belt portion of the seat belt assembly according to any procedures recommended in the vehicle owner's manual to activate any locking feature so that the webbing between points A and B is at the maximum length allowed by the belt system. (571.208 S7.1.1.5(c)(2) & S7.1.1.5(c)(1))
__10. Measure and record the distance between points A and B along the longitudinal centerline of the webbing for the lap belt or lap belt portion of the seat belt assembly. (571.208 S7.1.1.5(c)(2))
Measured distance between A and B _____ mm
__11. Readjust the belt system so that the webbing between points A and B is at ½ the maximum length of the webbing. (571.208 S7.1.1.5(c)(3))

__12. To the lap belt or lap belt portion of the seat belt assembly, apply a preload of 44.5 N using the webbing tension pull device shown in the figure below. Apply the load in a vertical plane parallel to the longitudinal axis of the vehicle and passing through the seating reference point of the designated seating position. Apply the preload in a horizontal direction toward the front of the vehicle with a force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. (571.208 S7.1.1.5(c)(4))
Measured force application angle_____(spec. 5 - 15 degrees)



Dimension A - Width of Webbing Plus 1/2 Inch
Dimension B - 1/2 of Dimension A

Figure B.1

__13. Measure the length between points A and B along the longitudinal centerline of the webbing while the preload is being applied. (571.208 S7.1.1.5(c)(4))
Measured distance between A and B _____ millimeters

__14. Increase the load to 222.5 newtons at a rate of no more than 222.5 newtons per second. Attain the load in not more than 5 seconds. (If webbing sensitive emergency locking retractors are installed as part of the lap belt or lap belt portion of the seat belt assembly, apply the load at a rate less than the threshold value for lock-up specified by the manufacturer.)

Maintain the load for at least 5 seconds. Measure and record the distance between points A and B along the longitudinal centerline of the webbing. (571.208 S7.1.1.5(c)(5))
Record onset rate _____newtons/sec (spec. 44.5 to 222.5 newtons/sec) (571.208 S7.1.1.5(c)(5))
Measured distance between A and B _____ millimeters (571.208 S7.1.1.5(c)(6))

__15. Let the seat belt webbing retract to its minimum length with the seat belt still buckled.

__16. To the lap belt or lap belt portion of the seat belt assembly, apply a preload of 44.5 newtons using the webbing tension pull device in Figure 5. Apply the load in a vertical plane parallel to the longitudinal axis of the vehicle and passing through the seating reference point of the designated seating position. Apply the preload in a horizontal direction toward the front of the vehicle with a force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. (571.208 S7.1.1.5(c)(4))
Measured force application angle_____(spec. 5 - 15 degrees)

__17. Measure the length between points A and B along the longitudinal centerline of the webbing while the preload is being applied. (571.208 S7.1.1.5(c)(4))
Measured distance between A and B _____ mm

__18. Increase the load to 222.5 newtons at a rate of no more than 222.5 newtons per second. Attain the load in not more than 5 seconds. (If webbing sensitive emergency locking retractors are installed as part of the lap belt or lap belt portion of the seat belt assembly, apply the load at a rate less than the threshold value for lock-up specified by the manufacturer.)
Maintain the load for at least 5 seconds. Measure and record the distance between points A and B along the longitudinal centerline of the webbing. (571.208 S7.1.1.5(c)(5))
Record onset rate _____newtons/sec (spec. 44.5 to 222.5 newtons/sec) (571.208 S7.1.1.5(c)(5))
Measured distance between A and B _____ mm (571.208 S7.1.1.5(c)(6))

__19. Subtract the measurement in 13 from the measurement in 14 and the measurement in 17 from the measurement in 18. Is the difference 50.8 mm or less for both? (571.208 S7.1.1.5(c)(7))
14-13 =_____mm;
18-17 =_____mm
__Yes-Pass; __**No-FAIL**

__20. Subtract the measurement in 14 from the measurement in 10 and the measurement in 14 from the measurement in 18. Is the difference 76.2 mm or more for both? (571.208 S7.1.1.5(c)(8))
10-14 =_____mm;
10-18 =_____mm
__Yes-Pass; __**No-FAIL**

REMARKS:

_____ _____
I certify that I have read and performed each instruction. Date

APPENDIX C
WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES

WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGES AND RESTRAINTS
FMVSS 222
APPLICABLE TO SCHOOL BUSES WITH WHEELCHAIR LOCATION ONLY

TABLE OF CONTENTS

C1. TEST EQUIPMENT DESCRIPTION……2

C2. DEFINITIONS……...2

C3. COMPLIANCE TEST EXECUTION……..3

C4. DATA SHEETS…… 5

DATA SHEET C1- WHEELCHAIR SECUREMENT ANCHORAGES……..5

C1. TEST EQUIPMENT DESCRIPTION

The following is a list of the minimum suggested test equipment needed to evaluate the minimum performance requirements as outlined in S5.4 of S222.

A. A hydraulic ram capable of generating the pull-force levels called for in S222 (S5.4.1 and S5.4.3).

B. Loads cells to measure force levels called for in S222 (S5.4.1 and S5.4.3).

C. Appropriate angle, length, width, height, etc. measuring devices.

Recorded data shall include preload, loading, and unloading of the anchorages at the end of the holding period. The measured force at each anchorage shall be applied and controlled at a rate less than the maximum onset rate specified (133,440 newtons per second for a wheelchair anchorage, or a wheelchair occupant restraint floor anchorage; 66720 newtons per second for a wheelchair occupant upper torso restraint anchorage) in S222. The maximum specified force value, maintained for the time interval specified, shall be within a tolerance of +0, -1 percent. The loading apparatus shall be mounted so that it is sturdy enough to withstand the loads applied and so that it will load the anchorage at the required angle.

It is important to note that only 1 loading device (hydraulic ram) and 1 load cell is allowed for each test to ensure smooth load application and recording. A plot of load versus time must be generated during the test or real time continuous measurements recorded and stored during the test.

C2. DEFINITIONS

C2.1. TYPE A ANCHORAGE

Wheelchair securement anchorage which transfers ONLY the wheelchair inertia loads to the vehicle structure.

C2.2. TYPE B ANCHORAGE

Wheelchair occupant pelvic and upper torso restraint floor anchorage which transfers ONLY the wheelchair occupant inertia loads to the vehicle structure.

C2.3. TYPE C ANCHORAGE

Common anchorage for the wheelchair securement device and wheelchair occupant restraint; transfers both the wheelchair and its occupant inertia loads to the vehicle structure.

C2.4. TYPE D ANCHORAGE

Upper torso restraint anchorage for the upper end of wheelchair occupant torso restraint; transfers wheelchair occupant inertia loads to the vehicle structure.

C2.5. WHEELCHAIR

A wheeled seat frame for the support and conveyance for a physically disabled person, comprised of at least a frame, seat, and wheels. (S4)

C2.6. WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGE

The provision for transferring wheelchair occupant restraint system loads to the vehicle structure. (S4)

C2.7. WHEELCHAIR SECUREMENT ANCHORAGE

The provision for transferring wheelchair securement device loads to the vehicle structure. (S4)

C2.8. WHEELCHAIR SECUREMENT DEVICE

A strap, webbing or other device used for securing a wheelchair to the school bus, including all necessary buckles and other fasteners. (S4)

C3. COMPLIANCE TEST EXECUTION

C3.1. Perform a visual inspection of all wheelchair securement and anchorage devices.

C3.1.1. The wheelchair securement anchorages and wheelchair occupant restraint anchorages are designed for forward seating wheelchair position. Each wheelchair location shall have not less than four wheelchair securement anchorages (Type A or C) -- two located in the front of the wheelchair and two in the rear. Type C anchorages may be used rearward of the wheelchair only. Each wheelchair location shall have not less than two wheelchair occupant pelvic and upper torso restraint anchorages (Type Bs, Cs, or combination). The pelvic belt may attach to but must not terminate at the wheelchair. Each wheelchair location shall have not less then one Type D anchorage. Record the number and type(s) of anchorages on Data Sheet C1. Wheelchair securement device incorporating webbing or a strap shall provide a means of adjustment to remove slack from the device. If webbing or a strap is not used, then the securement device shall provide means which limit movement of the wheelchair.

C3.2. Test wheelchair securement anchorages and devices. Follow the steps outlined in Data Sheet C1.

C3.2.1. PREPARATION OF TEST VEHICLE AND EQUIPMENT

(1) The test equipment and its installation onto the vehicle and any modifications made to the vehicle in order to perform the test, shall not strengthen or weaken the vehicle structure in the vicinity of the anchorage to be tested, or interfere in any way with the proper execution of the test.

(2) Connect, as a load transfer device, the wheelchair securement device or wheelchair occupant restraint device to the load cell. These devices will transfer the applied test loads to the anchorages to be tested. If this is not

feasible, then a suitable load transfer device must be fabricated. This device must be capable of transferring the required test load, and must not alter the force application angle or direction, or introduce any additional loads or moments at the anchorage. THE LOAD TRANSFER DEVICE MUST BE APPROVED BY THE COTR, AND THE ANCHORAGE MUST NOT BE MODIFIED IN ANY WAY.

(3) Connect the load application device to the load cell.
NOTE: THE COTR MUST BE CONSULTED IN DETERMINING THE EXACT TEST ANGLES.

(4) For each anchorage load application, the test force shall be adjusted to 5% of target load. While at this load level, photographs and measurements of the load application angles shall be taken. The load application angles shall be recorded on Data Sheet C1. The load shall then be increased to 100% of the target load. After holding the load for a minimum of 10 seconds (load application time from 5% of load cannot exceed 30 seconds), the test load shall be released, anchorages inspected, and all post test photographs taken.

(6) Descriptions of test vehicle damage resulting from the anchorage loadings shall be recorded on the "Report of Vehicle Condition at the Completion of Testing" form and included in the final report. Permanent deformation or rupture of a wheelchair securement anchorage or wheelchair occupant restraint anchorage, or its surrounding area is not considered to be a failure, if the required test force is sustained for the specified time.

Data Sheet C1
WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES
WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGES AND RESTRAINTS

School Bus NHTSA No._____ Test Date: _____
Laboratory: _____ Test Technician(s): _____
Seat Number(s): _____ Seat Type and Configuration: _____

__1. Wheelchair location _____
__2. Are all wheelchair securement and occupant restraint anchorages designed for forward wheelchair position?
Yes ___ - Pass No ___ - Fail
__3. Each wheelchair location shall have not less than four wheelchair securement anchorages (Type A or C) -- two located in front of the wheelchair and two in the rear. Type C anchorage may be used in rear of the wheelchair only.
Number of Type A anchorages in front of the wheelchair:
≥2 ___ - Pass <2 ___ - Fail
Number of anchorages behind the wheelchair:
Type A - ____ Type C - ___
Total ≥ 2 ____ - Pass Total < 2 ___ - Fail
__4. Each wheelchair location shall have not less than two wheelchair occupant pelvis and upper torso restraint anchorage (type B, C, or combination). The pelvic belt must not terminate at the wheelchair.
Number of anchorages:
Type B - ___ Type C - ___
Total ≥ 2 ___ - Pass Total < 2 ___ - Fail
__5. The wheelchair location has at least one type D anchorage:
Yes ___ - Pass No ___ - Fail
__6. The wheelchair securement device has means to limit movement of the wheelchair:
Yes ___ - Pass No ___ - Fail
__7. Perform and record pretest zero and calibration settings on instrumentation prior to testing, and document for inclusion in the final report. Provide tolerance range indicators on the tracings, chart, or data paper, and provide tolerance range indicators on instruments so that if the test is videotaped it shall be apparent that the test was conducted within the test procedure requirements. Identify each recording with date, time, vehicle, test technicians, NHTSA Number, chart speed, if applicable, FMVSS Number, X axis and Y axis names, units of measure and instrument settings. Record the serial numbers of equipment used for each specific load application location.

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_____

__8. Apply the test load for type A anchorages.
__8.1. Position the load application device such that the angle of pull is not less than 30 degrees, but not more than 60 degrees, measured from the horizontal. In addition, the horizontal projection of the force direction shall be within a horizontal arc of ± 45 degrees relative to a longitudinal line which has its origin at the anchorage location and projects rearward for an anchorage whose

wheelchair securement device is intended to secure the front of the wheelchair and forward for an anchorage whose wheelchair securement device is intended to secure the rear of the wheelchair (see Figure C.1).

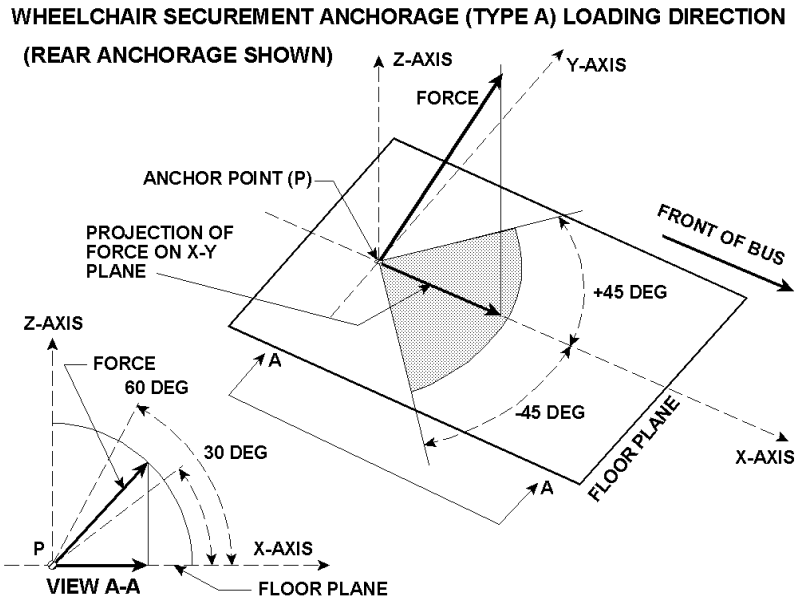

Figure C.1

__8.2. Apply a test force of 13,344 newtons. The force shall be applied at the onset rate of not more than 133,440 newtons per second. The 13,344 newtons force shall be attained in not more than 30 seconds, and shall be maintained for 10 seconds. When more than one wheelchair securement device share a common type A anchorage, the test force shall be 13,344 newtons multiplied by the number of securement devices or occupant restraints sharing that anchorage.

__8.3. Record the results in Table C. 1.

__9. Apply the test load for type B and C anchorages.

__9.1. The load application device shall be positioned such that the angle of pull is not less than 45 degrees, but not more than 80 degrees, measured from the horizontal. In addition, the horizontal projection of the force direction shall be within a horizontal arc of ± 45 degrees relative to a longitudinal line which has its origin at the anchorage location and projects forward (see Figure C.2).

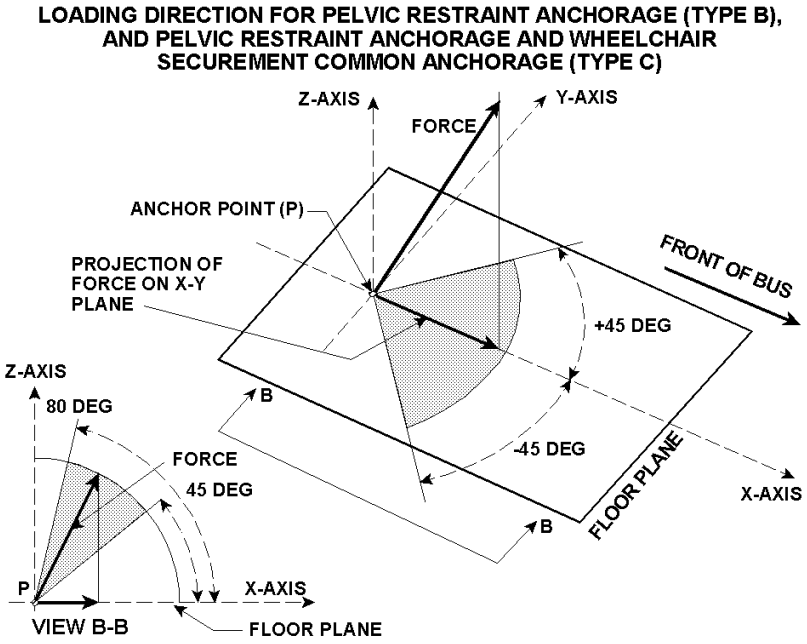

Figure C.2

__9.2. Apply a test force of 13,344 newtons. The force shall be applied at the onset rate of not more than 133,440 newtons per second. The 13,344 newtons force shall be attained in not more than 30 seconds, and shall be maintained for 10 seconds. When more than one wheelchair securement device share a common type B or C anchorage, the test force shall be 13,344 newtons multiplied by the number of securement devices or occupant restraints sharing that anchorage.

__9.3. Record the results in Table C. 1.

__10. Apply the test load for type D anchorages

__10.1. The loading application device shall be positioned such that the angle of pull shall be applied at a vertical angle of not less than 0 degrees but no more than 40 degrees, below a horizontal plane which passes through the anchorage as shown in Figure C.3 below.

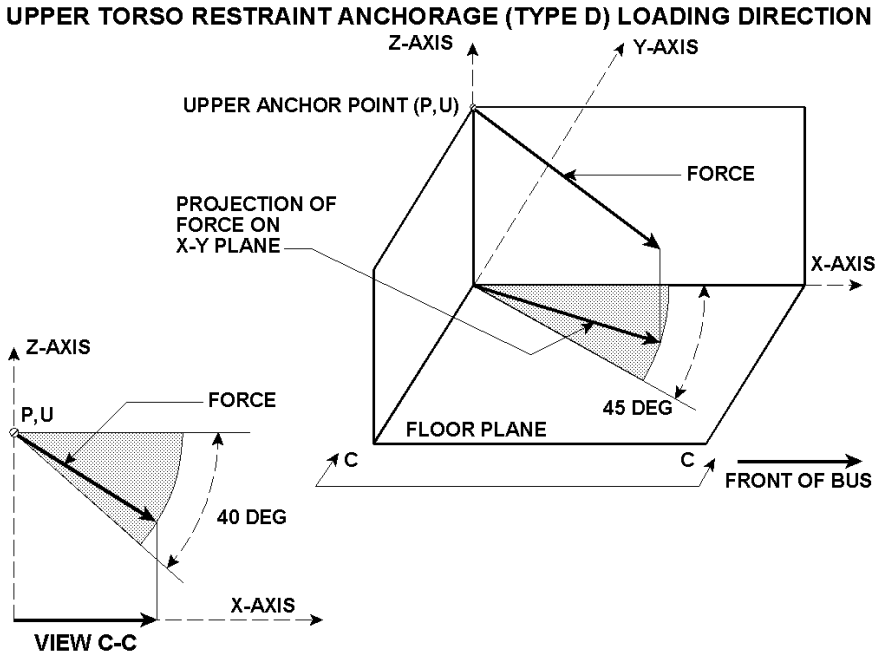

Figure C.3

__10.2. Apply a test force of 6,672 newtons. The force shall be applied at the onset rate of not more than 66,720 newtons per second. The 6,672 newtons force shall be attained in not more than 30 seconds, and shall be maintained for 10 seconds.

__10.3. Record the results in Table C. 1.

__11. Perform and record post test zero and calibration checks.

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Table C. 1

Wheelchair Location	Anchorage Location	Anchorage Type	Required Load (N)	Actual Max. Test Load (N)	Pass/ Fail	Comment
	LF					
	RF					
	LR					
	RR					
	Upper Torso					
	Other					
	LF					
	RF					
	LR					
	RR					
	Upper Torso					
	Other					
	LF					
	RF					
	LR					
	RR					
	Upper Torso					
	Other					
	LF					
	RF					
	LR					
	RR					
	Upper Torso					
	Other					

REMARKS:

_____ _____

I certify that I have read and performed each instruction. Date

REFERENCES

SAE J826, Devices For Use In Defining and Measuring Vehicle Seating Accommodation

SAE J383, Motor Vehicle Seat Belt Anchorages -- Design Recommendations