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July 16, 1991

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 220

School Bus Rollover Protection

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

OVSC LABORATORY TEST PROCEDURE NO. 220
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1. PURPOSE AND APPLICATION

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

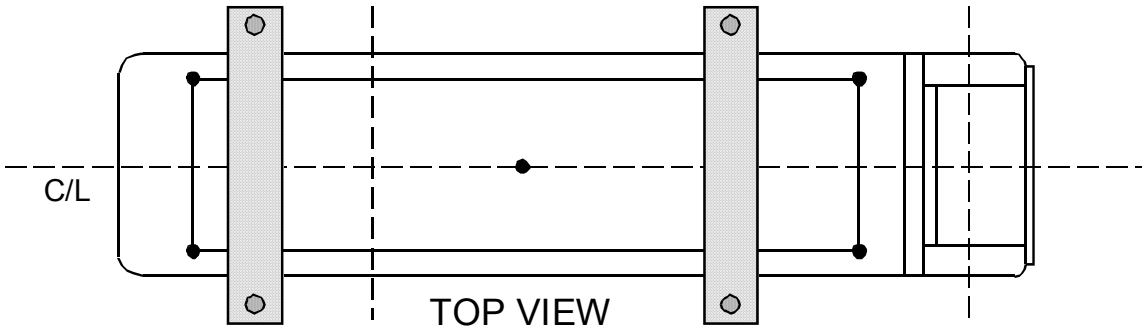
Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used. The OVSC Laboratory Tps are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment, which will assist in procuring the required compliance test data.

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

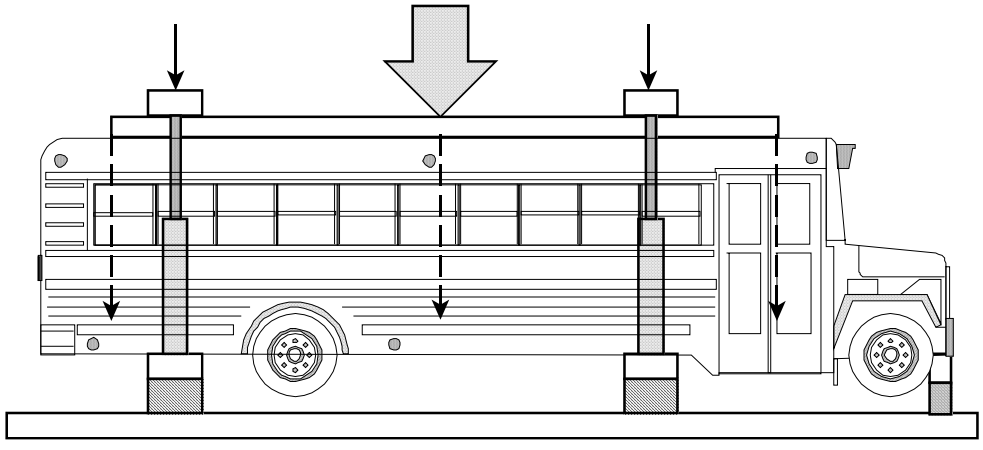
2. GENERAL REQUIREMENTS

Standard 220 establishes performance requirements for school bus rollover protection. The purpose of the standard is to reduce the number of deaths and the severity of injuries that result from failure of the school bus body structure to withstand forces encountered in rollover crashes. The standard applies to school buses.

A force equal to 1-1/2 times the unloaded vehicle weight (UVW) shall be applied to the roof of the vehicle's body structure through a flat, rigid, rectangular force application plate at any rate not more than 1/2 inch per second. The force application plate is measured with respect to the vehicle roof longitudinal and lateral centerlines. For vehicles with a GVWR of more than 10,000 pounds, the plate shall be 12 inches shorter than the roof and 36 inches wide. For vehicles with a GVWR of 10,000 pounds or less, the plate shall be 5 inches longer and 5 inches wider than the vehicle roof. The downward vertical movement at any point on the application plate shall not exceed 5-1/8 inches, and each emergency exit shall be capable of opening during the full application of the force and after release of the force. However, an emergency exit located in the roof of the vehicle is not required to be capable of being opened during the application of the force. A particular vehicle need not meet the emergency opening requirement after the release of force if it is subjected to the emergency exit opening requirements during the full application of the force.



TOP VIEW



RIGHT SIDE VIEW

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test vehicles 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. Any security problems, which arise, shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours. The contractor shall protect and segregate the data that evolves from compliance testing before and after each vehicle test. No information concerning the vehicle safety compliance-testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.
NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM, SHALL BE ALLOWED TO WITNESS ANY VEHICLE COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

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

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a vehicle or equipment test schedule to the COTR prior to conducting the first compliance test. Tests shall be completed as required in the contract.

Scheduling of vehicle tests shall be adjusted to permit vehicles to be tested to other FMVSSs as may be required by the OVSC. All vehicle compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired.

6. TEST DATA DISPOSITION

The contractor shall make all vehicle preliminary compliance test data available to the COTR on location within four hours after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR within five working days. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR. All backup data sheets, strip charts, recordings, plots, technicians notes, etc., shall be either sent to the COTR or destroyed at the conclusion of each delivery order, purchase order, etc.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

ACCEPTANCE OF SCHOOL BUS TEST VEHICLES

The Contractor has the responsibility of accepting school bus test vehicles from either bus manufacturers or distributors. In both instances, the contractor acts in the OVSC's behalf when signing an acceptance of school bus test vehicles. If a distributor delivers a school bus, the contractor must check to verify the following:

A. Tires and wheel rims are new.

B. There are no dents or other interior or exterior flaws in the bus body.

C. The school bus has been properly prepared and is in running condition.

D. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.

E. Proper fuel filler cap is supplied on the school bus.

If a government-contracted transporter delivers the school bus test vehicle, the contractor should check for damage, which may have occurred during transit.

A "Vehicle Condition" form will be supplied to the contractor by the COTR when the school bus test vehicle is transferred from the bus manufacturer or distributor or between test contracts. The upper half of the form describes the school bus in detail, and the lower half provides space for a detailed description of the posttest condition. School Bus Test Vehicle Condition forms must be returned to the COTR with the copies of the Final Test Report or the reports will NOT be accepted.

NOTIFICATION OF COTR

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

8. CALIBRATION OF TEST INSTRUMENTS

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

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

B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals NOT TO EXCEED SIX (6) MONTHS! Records, showing the calibration trace ability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

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

(1) Date of calibration
(2) Date of next scheduled calibration
(3) Name of the technician who calibrated the equipment

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

(1) Type of equipment, manufacturer, model number, etc.
(2) Measurement range
(3) Accuracy
(4) Calibration interval
(5) Type of standard used to calibrate the equipment (calibration trace ability of the standard must be evident)
(6) The actual procedures performed to do the calibrations

E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner, which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system shall need the acceptance of the COTR before the test program commences.

F. Test equipment shall receive a calibration check immediately prior to and after the test. This check will be recorded by the test technician(s) and included in the final report.

NOTE: In the event of a failure to the standard's minimum performance requirements, a posttest calibration check 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 will be performed without additional cost.

9. PHOTOGRAPHIC DOCUMENTATION

Photographs shall be glossy black and white, 8 x 10 inches, and legible. A tag, label or placard identifying the school bus test vehicle model and NHTSA number shall appear in each photograph and be legible. Each photograph shall be labeled as to subject matter. As a minimum the following photographs shall be included:

A. School bus being weighed

B. Frontal view of the school bus before testing

C. Frontal view of the school bus after testing

D. Rear view of the school bus before testing

E. Rear view of the school bus after testing

F. 3/4 forward view of the school bus before testing

G. 3/4 forward view of the school bus after testing

H. 3/4 rearward view of the school bus before testing

I. 3/4 rearward view of the school bus after testing

J. Full view of left side of school bus before testing

K. Full view of left side of school bus after testing

L. Full view of right side of school bus before testing

M. Full view of right side of school bus after testing

N. Photo of loading device placed against bus's roof at beginning of test

O. Photo of loading device placed against bus's roof at maximum load condition

P. Photo of backup roof deflection measuring device at maximum load.

Q. Photo of actual instrumentation setup

R. Roof, after removal of loading device, viewed from the bus exterior

S. Roof, after removal of loading device, viewed from the bus interior

T. Exits opened after roof loading has been attained (with parallelepiped or measuring devices in place)

U. Any damage to school bus not shown in above photos

V. Close-up view of school bus's certification label

W. Close-up view of school bus's tire information placard or label

X. Any other photographs requested by the NHTSA COTR

10. DEFINITIONS

BUS

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

BUS BODY

Portion of the bus that encloses the bus's occupant space, exclusive of the bumpers, the chassis, the frame and any structure forward of the forward most point of the windshield mounting. (571.3)

EMERGENCY EXIT

Any areas designated for egress during an emergency. A push-out window, the entrance door or an exit door can be designated as an emergency exit if it meets the criteria of 571.217, S5.2.3.1. A push-out window means a vehicle window designed to open outward to provide for emergency egress (571.217, S4).

FLAT

Having a level surface where the depressions and elevations do not exceed ±0.250 inches over the entire structure.

FORCE APPLICATION PLATE

Flat, rigid, rectangular structure that is measured with respect to the vehicle roof longitudinal and lateral centerlines.

GROSS AXLE WEIGHT RATING (GAWR)

Value specified by the vehicle manufacturer as the load-carrying capacity of a single axle system, as measured at the tire-ground interfaces. (571.3)

GROSS VEHICLE WEIGHT RATING (GVWR)

Value specified by the manufacturer as the loaded weight of a single vehicle. (571.3)

10. DEFINITIONS....Continued

MOTION

Any action, which has direction and force. When used to release the emergency exit the motion is rotary or straight and can be upward, downward, inward, forward, rotational or any combination of these. When used to extend the emergency exit, the motion is a push-pull action and in most cases will be straight and perpendicular to the undisturbed exit surface.

PARALLELEPIPED CLEARANCE

Unobstructed passage of the parallelepiped has occurred when its rearmost surface coincides with the vertical transverse plane that intersects the outer surface of the bus body at the bottom of the door opening.

RIGID

Being capable of resisting deflection resulting from a bending moment or a force. A specification for allowable deflection is denoted under the appropriate test equipment description.

ROTARY FORCE (MOTION)

If the primary motion of the unlatching mechanism is a rotating shaft or hub, then the mechanism release force is termed as rotary motion, even if a long handle moves through a small arc.

SCHOOL BUS (See next page)

UNLOADED VEHICLE WEIGHT (UVW)

Weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but without cargo or occupants, or accessories that are ordinarily removed from the vehicle when they are not in use. (571.3)

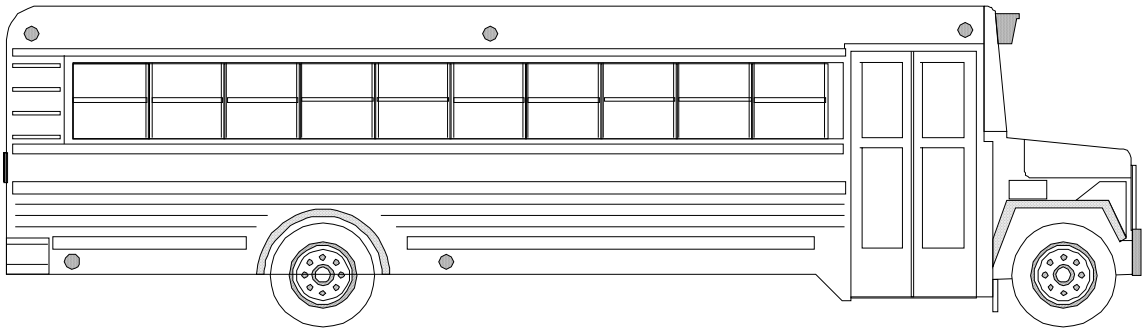
VEHICLE ROOF

That structure, seen in the top projected view, that coincides with the interior passenger and driver compartment of the vehicle. It is possible that the vehicle roof per this definition may not coincide with the physical roof dimensions of the vehicle.

10. DEFINITIONS....Continued

SCHOOL BUS

Bus 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 or sold for operation as a common carrier in urban transportation. (571.3)



11. PRETEST REQUIREMENTS

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

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

TEST DATA LOSS

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.

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 that test, by telephone, within 24 hours of the test and send written notice to the COTR within 48 hours of the test completion.

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.

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.

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.

Test Report: No test report is required for any test, which is determined to be invalid unless NHTSA specifically decides, in writing, to require the Contractor to submit such report. The test data from the invalid test must be safeguarded until the data from the retest has been accepted by the 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.

11. PRETEST REQUIREMENTS....Continued

Default: The contractor is subject to default and subsequent reprocurement costs for non-delivery of valid or conforming tests (pursuant to the Termination For Default clause in the contract.

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.

TEST EQUIPMENT DESCRIPTION

A. A load application system utilizing a device that continuously and automatically monitors the actual applied load via a load cell feedback circuit and is capable of maintaining the specified load limits throughout the test. As a minimum, this system should be able to automatically disengage the force at a preset load limit.

B. A force application plate consisting of a structural grade steel plate, having a minimum thickness of 1/4 inch, assembled to and reinforced by a framework of structural steel members such that it is level and the final surface is flat. This force application plate should be designed with length and width adjustment capabilities as required by the following:

(1) In the case of a school bus with a GVWR of more than 10,000 pounds, the force application plate is to be 12 inches shorter than the school bus roof and 36 inches wide. (S5.2(a))

(2) In the case of a school bus with a GVWR of 10,000 pounds or less, the force application plate is to be 5 inches longer and 5 inches wider than the school bus roof. (S5.2(b))

Once assembled to the required length and width with load actuation beams attached, the deflection measured at the longitudinal and transverse center of the force application plate simply supported at the extreme ends should not exceed 1/8 inch.

C. A load application device capable of applying an evenly distributed vertical force in the downward direction to the force application plate. This can be achieved with the use of hydraulic or pneumatic power.

11. PRETEST REQUIREMENTS....Continued

D. Force application plate displacement measuring device. Deflection of the force application plate shall be measured using a linear displacement potentiometer. Also, a measuring scale or any standard length-measuring device that is not subject to weather or damaging effects, which could result in variations that would exceed the specified tolerance, should be used for backup. Photographs should be taken of this scale at maximum load.

E. Load measuring device. A load cell(s) of proper capacity shall be used for measuring load and will be placed in the loading system so that it measures the actual load being transmitted to the roof. As a backup, a second load-measuring device, such as a pressure gage in the case of hydraulic load application, or a suitable instrument in the case of mechanical load application, should also be used.

F. Data recording equipment having a sufficient number of channels available for recording the necessary time histories of loads and deflection. Each data channel comprised of sensor, signal conditioner, data acquisition device and all interconnecting cables, must conform to the requirements of section 7 for a system and individual component calibration.

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

H. A direct writing pen recorder to provide a quick look at all deflection and force data prior to data reduction. Paper speed and beam deflections will be calibrated prior to the test.

I. Force measuring device(s) to determine the loads required to unlatch and open the emergency exits. The device(s) for measuring the force(s) will be calibrated for a tension or compression force/load scale with a range of at least 100 lbs., but not to exceed 150 lbs.

J. Rectangular parallelepiped. Fabricate a parallelepiped whose dimensions are 45 inches high by 24 inches wide by 12 inches deep, and incorporate provisions so it may also be used as a parallelepiped of 45 inches high by 24 inches wide by 6 inches deep.

K. A chassis support structure capable of supporting the entire school bus on the rigid chassis-to-body mounts or body sills.

11. PRETEST REQUIREMENTS....Continued

VEHICLE RECEIVING INSPECTION AND TEST PREPARATION

A. Wash and clean the vehicle exterior and interior. Affix a NHTSA No. placard inside the windshield and to the exterior front sides and rear of the bus. This number is the primary identification number and will be used throughout the test program.

B. The bus'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, misadjustment or other condition 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 COTR before initiating the test.

C. The school bus must have fluids added to the specified levels or filled to capacity and the vehicle weight recorded at each wheel to determine the Unloaded Delivered Weight (UDW). This weight is the Unloaded Vehicle Weight (UVW) and will be used as such in calculating the test load to be applied to the force application plate as specified. Check and record vehicle-unloaded attitude on a level surface (tire inflation pressure of all tires must conform to the vehicle manufacturer's recommended pressure for the unloaded vehicle). All measurements are to be taken before testing.

D. Record data from manufacturer's certification label for the complete vehicle and, if applicable, incomplete vehicle, on the Administrative Data Sheet.

E. Obtain pretest photographs of the school bus exterior and interior.

F. Determine if the vehicle is constructed with a frame or if it is constructed with rigid body-to-chassis mounts.

G. The school bus is to rest on a rigid surface so that the school bus is entirely supported by means of the bus's frame or body sills.

H. The tires must not absorb any loads. If the bus is constructed with non-rigid chassis-to-body mounts, these are to be replaced with equivalent rigid mounts.

I. Remove any components or appurtenances, which extend upward from the school bus roof.

J. The school bus windows, doors, and emergency exists are to be in the fully closed position and latched but not locked.

K. Determine if the emergency door can be unlatched by a single person from both inside and outside the bus passenger compartment without the use of remote controls or tools and with the engine not running.

11. PRETEST REQUIREMENTS....Continued

L. The ambient temperature must be maintained at any level between 32° Fahrenheit (F) and 90° F.

PROCEDURE AND TESTS FOR EMERGENCY EXITS

Using the following procedure, make the necessary tests to determine that all emergency exits can be unlatched and opened using the specified force levels and when opened, have the specified unobstructed opening. These same measurements must be made before the roof crush test and then repeated when the roof is under load and also after the roof crush test. Record the results of these measurements on Data Sheet No. 2.

A. School Bus Emergency Exit Requirements: Each school bus shall comply with either one of the following minimum emergency exit provisions, chosen at the option of the manufacturer: (571.217 S5.2.3)

(1) One rear emergency door that opens outward and is hinged on the right side (hinged on either side in the case of a school bus with a GVWR of 10,000 pounds or less), or,

(2) One emergency door on the vehicle's left side that is in the rear half of the school bus passenger compartment and is hinged on its forward side, and a push out rear window that provides a minimum opening clearance 16 inches high by 48 inches wide.

B. Procedure: Check the above required emergency exits (and only those exits) as follows and record the information on Data Sheet No. 2:

(1) On school buses over 10,000 lbs. GVWR, check the following:

(A) Inside the school bus:

[1] Record the force required to unlatch (release) the emergency exit door and the type of motion used - this force cannot exceed 40 pounds. The type of motion must be upward. If the motion is rotary, then the force application must be maintained perpendicular to the emergency exit release handle. (571.217 S5.3.3)

[2] Record the force required to manually extend (push out and open) the exit door and the type of motion used - this force cannot exceed 40 pounds. The type of motion must be straight and perpendicular to the undisturbed exit surface. (571.217 S5.3.1(b))

11. PRETEST REQUIREMENTS....Continued

[3] Record the force required to unlatch the rear window emergency exit - the number and force application configuration of the release mechanism(s). There can be no more than two release mechanisms. Each release mechanism can require one or two force applications for unlatching, however, at least one of these force applications must differ 90° to 180° from the direction of the initial push out motion of the emergency exit (outward and perpendicular to the exit surface). The magnitude of the force(s) cannot exceed 40 pounds and the type of motion(s) required for unlatching must be either rotary or straight or both. If the motion is rotary, then the force application must be maintained perpendicular to the emergency mechanism. (571.217 S5.2.3(b))

[4] Record the force required to extend the rear window exit - this force cannot exceed 40 pounds. (571.217 S5.2.3(b))

[5] All emergency exits can be manually released and extended by a single person to provide the specified unobstructed opening. (571.217 S5.3.3)

[6] The unobstructed opening of the extended emergency exit: The rear emergency door must provide an opening large enough to permit the unobstructed passage of a rectangular parallelepiped 45 inches high by 24 inches wide by 12 inches deep, keeping the 45 inch dimension vertical, the 24 inch dimension parallel to the opening and the lower surface in contact with the floor of the bus at all times. **EXCEPTION:** In the case where buses are constructed with a threshold, the parallelepiped described above is passed through the unobstructed opening as described except the parallelepiped may be raised off the floor of the bus no more than 1 inch to clear the threshold. The side emergency door must provide an opening at least 45 inches high by 24 inches wide. A vertical transverse plane tangent to the rear most point of a seat back shall pass through the forward edge of the side emergency door.

11. PRETEST REQUIREMENTS....Continued

NOTE: The transverse plane shall not intersect a plane tangent to the vehicle's side either in front of or to the rear of the forward edge of the side emergency door. The push out rear window shall provide a minimum opening clearance of 16 inches high by 48 inches wide. (571.217 S5.4.2.1(a))

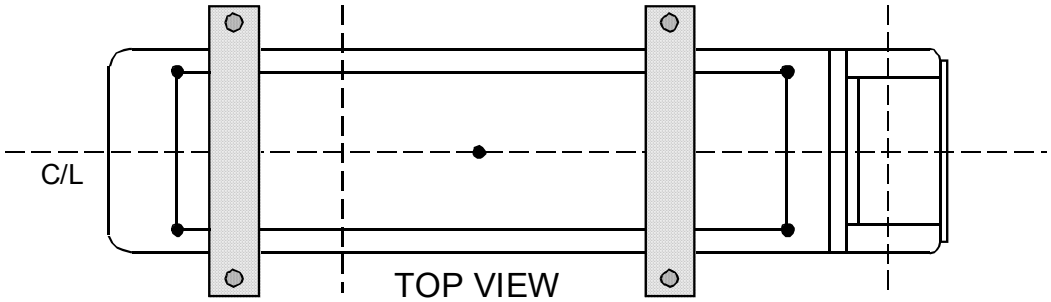
(B) Outside the school bus: Record the force required to release the emergency exit door and the type of motion - this force cannot exceed 40 pounds. The type of motion is at the discretion of the vehicle manufacturer. If the motion is rotary, then the force application must be maintained perpendicular to the emergency exit release handle. (571.217 S5.3.3)

(2) Emergency exits on school buses 10,000 pounds or less GVWR will be checked the same as those over 10,000 pounds except the dimensions of the parallelepiped passed through the unobstructed opening of the rear door or doors is 45 inches high by 24 inches wide by 6 inches deep.

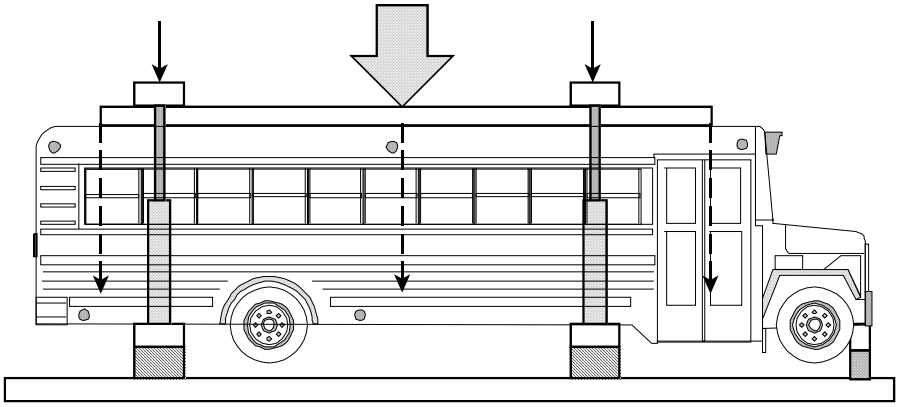
12. COMPLIANCE TEST EXECUTION

ROOF STATIC LOAD TEST

A. Place the school bus on a rigid surface so that the bus is entirely supported by means of the bus frame. If the school bus is constructed without a frame, place the bus on its body sills. The transverse axis of the bus must be level. (S5.1) A suggested test setup is shown below:



TOP VIEW



RIGHT SIDE VIEW

NOTE:
The school bus longitudinal centerline coincides with longitudinal centerline of force application plate. (S5.3)

Force application plate is 12" shorter than school bus roof and 36" wide if GVWR>10K lbs. or 5" longer and 5" wider than bus roof if GVWR10K lbs. (S5.2)

Continuous deflection measuring and recording devices shall be connected at each of the corners of the force application plate and at the center of the plate. Record all instrument settings, equipment serial numbers, test date, test operators, and zero and calibration checks.

Load cylinders extending between rigid mounts which support the weight of the bus on its frame or body sills and supports which extend across force application plate shall be connected to a common manifold hydraulic pressure system to provide even load. The output of force versus time shall be recorded for each load cylinder. A plot of this data shall be included in the final report.

12. COMPLIANCE TEST EXECUTION....Continued

B. Position the force plate on the school bus's roof so that its transverse axis is level and the force application plate contacts the roof at not less than two points. The longitudinal axis of the force application plate may deviate from the level or horizontal position. Also, in the top projected view, its longitudinal centerline coincides with the longitudinal centerline of the school bus, and its front and rear edges are an equal distance inside or outside the front and rear edges of the bus roof at the centerline. (S5.3)

C. Photograph test setup of front, side, and plan views of the school bus.

D. Apply an EVENLY DISTRIBUTED VERTICAL FORCE in the downward direction to the force application plate at any rate not more than 1/2 inch per second, until a force of 500 pounds (+0, -50) has been applied. If the force application plate weighs more than 500 pounds, some type of suspension device should be used to constrain the load level to the initial value, Record on the distance versus time plot the deflection where the downward force was 500 lb. Do NOT rezero the deflection measuring devices. (S5.4) **NOTE:** The initial load of 500 lbs is applied to eliminate slack from the system and the deflection caused by this load is not considered in the 5-1/8 inch limit. Load versus time shall be recorded. If the load-measuring device is subjected to both tension and compression, compression shall be shown as negative load and tension as positive load on the recording device. Record all instrument settings, equipment serial numbers, test date, test operators, and zero and calibration checks.

E. Apply additional EVENLY DISTRIBUTED VERTICAL FORCE in the downward direction to the force application plate at a continuous rate of not more than 1/2 inch per second until the force is equal to 1-1/2 times the Unloaded Vehicle Weight or UVW (-1% to -3%). The downward vertical movement of the force application plate should be measured, as a minimum, at the center and all four corners of the force application plate and the data recorded on Data Sheet No. 3. (S4 & S5.5)

NOTE 1: Linear potentiometers may be used as an alternate method of recording roof deflection.

NOTE 2: If the school bus design prevents location of deflection measuring devices at the exact corners of the force application plate, then the deflection measuring devices will be located as close as possible to the corners of the force application plate and the value of any deflection of the corner on the force application plate will be extrapolated from the deflection measured at the deflection measuring device location.

12. COMPLIANCE TEST EXECUTION....Continued

F. If the deflection reaches 6.125 inches, stop the load application, hold the load, and continue the rest of the test procedure.

G. When the specified downward vertical force has been achieved, as specified previously, this force should be maintained and photographs taken of the roof deflection for record purposes.

H. While the full force is being maintained, make the necessary tests to determine that all the required emergency exits can be unlatched and opened within the specified force requirements and that they provide the specified unobstructed opening(s). These same tests are to be repeated after release of all the downward force. Record results on Data Sheet No. 2. The FMVSS does not require the repeat test for compliance; however, this data is needed for record purposes. If possible, close all the emergency exits before release of the downward force from the roof. **CAUTION:** Some means of constraining the maximum deflection of the force application plate must be utilized to prevent collapsing of the plate and/or the school bus roof on individuals inside the school bus who are testing the emergency exits.

I. Record the calibration and zero checks.

J. Obtain sufficient photographs to record the test equipment setup and the school bus body prior to, during, and at completion of test.

K. Remove force application plate and photograph final damage configuration of the school bus. Store and secure the bus so that no further damage occurs to the bus body.

L. PASS/FAIL CRITERIA:

The school bus fails if any of the following occur:

(1) Downward vertical movement at any point on the force application plate exceeds 5.125 inches

(2) The required emergency exit/doors fail to open within the specified force requirements before or during load application

(3) The required emergency exit/doors fail to provide the specified unobstructed opening before or during load application

13. POST TEST REQUIREMENTS

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

A. Protect the school bus from further damage and the elements

B. Move the school bus to a secure area

C. Prepare the vehicle final test report

14. REPORTS

14.1 MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and a Vehicle or Equipment Status Report to the COTR. The Vehicle or Equipment 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.

14.2 APPARENT NONCOMPLIANCE

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

14.3 FINAL TEST REPORTS

14.3.1 COPIES

In the case of a test failure, **SEVEN** 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, **THREE** 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. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within 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.

14. REPORTS....Continued

14.3.2 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.

14.3.3 FIRST THREE PAGES

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

(1) Final Report Number such as 220-ABC-9X-001 where
220 is the FMVSS tested
ABC are the initials for the laboratory
9X is the Fiscal Year of the test program
001 is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

(2) Final Report Title And Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 220
SCHOOL BUS ROLLOVER PROTECTION
****
World Motors Corporation
199X Ace 65-Passenger School Bus
NHTSA No. CX0901

(3) Contractor's Name and Address such as

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

14. REPORTS....Continued

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
Safety Assurance
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6115 (NSA-30)
Washington, DC 20590

14. REPORTS....Continued

B. FIRST PAGE AFTER FRONT COVER --

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

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

Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY

Accepted By: _____

Acceptance Date: _____

14. REPORTS....Continued

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

Block 1 -- REPORT NUMBER

220-ABC-9X-001

Block 2 -- GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 -- RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 -- TITLE AND SUBTITLE

Final Report of FMVSS 220 Compliance Testing of 199X Ace 65-Passenger School Bus, NHTSA No. CX0901

Block 5 -- REPORT DATE

March 1, 199X

Block 6 -- PERFORMING ORGANIZATION CODE

ABC

Block 7 -- AUTHOR(S)

John Smith, Project Manager / Bill Doe, Project Engineer

Block 8 -- PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block 9 -- PERFORMING ORGANIZATION NAME AND ADDRESS

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

14. REPORTS....Continued

Block 10 -- WORK UNIT NUMBER

Leave blank

Block 11 -- CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

Block 12 -- SPONSORING AGENCY NAME AND ADDRESS

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

Block 13 -- TYPE OF REPORT AND PERIOD COVERED

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

Block 14 -- SPONSORING AGENCY CODE

NSA-30

Block 15 -- SUPPLEMENTARY NOTES

Leave blank

Block 16 -- ABSTRACT

Compliance tests were conducted on the subject 199X Ace 65-Passenger School Bus in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-220-0X for the determination of FMVSS 220 compliance. Test failures identified were as follows:

None

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

14. REPORTS....Continued

Block 17 -- KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 220

Block 18 -- DISTRIBUTION STATEMENT

Copies of this report are available from--

National Highway Traffic Safety Administration
Technical Reference Division
Room 5108 (NAD-52)
400 Seventh St., SW
Washington, DC 20590
Telephone No. (202) 366-4946

Block 19 -- SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 -- SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 -- NUMBER OF PAGES

Add appropriate number

Block 22 -- PRICE

Leave blank

14. REPORTS....Continued

14.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

A. Section 1 - Purpose of Compliance Test

B. Section 2 - Compliance Data Summary

C. Section 3 - Test Data

D. Section 4 - Test Equipment List and Calibration Information

E. Section 5 - Photographs

F. Section 6 - Notice of Test Failure (if applicable)

15. DATA SHEETS

DATA SHEET 1

ADMINISTRATIVE DATA

CONTRACT NO.: DTNH22- _____

LABORATORY NAME: _____

DESCRIPTION OF SCHOOL BUS:

A. Incomplete Vehicle (if applicable)

(1) MFR.: _____

(2) MODEL: _____

(3) VIN: _____

(4) BUILD DATE: _____

(5) CERTIFICATION DATE: _____

B. Completed Vehicle (SCHOOL BUS)

(1) MFR: _____

(2) MAKE/MODEL: _____

(3) VIN: _____

(4) NHTSA NO: _____

(5) COLOR: _____

(6) GVWR: _____

(7) BUILD DATE: _____

(8) CERTIFICATION DATE: _____

15. DATA SHEETS....Continued

DATES:

(1) VEHICLE RECEIPT: _____

(2) START OF COMPLIANCE TEST: _____

(3) COMPLETION OF COMPLIANCE TEST: _____

TEST VEHICLE (SCHOOL BUS) DISPOSITION:

COMPLIANCE TEST:

All tests were performed in accordance with the references outlined in:

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

DATA SHEET 2

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS

BUS MODEL YR/MAKE/MODEL/BODY: _____

BUS NHTSA NO.: _____ ; VIN: _____

BUS BUILD DATE: _____ ; TEST DATE: _____

TEST LABORATORY: _____

A. Can all exits be manually released and extended by a single person without tools, remote controls, and without the engine running?

NOTE: BEFORE, DURING & AFTER refer to the point in time in relation to the load applied to the load application plate on the school bus roof.

BEFORE LOAD: Yes ___ NO ___ -FAIL

DURING LOAD: Yes ___ NO ___ -FAIL

AFTER LOAD: Yes ___ NO ___ -FAIL

B. Is emergency exit door releasable from outside the school bus?

BEFORE LOAD: Yes ___ NO ___ -FAIL

DURING LOAD: Yes ___ NO ___ -FAIL

AFTER LOAD: Yes ___ NO ___ -FAIL

C. If emergency exit is push-out rear window, note in comments if release mechanism requires one or two force applications and the angle of these force applications from the extension motion.

A failure of an emergency exit after release of load application is NOT a compliance test failure, but is rather for investigative purposes, since it is believed most critical that all emergency exits be tested during load application.

15. DATA SHEETS....Continued

EXIT RELEASE MECHANISM FORCE - 40 LBS. MAXIMUM:

DESCRIPTION OF EXIT	ACTUAL BEFORE	PASS	FAIL	ACTUAL DURING	PASS	FAIL	ACTUAL AFTER	PASS	FAIL	TYPE OF MOTION ROTARY/STRAIGHT

EXIT EXTENSION FORCE - 40 LBS. MAXIMUM:

DESCRIPTION OF EXIT	ACTUAL BEFORE	PASS	FAIL	ACTUAL DURING	PASS	FAIL	ACTUAL AFTER	PASS	FAIL	TYPE OF MOTION ROTARY/STRAIGHT

15. DATA SHEETS....Continued

OPENING AREA MEASUREMENTS:

Describe the parallelepiped used to determine exit-opening dimensions (give dimensions and shape):

_____

_____

Location and Description of Exits (include width and length for rear windows exits and side door exits)

_____

_____

_____

_____

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

_____ P-__ F-___

REMARKS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

DATA SHEET 3

FORCE APPLICATION PLATE DEFLECTION

BUS MODEL YR/MAKE/MODEL/BODY: _____

BUS NHTSA MO.: _____; VIN: _____

BUS BUILD DATE: _____; TEST DATE: _____

TEST LABORATORY: _____

1. Deflection at the initial 500 lb. load:
   Station 1 - _____

   Station 2 - _____

   Station 3 - _____

   Station 4 - _____

   Station 5 - _____

2. Max. applied load = Station 1 + Station 2 + Station 3 + Station 4
   2.1 UVW = _____

   2.2 1.5 x UVW = _____

   2.3 Max. load = _____ + _____ + _____ + _____ = _____

3. Roof deflection at the maximum load of 1-1/2 times the unloaded vehicle weight. (Maximum allowed = 5.125") (S4(a))

	Total Defl.		**Initial Defl.**		**Defl.**	**Pass/ Fail**
Station 1:	_____	-	_____	=	_____	____
Station 2:	_____	-	_____	=	_____	____
Station 3:	_____	-	_____	=	_____	____
Station 4:	_____	-	_____	=	_____	____
Station 5:	_____	-	_____	=	_____	____

15. DATA SHEETS....Continued

REMARKS:

RECORDED BY:_____ DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

DATA SHEET 4

POST TEST VISUAL INSPECTION

BUS MODEL YR/MAKE/MODEL/BODY: _____

BUS NHTSA NO.: _____ ; VIN: _____

BUS BUILD DATE: _____ ; TEST DATE: _____

TEST LABORATORY: _____

Upon completion of testing, a detailed visual inspection of the school bus shall be made. Describe all damage and deformation that occurred during the test. Attach posttest final damage configuration photographs.

RESULTS:

RECORDED BY: _____ DATE: _____

APPROVED BY: _____

16. FORMS

LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS NO.: 220 TEST DATE: _____

LABORATORY: _____

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

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST SPECIMEN DESCRIPTION: _____

_____

VEHICLE NHTSA NO.: _____; VIN: _____

PART NO.: _____ MFR: _____

TEST FAILURE DESCRIPTION: _____

_____

_____

_____

FMVSS REQUIREMENT, PARAGRAPH §____ : _____

_____

_____

_____

NOTIFICATION TO NHTSA (COTR): _____

DATE: _____ BY: _____

REMARKS: _____

_____

_____

_____

16. FORMS....Continued

MONTHLY TEST STATUS REPORT

FMVSS 220

DATE OF REPORT: _____

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

16. FORMS....Continued

MONTHLY VEHICLE STATUS REPORT

FMVSS NO. 220

DATE OF REPORT: _____

NO.	VEHICLE NHTSA NO., MAKE & MODEL	DATE OF DELIVERY	ODOMETER READING	TEST COMPLETE DATE	VEHICLE SHIPMENT DATE	ODOMETER READING
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						