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DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Part 571

[Docket No. NHTSA–98–4662]

RIN 2127–AC19

Federal Motor Vehicle Safety Standards; School Bus Body Joint Strength

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Final rule.

SUMMARY: This rule amends Federal Motor Vehicle Safety Standard No. 221, *School Bus Body Joint Strength* (49 CFR 571.221), which requires school bus body panel joints to be capable of holding the body panel to the member to which it is joined when subjected to a force of 60 percent of the tensile strength of the weakest joined body panel. Currently, the standard applies only to school buses with a gross vehicle weight rating (GVWR) greater than 10,000 pounds. This rule extends the applicability of the standard to school buses with a GVWR of 10,000 pounds or less, narrows an exclusion of maintenance access panels from the requirements of the standard, and revises testing requirements.

This rule ensures that children are provided equivalent levels of protection against joint separation in small as well as large school buses. Since a larger proportion of small school buses than of large school buses are lift-equipped to transport mobility impaired students compared to large buses, this rule particularly enhances the safety of mobility impaired children.

DATES: This rule is effective May 5, 2000. Optional early compliance with the changes made in this final rule is permitted beginning November 5, 1998. Any petitions for reconsideration of this final rule must be received by NHTSA not later than December 21, 1998.

ADDRESSES: Petitions for reconsideration should refer to the docket number for this action and be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590. Copies of the Final Regulatory Evaluation for this rule can be obtained from: Docket Management, Room PL–401, 400 Seventh Street, SW, Washington, DC, 20590, telephone: (202) 366–9324. Docket hours are 10 a.m. to 5 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: Mr. Charles R. Hott, Office of Crashworthiness Standards, National Highway Traffic Safety Administration, 400 Seventh Street SW, Washington, DC 20590, (202) 366–0247.

SUPPLEMENTARY INFORMATION:

I. Summary of the Final Rule
II. Background
II. Amendments
A. Applicability to small school buses
B. Maintenance access panels
C. Other issues relating to exclusions
D. Test procedures
E. Other issues
IV. Rulemaking Analyses and Notices
A. EO 12866; DOT Regulatory Planning and Review and DOT Policies and Procedures
B. Regulatory Flexibility Act
C. Paperwork Reduction Act
D. National Environmental Policy Act
E. Executive Order 12612 Federalism
F. Civil Justice Reform

I. Summary of the Final Rule

This rule is intended to enhance the applicability and objectivity of Standard No. 221's school bus joint strength requirements. The standard currently applies only to large school buses (GVWR greater than 10,000 pounds). The standard specifies strength requirements for each ''body panel joint,'' which is currently defined as the area of contact or close proximity between the edges of a body panel and another body component, excluding spaces designed for ventilation or another functional purpose, and excluding doors, windows, and maintenance access panels (MAPs).

This rule extends the applicability of Standard No. 221 to small school buses (GVWR of 10,000 pounds or less) and narrows the present exclusion of MAPs from the joint strength requirements. Except as noted below, the rule requires panels to be attached at least at every 8 inches (203 millimeters (mm)), and requires body panel joints to withstand a tensile strength of 60 percent of the tensile strength of the weakest joined body panel. Excluded from these requirements are MAPs outside of the passenger area, and MAPs, smaller than a specified size, inside the passenger area. Joints from which a test sample cannot be obtained because of the joint's size or the curvature of the panels comprising the joint, are excluded from the tensile strength requirements.

Some of the definitions adopted by this rule differ from the NPRM. For example, the rule simplifies the definition of ''maintenance access panel,'' and adopts a definition of ''passenger compartment'' based on the definition in Standard No. 217, *Bus Emergency Exits and Window Retention and Release* (49 CFR 571.217). The proposal for deleting the ''hourglass'' shape of the test specimen has not been adopted.

II. Background

NHTSA is authorized by 49 U.S.C. 30101, *et seq.*, to issue Federal motor vehicle safety standards for new motor vehicles, including school buses.[1] In 1974, Congress enacted the Motor Vehicle and Schoolbus Safety Amendments (Pub. L. 93–492), which directed NHTSA to issue Federal motor vehicle safety standards for various aspects of school bus safety, including interior protection for occupants, floor strength, and crashworthiness of body and frame. In response to that Congressional mandate, NHTSA issued Standard No. 221, *School Bus Body Joint Strength.*

Standard No. 221 requires the strengthening of school bus body panel joints to prevent these joints from separating during a crash and becoming cutting edges that could cause serious injuries or allowing passenger ejection through openings created by such panel separations. The standard currently provides that each school bus body panel joint must be capable of holding the body panel to the member to which it is joined when subjected to a force of 60 percent of the tensile strength of the weakest joined body panel. Excluded from this requirement are doors, windows, spaces designed for ventilation or another functional purpose, and MAPs. MAPs were excluded because they involve areas on the vehicle requiring frequent maintenance and need to have unrestricted accessibility. Although MAPs were not defined in the standard, it was NHTSA's intent that manufacturers would limit MAPs to panels providing access to areas requiring routine maintenance.

Maintenance access panels (MAPs). The exception of MAPs from Standard No. 221 has been an issue of concern to NHTSA, the National Transportation Safety Board (NTSB), and school bus

[1] 49 U.S.C. 30125(a)(1) defines a *schoolbus* as a passenger motor vehicle designed to carry a driver and more than ten passengers that the Secretary of Transportation determines ''is likely to be used significantly to transport preprimary, primary, and secondary school students to or from school or an event related to school.'' NHTSA further defines a school bus as a bus that is sold or introduced in interstate commerce for purposes that include carrying students to and from school and related events, but does not include a bus that is designed and sold for operation as a common carrier in urban transportation. 49 CFR 571.3.

manufacturers. Through information provided by manufacturers and inspection of buses being built in the years following the effective date of the standard in 1977, NHTSA learned that most manufacturers created MAPs that ranged from a few inches up to 12 inches wide above the window area and extending the entire length of the bus. In addition, nearly the entire rear wall of some buses was designated as a MAP.

In testing some of those MAPs after the effective date of the standard, the agency found the panels to be loosely attached and unable to withstand much force before detaching from the bus body or adjacent panels. For example, NHTSA's inspections of a variety of school bus makes and models disclosed that MAPs extending the length of the bus above the windows were not fastened down, but were held in place only by the window frames. On the other hand, NHTSA observed that in some buses which had been involved in crashes, panels that complied with the standard performed very well and rarely detached from the bus body and adjacent panels.

To correct the perceived MAP problem, NHTSA issued a notice of proposed rulemaking on November 27, 1981 (46 FR 57939) proposing to remove the exemption for all maintenance access panels except for a few that were considered critical for proper maintenance.

Over 200 comments were received in response to that notice, all but two of which opposed the proposed amendments. In addition, public meetings were held on these issues in March 1982, and again in January 1983. Commenters on the notice and representatives of interested parties at the meetings contended that NHTSA could show no safety problem or abuse of the standard and no injuries attributed to MAP failure, and that extra fasteners could delay proper maintenance because of difficulties in removing them. They also suggested that the additional cost of compliance might be $500 per bus with no greater safety benefits, and that the proposals could include other previously excluded joints unrelated to MAPs.

NHTSA conducted an internal review of the comments received and available crash data and concluded that the assertions of the commenters had substantial merit. The agency was not able to locate a documented case of personal injury resulting from MAP failure, and was unable to identify any specific instances of abuse of the MAP exclusion. The agency believed, however, that the potential for abuse existed and urged manufacturers to limit their use of MAPs to those areas where such panels were clearly necessary. The agency also agreed that requiring extra fasteners on MAPs might not enhance safety because an increase in fasteners or a decrease in MAPs could complicate the maintenance process, thus discouraging prompt maintenance. Finally, the agency concluded that increased compliance costs could be detrimental to safety by inducing owners of older buses to keep them longer than they normally would, without a safety benefit. In view of these considerations, NHTSA terminated the rulemaking on July 2, 1984 (49 FR 27181), but nevertheless urged bus manufacturers to minimize the number of MAPs.

Although NHTSA terminated the rulemaking, NHTSA continued to consider the matter in light of additional information received after the termination, such as documentation of MAP separations in actual crashes that caused injuries, and evidence that some previously-complying panels had been redesignated as MAPs. The NTSB, in several recommendations based on a number of serious school bus accidents occurring after the termination, proposed elimination of the exclusion for MAPs and recommended other improvements in school bus safety. The NTSB also indicated that joint separation had occurred in crashes involving small school buses.

In June 1987, NHTSA issued an advance notice of proposed rulemaking (ANPRM) (52 FR 23314; June 19, 1987) on school bus body joint strength issues. The ANPRM requested comments on possible proposals to specify minimum strength requirements for the floors of school buses with a GVWR over 10,000 pounds, narrow the MAP exclusion from the joint strength requirements of Standard No. 221, and revise the test procedures of the standard.

Thirty-seven comments were received in response to the ANPRM, including comments from school bus manufacturers, school bus operators, and Federal, state and local governmental agencies. After considering all comments and completing a series of dynamic tests of school bus floor joints, NHTSA published a notice of proposed rulemaking on March 15, 1991 (56 FR 11142) (hereinafter NPRM), proposing to: (1) Extend the applicability of Standard 221 to small school buses (GVWR 10,000 pounds or less); (2) narrow the existing exclusion of MAPs; and (3) expand testing requirements and clarify testing procedures for school bus body panel joints.

NHTSA received 18 comments to the NPRM. Commenters included seven school bus manufacturers, one equipment supplier, six state organizations, three trade and citizens' associations, and one private citizen. All comments were fully considered and the significant ones are addressed below.

III. Amendments

A. Applicability to Small School Buses

This rule extends the applicability of Standard No. 221 to small school buses (GVWR 10,000 pounds or less), as proposed.

Commenters were divided in their support of NHTSA's proposal to extend the standard to small school buses. The Maryland State Department of Education (MSDE), Maryland Motor Vehicle Administration (MMVA), Washington Superintendent of Public Instruction (SPI), Connecticut Department of Motor Vehicles (CDMV), California Department of Education (CDE), and the Blue Bird Body Company (Blue Bird) all expressed support for the proposal. In general, the state agencies believed that small school buses should offer the same passenger protection as large school buses. Blue Bird stated that although there does not appear to be sufficient safety need or cost benefit justification for extending the requirements of Standard No. 221 to small school buses, the company supports the proposal in the interest of providing uniform safety levels in all school buses and because use of small school buses is growing.

Commenters opposed to the extension of Standard No. 221 to small school buses were Collins Industries (Collins), National Truck Equipment Association on behalf of the Manufacturers Council of Small School Buses (MCSSB), General Motors Corporation (GM), Ford Motor Company (Ford), and Mid Bus Inc. (Mid Bus). Most of these commenters believed that the findings of the NTSB were insufficient to establish a safety need to extend the standard to small school buses.

The agency disagrees, and believes there is a safety need to extend the standard to small school buses. NTSB was concerned that small school buses experience higher crash forces in a crash than do large school buses, since size and mass are important factors in crash severity. The NTSB studies on the crashworthiness of large and small school buses found that 6 of 19 small school bus crashes resulted in body panel joint separation (32 percent of the cases studied). In contrast, joint separations in large school buses

occurred in MAPs and floor joints, while body panel joints maintained structural integrity very well, even in severe crash forces. These results indicate that the requirements of Standard 221 are very effective (see NTSB Safety Study: Crashworthiness of Small Poststandard School Buses, October 11, 1989). Further, these results lead NHTSA to conclude that the structural integrity of small buses would be enhanced by the joint strength requirement of Standard 221. NHTSA concludes that small school buses should at least be subject to the same joint strength requirements as large school buses. This will better ensure that all children are provided equivalent levels of protection against injuries from joint separation, regardless of the GVWR of the vehicle transporting them.

Small school buses are becoming an increasingly larger part of the school bus fleet. From 1988 to 1993, the percentage of total school bus sales for small school buses rose from about 13 percent to about 19 percent (an increase of almost 50 percent in market share). From 1994 to the present, the percentage of small school bus sales has been holding steady at about 16 percent. This rise of sales is of concern because it indicates that crashes, and resultant injuries, are likely to increase.

Moreover, the agency notes that a larger proportion of small school buses than of large buses are lift-equipped to transport mobility impaired students. The school bus industry describes Type A and Type B school buses as being for ''disability/special purpose'' use. Extending Standard No. 221's requirements to small school buses thus enhances the safety of mobility impaired children. In addition, these buses may frequently be used to carry pre-primary, Head Start program children.

GM stated that small school buses are already subject to standards not applicable to large school buses, such as Standard Nos. 204, 208, 209, 210, 212, 219, and 301. Therefore, GM argued, a vehicle built in compliance with those standards has inherent structural integrity and occupant protection. Collins and MCSSB stated that small school buses actually have a double approach to passenger protection and restraint in crashes since they are subject to the compartmentalization requirements of large school buses as well as the seat belt requirements of Standard No. 208, *Occupant Crash Protection*.

NHTSA is not persuaded by these comments. The standards cited by GM help ensure the crashworthiness of a small school bus, but those standards address safety systems that are not directly relevant to school bus body panel joint integrity. For example, Standard No. 204 limits the rearward displacement of the steering control into the passenger compartment; 208, 209 and 210 address the occupant belt systems; 212 and 219 pertain to retention and intrusion of the windshield; and 301 addresses the vehicle's fuel system integrity. Similarly, in response to Collins and MCSSB, the fact that small school buses must comply with seat belt requirements and most (but not all) of the compartmentalization requirements of Standard No. 222 is irrelevant to the issue of upgrading the integrity of the bus body. The seat belt and compartmentalization requirements for small school buses help ensure that the passenger is restrained safely. Standard No. 221 regulates the lap joint construction method used to manufacture school bus bodies. The joint strength requirements will help ensure that the environment in which the passenger is restrained does not lose structural integrity in a crash. NHTSA views the occupant restraint and compartmentalization requirements of Standards No. 208 and 222 as complementing the joint strength requirements of Standard No. 221, and not as requirements that obviate the need for them.

MCSSB argued that the cost to manufacturers of bringing small school buses into compliance with Standard No. 221 would be prohibitive, considering the need for complete joint analysis, testing and certification programs, and possible material and design changes. Mid Bus estimated that having to comply with Standard No. 221 requirements would increase the cost of a small school bus by $1,982 (1996 dollars).[2]

The agency disagrees that the cost impact of the rule on small school buses is unreasonable. Currently, 21 states and the District of Columbia already require small school buses to comply with the joint strength requirements of Standard No. 221 at an additional cost ranging from $91 to $1,087 per vehicle. NHTSA estimates that the sales-weighted average increase in the consumer cost of a small school bus to comply with both the joint strength and the MAP requirements would be $343 (for a more detailed discussion of costs, including the cost impacts of the rule on large school buses, see the discussion of NHTSA's Final Regulatory Evaluation in the section on *Rulemaking Analyses and Notices*, below). All small school bus manufacturers already produce, at the purchaser's option, small school buses with body panel joints that comply with Standard No. 221. NHTSA believes, therefore, that extending the requirements of the standard to all school buses would not create an undue burden or expense for small school bus manufacturers since they are already tooled up for producing complying small school buses.

MCSSB expressed concern that chassis manufacturers would refuse to certify their chassis, forcing small school bus manufacturers to certify the chassis themselves or go out of business. Ford and Mid Bus also alluded to the potential problem of chassis manufacturers refusing to certify their chassis.

NHTSA does not believe the impacts of this rule on final-stage manufacturers will be unduly burdensome. As noted above, many states currently require small school buses to meet the joint strength requirements of Standard No. 221. Any final-stage school bus manufacturer producing a vehicle for sale in one of these states is already taking the necessary steps toward fulfilling its contractual obligations to meet Standard No. 221. In addition, any final-stage manufacturer of school buses is also required to meet the compartmentalization requirements of Standard No. 222, the crashworthiness requirements of Standard Nos. 204, 208, 209, 210, 212, 219, and 301 (as mentioned by GM, above), as well as the comprehensive series of FMVSSs that apply to school buses (e.g., Standard No. 217 for emergency exits and No. 108 for school bus lights). The commenters did not provide any information to demonstrate that a final-stage manufacturer, who is capable of fulfilling its present obligation to certify its vehicles to the extensive school bus safety standards, would be unable to certify to Standard No. 221. Moreover, Standard No. 221 specifies a relatively simple static-pull test procedure that manufacturers who choose to perform the test would not find burdensome to conduct. In contrast, Standards No. 212, 219 and 301 specify dynamic crash tests, and Standard No. 222 call for force applications and the calculation of head injury criterion values. NHTSA believes that, given the present certification responsibilities of final-stage manufacturers of small school buses and the level of testing necessary to test to FMVSS No. 221, these manufacturers have the means necessary to certify their vehicles to Standard No. 221, even in the absence of assurances from the chassis manufacturer. This assumes that

[2] All costs shown are in terms of 1996 dollars unless otherwise noted.

the chassis manufacturer would not provide such assurances. The agency believes that the provision in the rule that excludes joints that can not be physically accommodated in the tensile testing apparatus from the 60 percent joint strength requirement will make it easier for more chassis manufacturers to provide assurances to final-stage manufacturers that the joints on the incomplete vehicle meets Standard No. 221.

B. Maintenance Access Panels

NHTSA is defining ''maintenance access panel'' to limit a manufacturer's latitude to designate panels as MAPs and thus be excluded from the strength requirements of the standard. Under this rule, to be excluded from the requirements of Standard No. 221 as a ''maintenance access panel,'' a panel must meet the definition of a MAP, and must also meet certain criteria.

Definition. The definitions pertaining to maintenance access panels are the same as those proposed in the NPRM. This rule defines ''maintenance access panel'' as ''a body panel which must be moved or removed to provide access to one or more serviceable component(s).'' This rule also defines ''serviceable component'' as a part of the bus which is identified by the body or chassis manufacturer in the owners' or service manuals as requiring routine maintenance at least once each year. The definition specifies that ''serviceable component'' includes pneumatic and hydraulic devices, wiring harnesses, and tubing only at their attachments.

Criteria to be Excluded. However, the rule differs from the NPRM in setting criteria that a MAP must meet to be excluded from the requirements of Standard No. 221. To be excluded, the MAP must either: (1) Be located forward of the passenger seating area (the MAP must not lie between a vertical transverse plane located 762 mm (30 inches) in front of the forwardmost passenger seating reference point and a vertical transverse plane tangent to the rear interior wall of the bus at the vehicle's centerline); or (2) be located within the passenger seating area but have an opening that does not exceed 305 mm (12 inches) when measured across any two points diametrically on opposite sides of the opening.

In the NPRM, NHTSA proposed that any MAP that exposes the bus interior to areas below the floor, to the engine compartment or to compartments adjoining the engine compartment, would not be excluded, regardless of where in the bus interior the MAP was located. NHTSA also proposed that MAPs, other than those exposing the interior to areas below the floor or to the engine compartment or to compartments adjoining the engine compartment, which were in the passenger seating area had to meet size limits to be excluded from the joint strength requirements, ensuring that the MAP is no larger than required to provide access to the serviceable components the MAP covered. The proposed size limits provided a two-inch access margin around the periphery of serviceable components or clusters of components for handling and tool clearance during installation, replacement, inspection and adjustment procedures. The average spacing between components within a cluster of components covered by a single MAP could not exceed four inches.

Five manufacturers, two associations, and two state organizations commented on the proposal to narrow the exclusion of MAPs. The SPI and the California Highway Patrol (CHP) concurred with the proposal to restrict the size and locations of MAPs. SPI asserted that the present exclusion compromises the safety and structural integrity of school buses and that the proposed changes reflect a realistic limitation on the use of access panels.

Commenting in opposition to the NPRM, Thomas and Mid Bus asserted that there was not sufficient need shown to restrict MAPs. NHTSA disagrees. After reviewing both NTSB studies as well as reviewing recent NTSB school bus crash investigation reports, the agency found 7 out of 80 crashes studied involved MAP separations, causing head laceration injuries in two of the cases. In 4 of the 20 crashes involving small school buses, body joint separations occurred, resulting in one occupant with multiple leg fractures. Further, NHTSA's own tests have shown that MAP joints are not strong and can and do separate easily.

Navistar International Transportation Corporation (Navistar), National School Transportation Association (NSTA), MCSSB, and Blue Bird expressed concern that restricting MAPs as proposed would make required maintenance too difficult and time-consuming. They argued that mechanics would not take the time to replace all the fasteners to restore body panel joints to the 60 percent joint strength, and that mechanics would experience more cuts and abrasions because of tighter working areas. Those conditions could result in improperly accomplished maintenance, delays in required maintenance, increased failure of improperly-maintained parts, increased maintenance costs, and increased injuries because of the smaller sizes of the panels. Thomas, Mid Bus, and NSTA argued that the size restriction is too stringent. Mid Bus suggested an alternative restriction, i.e., that the MAP should be no smaller than 92,903 square millimeters (mm^2) or 144 square inches (in^2).

NHTSA can not agree with commenters that the proposed MAP restrictions will necessarily result in maintenance personnel not replacing all the fasteners after opening or removal. NHTSA believes that manufacturers are capable of designing their MAPs in such a manner as to minimize potential problems. For example, school bus designers and engineers may be able to redesign their current MAPs to provide fewer fasteners for mechanics to replace. Nevertheless, NHTSA has decided that the proposed limitations on MAP size are too restrictive. Clearance of two inches on a side in servicing components does not appear to be sufficient. After considering other alternatives for MAP exclusions, NHTSA has decided to exclude from the joint strength requirements of Standard No. 221 those maintenance access openings that do not exceed 305 mm (12 inches) when measured across any two points diametrically on opposite sides of the opening. That measurement is independent of the serviceable component's perimeter and location. The adopted restriction will ensure that MAPs are no larger than needed to provide access to the serviceable components the MAP covered. The proposed 102 mm (4 inches) average maximum distance limitation between components has not been adopted since no such component clusters have been identified either by NHTSA or by the commenters.

Engine access panels. Thomas and Navistar asserted that because engines need sometimes daily maintenance, engine covers should be excluded wherever located. NHTSA believes that most front engine buses have engine covers that are located outside the defined passenger compartment area and that maintenance on rear engine buses is routinely accomplished from the outside. Nevertheless, the agency agrees that direct and often-recurring engine maintenance should be quickly and easily accomplished. This includes easy accessibility to the engine compartment by the driver who may not have an extensive array of tools available. Accordingly, NHTSA has decided that engine access panels will be excluded from the requirements of the standard.

MAP floor panels. MAPs that expose the bus interior to areas located below

the bus floor or within the engine compartment are excluded from Standard No. 221's requirements if the MAP meets the restrictions on either MAP location or size described above. The NPRM did not provide for conditions whereupon interior MAP floor panels or interior MAPs leading into the engine compartment could be excluded from Standard No. 221. This was because NHTSA believed these panels should be universally required to comply with the joint strength requirement since the panels serve to isolate the bus interior from areas where fire is most likely to occur, and are an integral part of the vehicle's barrier against passenger compartment fires. In commenting on the proposal, Blue Bird asserted that subjecting floor panels to the body panel strength requirements is an unjustified extension of the standard that would do little to provide fire protection for the passenger compartment. NSTA stated that the strength of a joint has little or no relation to its effectiveness as a firestop.

It was NHTSA's intent in making the proposal to protect passengers as much as possible from fire entering the passenger compartment through a separated floor panel, as well as to prevent passengers from being ejected through a separated floor panel. Even though compliance with the joint strength requirement may not render a floor panel fireproof, proper joint strength may prevent the panel from separating. This would, in turn, help confine a fire to the area outside the passenger compartment, thereby allowing passengers more time to evacuate the vehicle. However, NHTSA agrees that there is an insufficient fire-related reason at this time to require any MAP, regardless of its location outside the bus occupant space or insignificant size, to meet the joint strength requirement if it is on the floor. Thus, the rule excludes MAPs on the floor of the vehicle if the MAP is forward of the passenger compartment or is of a size small enough to qualify the MAP for the exclusion.

C. Other Issues Relating to Exclusions

Ventilation. Currently, spaces designed for ventilation are excluded from the body joint strength requirements, and this rule continues that exclusion. The NPRM proposed to end the exclusion because the agency believed that the exclusion is not being utilized and therefore serves no useful purpose. However, Blue Bird and Thomas informed NHTSA that that belief is not correct. Blue Bird stated that, contrary to NHTSA's impression, ventilation panels are used for heater housings, heater air diffusers, heater ducts, heater hose covers, and air conditioning ducts and diffusers. Blue Bird argued that all those components serve important functional purposes, that they enclose no occupant air space, and are typically supported by panels that are required to comply with the standard. Blue Bird further asserted that eliminating this exclusion is not justified from a safety need and would be overly burdensome in terms of cost and restricted access to those components by maintenance personnel. Thomas stated that this revision would result in increased costs from redesign and extra fastening as well as decreased serviceability for the end user of the vehicle.

After careful consideration of the comments of Thomas and Blue Bird, NHTSA is persuaded that the ventilated panel exclusion is being utilized and that ventilation panels do serve important functional purposes. Further, due to their size and location, ventilation panels are not as likely as first thought to cause occupant injuries in an accident. NHTSA believes that extending the joint strength requirements to these panels would result in increased costs for redesign and additional fasteners, as well as decreased serviceability for the end user, without a commensurate safety benefit. Therefore, ventilation panels will continue to be excluded from the joint strength requirements of Standard 221.

Perforated panels. Thomas stated that perforated metal sheets are widely used in the interior linings of school buses to reduce interior noise. Thomas stated that the perforations do not extend into the joint area, making the joints stronger than the perforated portions of the panels. Thomas asserted, therefore, that the perforated portions could tear before the joints fail. Thomas suggested that NHTSA evaluate the safety advantages and disadvantages of the use of perforated headlining material to determine whether ''special considerations'' should be given for such material.

NHTSA is aware that perforated material is often used in school bus ceilings for noise reduction. The agency is unaware of any problems with perforated panels, such as instances where perforations contributed to the failure of a joint or where panels separated due to torn perforations. Nevertheless, the agency will monitor the use of perforated panels and their performance in school buses to determine whether there is a safety need to limit or otherwise regulate their use.

Curved and small joints. This rule excludes from the joint tensile strength requirement joints from which a test sample cannot be obtained because of the size of the joint or the curvature of the panels comprising the joint.

The NPRM proposed a procedure for testing curved joints, such as those found in roof or ceiling joints. The procedure would have specified that the test specimen is prepared by selecting a joint segment where the radius of curvature is at least 508 mm (20 inches). Thomas suggested a method of testing a curved joint, but stated that in order to prevent distortion of the test results, the gripping devices must be able to grip the sample in the same radius as the sample curvature. To avoid such complex test procedures, Thomas strongly recommended that NHTSA approve the use of surrogate joints.

NHTSA recognizes that the curved shape of such joints poses difficulty in obtaining accurate test results. The application of force on a curved surface would cause the surface to flatten, thus misrepresenting the actual force loading on the panel. Although NHTSA believes that it is possible to design and fabricate test fixtures and procedures capable of testing curved joints, such fixtures would involve additional certification costs for manufacturers and additional cost for NHTSA in the agency's compliance testing. Since the agency is not aware of any data indicating that injuries have been caused disproportionately by curved joint separation, NHTSA believes that the potential costs and technical difficulty of testing curved joints more than outweigh any potential safety benefits. However, the agency will continue to monitor this issue and initiate rulemaking should curved joint separation become a safety problem.

Thomas and GM commented on NHTSA's proposals to test small and complex joints such as those taken from door, window, and other small or inaccessible body panel joints. GM stated that NHTSA's proposals regarding the testing of these joints did not fully clarify specimen preparation procedures for such joints found in passenger vans or van cutaways. The commenters contended that many of the joints in those vehicles cannot be tested under either current or proposed testing procedures. GM suggested that NHTSA further study such types of joints and either further clarify pertinent test procedures or exclude such joints from the requirements of Standard 221 as being nontestable. Thomas asserted that the testing of very short pieces of frame that would require fittings would violate ASTM test principles. Thomas further

argued that tests need not be performed in this manner if NHTSA would approve the use of surrogate sampling.

NHTSA agrees that complex joints such as those found in body panels configured to join two or more panels in a single plane in any manner other than linear, as well as other small joints, cannot feasibly be tested under either current or proposed testing procedures. Accordingly, NHTSA has decided that test specimens from joints with discrete fasteners will be taken from 305 mm (12 inch) segments (203 mm (8 inches) at the neck) of only flat body panels. Small and complex joints, as well as trim, decorative parts, floor coverings, and molding strips will not be tested. The agency has no data indicating that any injuries have been caused by failure of those small and complex joints or components, and NHTSA believes that the potential cost of trying to test them would far outweigh any potential safety benefits.

While curved, small and complex joints are excluded from the tensile test requirement because they cannot be accommodated on the test apparatus, they are nevertheless subject to the requirement in S5.1.1 that no body panel, when joined to another body panel, shall have an unattached segment at the joint longer than 203 mm (8 inches). Presumably rivets or other fasteners will be used. This requirement helps ensure that the joints will maintain their integrity in a crash.

D. Test Procedures

This rule makes a number of revisions to Standard No. 221's test procedures, including adopting a provision that support members must remain attached to the specimen during testing; and that the term ''approximately perpendicular'' be deleted from S6.3.2 and replaced by a provision that the joint be in stress at 90 degrees plus or minus 3 degrees from the joint centerline. The parts of the NPRM proposing these changes did not engender opposition.

In contrast, the proposal that the existing ''hourglass'' shape of test specimens be eliminated in favor of straight sides was strongly opposed by Thomas and Blue Bird. The idea behind the proposal was that with a simple rectangular shape, more joints could potentially be tested. However, Thomas stated that a straight-sided test specimen was contrary to the shape principles set forth in the ASTM sample testing procedures. Those principles were designed to ''even-out'' the force distortions induced by the testing device. Blue Bird stated that the proposal to eliminate the hour glass shape was unacceptable, arguing that the test specimens need to be wider at the grips than at the joint section being tested. It said that this width is needed to allow for proper attachment of the specimen to the test grips and to ensure that adequate loading can be properly applied to the joint portion of the specimen.

NHTSA is persuaded by the comments of Thomas and Blue Bird and has decided to retain the hourglass shape of test specimens. The ASTM Standards call for the shape of the test specimen to be narrower at the sample's longitudinal centerline than at the ends of the specimen where the grips are attached. That shape concentrates the load exerted by the grips in the center of the specimen rather than at the edges as in the case of a straight-sided specimen.

Another proposal that generated opposition was the proposed discontinuance of the deduction of the total area of material removed for installation of fasteners (i.e., holes drilled for installation of rivets or screws) in calculating the tensile strength of each joined component. Thomas asserted that the proposal was not logical because the removal of material to make the fastener holes does in fact reduce the cross-sectional area being tested. Further, the commenter said that the change proposed by NHTSA would have the effect of increasing the joint strength required to meet the test. Blue Bird alluded to the NHTSA interpretation letter to that company dated November 28, 1978, which was the basis for the proposal. In that letter, NHTSA stated that subtracting the fastener holes was the proper procedure for calculating the correct area of the sample, but did not explain the basis for that conclusion. Blue Bird urged that subtracting the fastener holes is the correct method of calculating the area of the sample.

NHTSA has carefully considered this issue in light of the comments of Thomas and Blue Bird. It is easier for a sample joint to meet the standard's tensile strength requirement when the deduction is made for fastener holes. As previously discussed in this notice, the required strength of a given joint is based on the tensile strength of the weakest body panel attached at that joint. If the area for fastener holes were deducted from the total area of the test specimen when calculating the strength of the test specimen, the tensile strength of a sample joint could appear higher than the actual tensile strength of that joint. As a result, a given joint could meet the 60 percent tensile requirement of Standard 221 using fewer fasteners than those that would be necessary if the deduction were not made. In setting the 60 percent tensile requirement, the agency determined that minimum value met the need for motor vehicle safety. Since deducting for fastener holes can result in a joint being actually weaker than 60 percent of its weakest member, safety is better served if the deduction were not made. Accordingly, the letter of interpretation issued by this agency on November 28, 1978 that provided for the deduction is hereby rescinded.

E. Other Issues

Relative vs. Minimum Strength

Several comments on NHTSA's ANPRM of June 19, 1987 suggested that NHTSA replace the present relative body joint strength requirement (60 percent of the tensile strength of the weakest joined body panel) with an absolute minimum strength requirement. Specifically, Thomas suggested that the minimum required joint strength for interior body panels be established at 60 percent of the strength of 22 gauge steel, with a minimum tensile strength of 3,103 mPa (45,000 psi). For exterior body panels, Thomas suggested that the requirement be based on 20 gauge steel. The State of Connecticut suggested that a minimum strength requirement be based on materials currently used in school buses that performed favorably relative to those that performed poorly in similar crashes studied by the NTSB. The National Association of State Directors of Pupil Transportation suggested that minimum strength requirements be based on 60 percent of the tensile strength of 18 gauge steel for exterior panels and 20 gauge steel for interior panels, regardless of the materials used. Ford suggested that NHTSA include a minimum strength requirement as an optional alternative to the present relative strength requirement. NHTSA tentatively determined that the standard should be amended to establish a minimum strength standard, but requested comments in the NPRM on the issue.

NHTSA received comments on both sides of this issue. Those favoring establishment of a minimum strength requirement generally agreed that all school buses, regardless of size, should be subject to the same body panel joint strength requirements. Thomas disagreed with the proposal to base a minimum strength requirement on 18 and 20 gauge steel, contending that 20 and 22 gauge steel would suffice. Connecticut agreed with Thomas, but disagreed with Ford's suggestion to make an absolute strength standard optional. The West Virginia Department

of Education urged adoption of the recommendation of the National Standards Committee of the 11th National Conference on School Transportation which met in May 1990. That committee recommended that school bus body panels be constructed of prime commercial quality steel or other metal or material with strength at least equivalent to all-steel, as certified by the manufacturer. The Maryland Departments of Education and Motor Vehicles believed it appropriate to establish a minimum absolute joint strength standard which allows for equivalent strength materials. SPI and the CDE favored basing an absolute strength standard on 18 and 20 gauge steel for external and internal body panels respectively, while the CHP favored a standard governing the minimum strength for the weaker component of each joint, thus preventing the manufacturer from deliberately selecting body panel materials of low tensile strength.

Collins, Blue Bird and MCSSB opposed the proposal to set an absolute minimum strength standard. Collins asserted that the relative strength standard makes the most sense, insofar as the joint strength requirements must be consistent with the parent materials being joined, the expected loads, the probability of occurrence, and the location of the joint. Blue Bird argued that the proposal was neither practical nor objective and stated that some state specifications contain design and performance standards that require manufacturers to provide specific gauges and thicknesses of material for most body components. MCSSB asserted that the relative strength standard is preferable to the absolute standard in that the relative standard provides greater flexibility in material usage and methods which will increase strength. To set an absolute minimum requirement would restrict future developments.

NHTSA carefully considered the comments on this issue and was persuaded by the comments of Collins, Blue Bird, and MCSSB that body panel joint strength should be consistent with the bus manufacturers' choice of body panel materials. School bus manufacturers currently utilize many different thicknesses, or gauges, of steel in constructing their bus bodies, depending on the type and location of the joints. Thicknesses of panels and structural components range from 0.9 millimeters (0.034 inches) to 16 millimeters (.625 inches). Lastly, a minimum standard based on steel gauge would force manufacturers to overdesign their lightly loaded joints, requiring costly new tooling. Many school bus manufacturers are small business entities. Having to build to the heaviest loaded joint or the thickest gauge, somewhere between 18 and 22 gauge steel as suggested by commenters, would result in increases in vehicle weight, manufacturing costs, and operating costs with little or no corresponding increases in school bus safety benefits. Therefore, specifying a minimum absolute strength requirement by specifying a minimum steel gauge would be design restrictive and require significant changes in current industry design practices and procedures.

Some commenters expressed concern that under the relative strength approach, a manufacturer could deliberately select weak materials, thus lowering overall joint strength and reduce the number of fasteners needed for assembly. This has not happened under standard industry practices, however, and this agency has noted no degradation of safety attributable to the relative strength requirement. In its *Safety Study: Crashworthiness of Large Poststandard School Buses*, March 18, 1987, the NTSB found that large school buses with body panel joints that complied with the standard maintained structural integrity very well, even in severe crashes, thus providing effective protection to school bus occupants. Accordingly, NHTSA perceives no safety basis for changing the current relative strength standard in favor of an absolute minimum standard.

Effective Date

49 U.S.C. 30111(d) provides that a standard may not become effective before the 180th day or later than one year after the standard is prescribed, except upon a finding that a longer or shorter lead time is in the public interest. The NPRM proposed an effective date of 18 months after date of publication in the **Federal Register** for this final rule. None of the commenters addressed that issue.

As pointed out above, many if not all small school bus manufacturers currently offer, as an option, small school buses with body panel joints that comply with Standard No. 221 to accommodate those 21 states and the District of Columbia that require such compliance. The agency believes, therefore, that at least some of the tooling needed to comply with the changes mandated by this final rule is already in place. Nevertheless, some additional tooling may be required for all small school buses to be produced in compliance with Standard No. 221. In addition, MAPs in both large and small school buses may require redesign and testing in order to meet the new requirements. Accordingly, NHTSA believes that 18 months is sufficient lead time for manufacturers to accomplish any necessary redesign, retooling, testing, and marketing strategy to meet the requirements promulgated by this final rule, and that the 18 month lead time is therefore in the public interest.

IV. Rulemaking Analyses and Notices

A. Executive Order 12866, Regulatory Planning and Review, and DOT Regulatory Policies and Procedures

NHTSA has evaluated the impacts of this final rule and has determined that it is significant within the meaning of the Department of Transportation's regulatory policies and procedures. This rule was reviewed under E.O. 12866.

The agency has prepared a Final Regulatory Evaluation (FRE) for this rulemaking action and has placed a copy of that FRE in the public docket. A copy of the FRE may be obtained by contacting the Department's Docket at the address given at the beginning of this document.

As explained in the FRE, NHTSA estimates that the average consumer cost per vehicle affected by this final rule will be approximately $221 per large school bus and $343 per small school bus. Those retail price increases include variable costs, fixed factory overhead, tooling, and manufacturers' and dealers' profit margins. The difference in cost between large and small buses arises from the fact that large school buses, which already comply with the body panel joint strength standards of Standard 221, have only to bring their MAPs into compliance. Small school buses, on the other hand, which have heretofore been excluded from the joint strength requirements of Standard 221, must bring their body panel joints and their MAPs into compliance.

Information available to NHTSA indicates that the average combined total of annual sales of large and small school buses is approximately 35,000 units. Approximately 84 percent of those are large and 16 percent are small.

The estimated costs for small school buses were derived as follows. As discussed above, 21 states and the District of Columbia currently require small school buses to comply with the joint strength requirements of Standard No. 221. Sales within those jurisdictions represent 35 percent of small school bus sales. NHTSA estimates that the average cost of bringing body panel joints on 65 percent (@($414) joint strength upgrade) of the small school buses and MAPs on 100 percent (@($74) MAP redesign) of

the small school buses into compliance with Standard No. 221 will be $343 per vehicle. (.65($414)+1.00($74)=$343.) The total annual consumer cost for implementing the terms of this final rule for small school buses, therefore, is estimated to be $1,920,800. ($343×16% of 35,000 school buses.) These costs are based on optional equipment costs and may be overstated when required on all vehicles.

As noted above, the agency estimates that the average cost per large school bus will be $222. Thus, the total annual consumer cost of limiting the MAP exclusion in large school buses would average approximately $6,526,800 ($222×84% of 35,000 school buses).

The total annual consumer cost to implement the amendments promulgated by this final rule for both large and small school buses is estimated to be $8,447,600.

NHTSA believes that this rule will reduce 6 to 46 minor to serious injuries (AIS 1–3) annually. It is estimated that 5 to 33 AIS 1–3 laceration-type injuries will be reduced on large school buses due to the narrowing of the MAPs requirements. It is also estimated that the injury reduction for small school buses will be 0 to 3 AIS 1–3 laceration-type injuries and 1 to 10 AIS–3 fracture-type injuries. The methodology used to obtain these benefits can be found in the Final Regulatory Evaluation available in the docket.

B. Regulatory Flexibility Act

NHTSA has also considered the impacts of this final rule under the Regulatory Flexibility Act. NHTSA's analysis appears in the FRE. Based on such evaluation, I certify that the amendments will not have a significant economic impact on a substantial number of small entities.

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires each agency to evaluate the potential effects of its rules on small businesses, small organizations, and small governmental jurisdictions. The small businesses and organizations most likely to be affected by this final rule are: (1) School bus manufacturers; (2) school bus dealers and distributors; and (3) public and private school bus transportation owners and operators.

The Small Business Administration (SBA) defines a bus manufacturer with less than 500 employees as a small business (13 CFR part 121). Using that definition, the agency believes that many of the school bus manufacturers qualify as small businesses. As discussed above, most bus manufacturers known by NHTSA to build small school buses currently offer small school buses with complying body panel joints as an option. The manufacturers produce these vehicles to accommodate the 21 states and the District of Columbia which require that all school buses comply with Standard No. 221. NHTSA believes, therefore, that no new manufacturing techniques or tooling will be required by school bus manufacturers in order to build school buses that comply with the requirements of Standard No. 221. Further, costs, as a percentage of the total school bus manufacturing cost, will not increase significantly. Thus, any impact on total school bus sales will be negligible. On balance, the agency anticipates little measurable impact on school bus manufacturers' revenue levels, profitability, or employment.

The SBA defines a motor vehicle retailer with less than $11,500,000 in annual receipts as a small business. There are approximately 465 school bus dealers and distributors in the United States. Over the past 6 years (1991–1996), an annual average of approximately 35,000 school buses were sold, representing an average of 75 buses per dealer. In order to reach the threshold of $11,500,000 in annual sales receipts, the average dealer would have to sell a much larger number (270) of large school buses annually, assuming a cost of $45,280 per unit. Thus, most school bus dealers are probably small businesses. Because of the negligible cost impact on manufacturers, the agency also anticipates little measurable impact on retailers' revenue levels, profitability, or employment.

School bus operators will probably be the group most affected by the amendments to Standard No. 221 set forth in this final rule because of increased school bus purchase prices as discussed above, and possibly increased maintenance costs. The modest increase in purchase prices is not expected to influence significantly the demand for new school bus products. The sales weighted average consumer cost increase of $222 for large school buses is 0.49 percent of the price of a new 66 passenger school bus with an approximate $45,280 retail purchase price. For small school buses, the estimated incremental consumer cost of $343 per affected vehicle represents 1.21 percent of the retail price of a new $28,300 small school bus.

It is difficult to predict what impact the projected retail price increases discussed above will have on school bus purchases by states and/or school districts. There is a strong and continuing demand for school buses to transport school children and no alternative to the purchase of those vehicles. On the one hand, for many states and school districts operating on tight budgets, a 1.21 percent rise in the prices of small school buses and a 0.49 percent increase in the prices of large school buses may result in a proportionate reduction in new school bus sales. On the other hand, school districts may offset price increases by purchasing school buses with less optional equipment, such as luggage racks, extra batteries, or upgraded interiors. Even assuming the ''tight budget'' scenario, the agency believes that new school bus sales revenues will remain relatively constant. Thus, the net impact on school bus production and sales should be negligible.

C. Paperwork Reduction Act

In accordance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*), the agency notes that there are no collection of information requirements associated with this final rule.

D. National Environmental Policy Act

NHTSA has analyzed this final rule for the purposes of the National Environmental Policy Act. The agency has determined that implementation of this action will not have any significant impact on the quality of the human environment.

E. Executive Order 12612, Federalism

NHTSA has analyzed this final rule in accordance with the principles and criteria contained in Executive Order 12612, Federalism, and has determined that this final rule has borderline federalism implications. The agency's initial determination, however, is that such implications are not sufficient to warrant preparation of a Federalism Assessment.

F. Civil Justice Reform

This final rule does not have any retroactive effect. Under 49 U.S.C. 30103(b), whenever a Federal motor vehicle safety standard is in effect, a state or political subdivision may prescribe or continue in effect a standard applicable to the same aspect of performance of a motor vehicle only if the standard is identical to the Federal standard. However, the United States Government, a state or political subdivision of a state may prescribe a standard for a motor vehicle or motor vehicle equipment obtained for its own use that imposes a higher performance requirement than that required by the Federal standard. 49 U.S.C. 30161 sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. A petition for reconsideration

or other administrative proceedings is not required before parties may file suit in court.

List of Subjects in 49 CFR Part 571

Motor vehicle safety, Reporting and recordkeeping requirements, Tires.

In consideration of the foregoing, 49 CFR 571.221 is amended as follows:

PART 571—FEDERAL MOTOR VEHICLE SAFETY STANDARDS

1. The authority citation for Part 571 continues to read as follows:

Authority: 49 U.S.C. 322, 30111, 30115, 30117, and 30166; delegations of authority at 49 CFR 1.50.

2. Standard No. 221 is amended by revising S3; revising the definitions of ''body panel joint'' and ''bus body'' in S4; adding, in alphabetical order, the definitions of ''maintenance access panel,'' ''passenger compartment'' and ''serviceable component'' to S4; and revising S5 and S6, to read as follows:

§ 571.221 Standard No. 221, School Bus Body Joint Strength.

* * * * *

S3. *Application.* This standard applies to school buses.

S4. *Definitions.*

* * * * *

Body panel joint means the area of contact or close proximity between the edges of a body panel and another body component, including but not limited to floor panels, and body panels made of composite materials such as plastic or plywood.

Bus body means that portion of a bus that encloses the bus occupant space, including the floor and firewall (the body panel separating the engine compartment from the occupant space), but excluding the bumpers and chassis frame and any structure forward of the forwardmost point of the windshield mounting.

* * * * *

Maintenance access panel means a body panel which must be moved or removed to provide access to one or more serviceable component(s).

Passenger compartment means space within the school bus interior that is between a vertical transverse plane located 762 mm in front of the forwardmost passenger seating reference point and including a vertical transverse plane tangent to the rear interior wall of the bus at the vehicle centerline.

Serviceable component means any part of the bus, of either a mechanical or electrical nature, which is explicitly identified by the bus chassis and/or body manufacturer in the owner's manual or factory service manual as requiring routine maintenance actions at intervals of one year or less. Tubing, wires and harnesses are considered to be serviceable components only at their attachments.

S5. *Requirements.*

S5.1 Except as provided in S5.2, each body panel joint shall meet S5.1.1 and S5.1.2.

S5.1.1 Body panels attached to each other shall have no unattached segment at the joint longer than 203 mm.

S5.1.2 When tested in accordance with the procedure of S6, each body panel joint shall hold each body panel to the component to which it is joined when subjected to a force that equates to 60 percent of the tensile strength of the weakest joined body panel, determined pursuant to S6.2.

S5.2 *Exclusions.*

S5.2.1 The requirements of S5.1.1 and S5.1.2 do not apply to—

(a) Any interior maintenance access panel which lies forward of the passenger compartment, or, which exceeds 305 mm when measured across any two points diametrically on opposite sides of the opening.

(b) Trim and decorative parts which do not contribute to the strength of the joint, support members such as rub rails which are entirely outside of body panels, doors and windows, ventilation panels, and engine access covers.

S5.2.2 The requirements of S5.1.2 do not apply to joints from which a test specimen of the dimensions specified in Figure 1 can not be obtained.

S6 *Procedure.*

S6.1 *Preparation of the test specimen.*

S6.1.1 If a body panel joint is 203 mm long or longer, cut a test specimen that consists of any 203 mm segment of the joint, together with a portion of the bus body whose dimensions are those specified in Figure 1, so that the specimen's centerline is perpendicular to the joint at the midpoint of the joint segment. Where the body panel joint is not fastened continuously, select the segment so that it does not bisect a spot weld or a discrete fastener. Support members which contribute to the strength of a body panel joint, such as rub rails on the outside of body panels or underlying structure attached to joint members, shall remain attached to the test specimen, except that material may be removed from the support members as necessary to clear the gripping areas of the joint members being tested.

S6.1.2 [Reserved]

S6.1.3 Prepare the test specimen in accordance with the preparation procedures specified in the 1989 edition of the Annual Book of American Society for Testing and Materials (ASTM) Standards.

S6.2 *Determination of minimum allowable strength.* For purposes of determining the minimum allowable joint strength, determine the tensile strengths of the joined body components as follows:

(a) If the mechanical properties of a joint component material are specified by the ASTM in the 1989 Annual Book of ASTM Standards, the lowest value of that material's tensile strength per unit of area shown in that source shall be used.

(b) If the mechanical properties of a material are not specified by the ASTM in the 1989 Annual Book of ASTM Standards, determine its tensile strength by cutting a sheet specimen from outside the joint region of the bus body in accordance with Figure 1 of E 8–89 Standard Test Methods of Tension Testing of Metallic Materials, in Volume 03.01 of the 1989 Annual Book of ASTM Standards, and by testing it in accordance with S6.3.

(c) The cross sectional area of material removed to facilitate the installation of fasteners shall be used in the determination of the tensile strength of the weakest joined body panel.

S6.3 *Strength test.*

S6.3.1 The joint specimen is gripped on opposite sides of the joint in a tension testing machine in accordance with the 1989 Annual Book of ASTM Standards.

S6.3.2 Adjust the testing machine grips so that the applied force on the joint is at 90 degrees plus or minus 3 degrees from the joint centerline, as shown in Figure 1.

S6.3.3 A tensile force is applied to the specimen by separating the heads of the testing machine at any uniform rate not less than 3 mm and not more than 10 mm per minute until the specimen separates.

3. Figure 1 is revised to read as follows:

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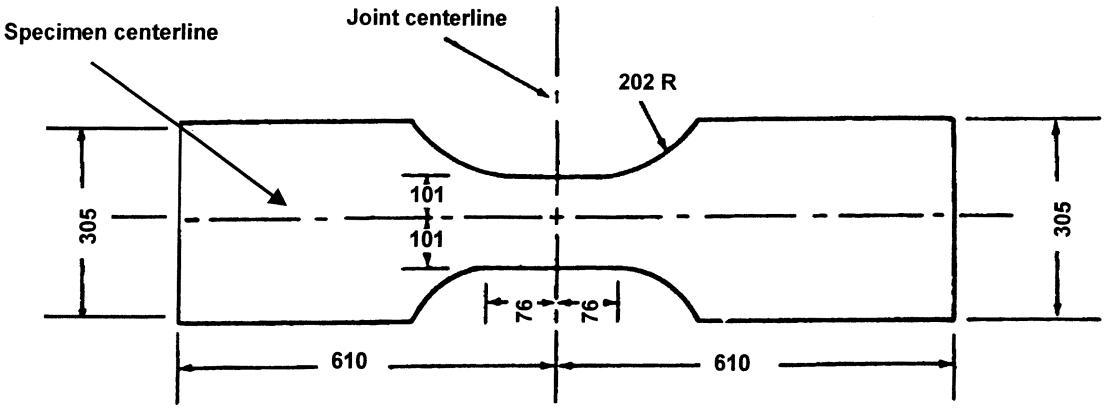
FIGURE 1



All dimensions in millimeters

BILLING CODE 4910–59–C

Issued: October 29, 1998.

Ricardo Martinez,

Administrator.

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