DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Parts 571, 585, 587, and 595

[Docket No. NHTSA 98–4405; Notice 1]

RIN 2127–AG70

Federal Motor Vehicle Safety Standards; Occupant Crash Protection

AGENCY: National Highway Traffic Safety Administration (NHTSA), DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: The agency is proposing to upgrade the agency's occupant protection standard to require advanced air bags. While current air bags have been shown to be highly effective in reducing overall fatalities, they sometimes cause fatalities to out-of-position occupants, especially children. The agency's proposal would require that improvements be made in the ability of air bags to cushion and protect occupants of different sizes, belted and unbelted, and would require air bags to be redesigned to minimize risks to infants, children, and other occupants. The advanced air bags would be required in some new passenger cars and light trucks beginning September 1, 2002, and in all new cars and light trucks beginning September 1, 2005. The agency's proposal is consistent with provisions included in the NHTSA Reauthorization Act of 1998 which mandate the issuance of a final rule for advanced air bags.

An appendix to this document responds to several petitions concerning requirements for air bag performance.

DATES: Comments must be received by December 17, 1998.

ADDRESSES: Comments should refer to the docket number and notice number, and be submitted to: Docket Management, Room PL–401, 400 Seventh Street, S.W., Washington, D.C. 20590 (Docket hours are from 10:00 a.m. to 5:00 p.m.)

FOR FURTHER INFORMATION CONTACT:

For information about air bags and related rulemakings. Visit the NHTSA web site at http://www.nhtsa.dot.gov and select ''Air Bags'' under ''Popular Information.''

For non-legal issues. Clarke Harper, Chief, Light Duty Vehicle Division, NPS–11, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590. Telephone: (202) 366–2264. Fax: (202) 366–4329.

For legal issues. Edward Glancy, Office of Chief Counsel, NCC–20, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590. Telephone: (202) 366–2992. Fax: (202) 366–3820.

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Overview of Proposed Requirements

The agency is proposing to upgrade Standard No. 208, *Occupant Crash Protection*, to require advanced air bags. The advanced air bags would be required in some new passenger cars and light trucks beginning September 1, 2002, and in all new cars and light trucks beginning September 1, 2005.

The agency is proposing to add a new set of requirements to prevent air bags from causing injuries and to expand the existing set of requirements intended to ensure that air bags cushion and protect occupants in frontal crashes. There would be several new performance requirements to ensure that the advanced air bags do not pose unreasonable risks to out-of-position occupants. The proposal gives alternative options for complying with those requirements so that vehicle manufacturers would be free to choose from a variety of effective technological solutions and to develop new ones if they so desire. With this flexibility, they could use technologies that modulate or otherwise control air bag deployment so deploying air bags do not cause serious injuries or that prevent air bag deployment if children or out-of-position occupants are present. To ensure that the new air bags are designed to avoid causing injury to a broad array of occupants, the agency would test the air bags using test dummies representing 12-month-old, 3-year-old, and 6-year-old children and 5th percentile adult females.

The agency is also proposing to ensure that the new air bags are designed to cushion and protect a broader array of belted and unbelted occupants, including teenagers and small women. The standard's current dynamic crash test requirements specify the use of 50th percentile adult male dummies only. Under the proposal, the agency would also use 5th percentile adult female dummies in the future. The weight and size of these dummies are representative of not only small women, but also many teenagers.

In addition to the existing rigid barrier test, representing a relatively ''stiff'' or ''hard'' pulse crash in perpendicular tests and a more moderate pulse crash in angled tests, the agency is proposing to add a deformable barrier crash test, representing a relatively ''soft'' pulse crash.[1] In relatively ''soft'' pulse

[1] ''Crash pulse'' means the acceleration-time history of the occupant compartment of a vehicle during a crash. This is represented typically in terms of g's of acceleration plotted against time in milliseconds (1/1000 second). The crash pulse for a given test is a major determinant of the stringency of the test, and how representative the test is of how a particular vehicle will perform in particular kinds

crashes, some current air bags do not deploy until after the occupants have moved so far forward that they are near the air bag cover when deployment begins. Such ''late deployments'' lead to high risks of injury. This proposed new crash test requirement is intended to ensure that air bag systems are designed so that the air bag deploys earlier, before normally seated occupants, including small-statured ones, move too close to the air bag. The agency is proposing to use 5th percentile adult female dummies in this test. If an air bag opens in time for small-statured occupants, who generally sit relatively far forward, it will open in time for taller occupants, who sit farther back.

The agency is proposing to phase out the unbelted sled test option as requirements for advanced air bags are phased in. Finally, NHTSA is proposing new and/or upgraded injury criteria for all of the standard's test requirements.

II. Executive Summary

Air bags have been shown to be highly effective in saving lives. They reduce fatalities in frontal crashes by about 30 percent. As of June 1, 1998, air bags had saved an estimated 3,148 drivers and passengers since their introduction in 1986. However, as of that same date, the agency had confirmed a total of 105 crashes in this country in which an air bag deployment had resulted in fatal injuries.

These deaths did not occur at random; they typically involved certain common factors. The persons who have been killed or seriously injured by an air bag were extremely close to the air bag at the time of deployment. The persons shown to be at greatest risk have been (1) unrestrained young children, who can easily be propelled close to or against the passenger air bag before the crash as a result of pre-crash braking, (2) infants in rear facing child seats, who ride with their heads extremely close to the passenger air bag, and (3) drivers (especially unrestrained ones) who sit extremely close to the steering wheel. These drivers are most likely to be small-statured women.

Since the problem of air bag deaths first emerged, NHTSA has taken a number of steps to address the problem. In late November 1996, the agency announced that it would be implementing a comprehensive plan of rulemaking and other actions (e.g., consumer education and encouragement of State seat belt use laws providing for primary enforcement of their requirements) addressing the adverse effects of air bags.

Recognizing that a relatively long period of lead time is required to make some types of significant design changes to air bags, the agency's comprehensive plan called for both interim and longer-term solutions. The interim solutions included temporary adjustments in Standard No. 208's performance requirements to ensure that the vehicle manufacturers had maximum flexibility to address quickly the problem of risks from air bags. One temporary change was to permit manufacturers to certify their vehicles to an unbelted sled test option, in which a vehicle is essentially stopped quickly, but not actually crashed, instead of to the standard's full scale unbelted crash test, in which a vehicle is actually crashed into a barrier. This made it much easier for the manufacturers to make quick design changes to their air bags. Another temporary change was to permit the vehicle manufacturers to install manual on-off switches for passenger air bags in vehicles without rear seats or with rear seats that are too small to accommodate a rear facing child restraint.

Another interim measure taken by NHTSA was to require improved labeling on new vehicles and child restraints to better ensure that drivers and other occupants are aware of the dangers posed by passenger air bags to children. Also, to address the problems faced by persons who are in groups at special risk from air bags, the agency issued a final rule exempting motor vehicle dealers and repair businesses from the statutory prohibition against making federally required safety equipment inoperative so that they may install retrofit manual on-off switches for air bags in vehicles owned or used by such persons and whose requests for switches have been approved by the agency.

In today's notice, NHTSA is proposing a longer-term solution. The proposed amendments contemplate implementation of advanced air bag system technology that would minimize or eliminate risks to out-of-position occupants and enhance the benefits provided by air bags to occupants of different sizes, belted and unbelted. The proposed amendments are consistent with the NHTSA Reauthorization Act of 1998, which requires advanced air bags.

In developing this proposal, the agency recognized that, to minimize or eliminate air bag risks, either (1) air bag deployment must be suppressed in situations that are risky to occupants, or (2) the air bag must be designed to deploy in such a manner that it does not present a significant risk of serious injury to out-of-position occupants.

The agency has used a number of methods to obtain up-to-date information regarding the technology needed for accomplishing these purposes. These methods included meetings with individual manufacturers, a public meeting and written information requests to vehicle and air bag manufacturers for specified types of information.

In numerous meetings with vehicle manufacturers and air bag suppliers, the agency discussed the steps that they were taking to address adverse effects of air bags. The agency found that these companies were working on a wide variety of technologies, involving one or both of the approaches (i.e., modulation of deployment or suppression of deployment) discussed above, to minimize or eliminate air bag risks. Vehicle manufacturers and suppliers are working on systems that would prevent an air bag from deploying in situations where it might have an adverse effect, using, for example, sensors that determine the weight, size, and/or location of the occupant. The vehicle manufacturers and suppliers are also working on systems that would modulate the speed and force of the air bag, using multiple level inflators. The activation of those different levels is keyed to sensors that determine such factors as crash severity, seat-track position, occupant weight and/or size, and whether an occupant is belted or not. They are also working on a variety of approaches that make air bags less aggressive to out-of-position occupants, e.g., by changing fold patterns, deployment paths, and venting systems.

NHTSA conducted a public meeting in February 1997 to obtain information about available technologies, and separately asked the National Aeronautics and Space Administration's Jet Propulsion Laboratory (JPL) for help in obtaining information. JPL surveyed the automotive industry and conducted

of real world crashes. Generally speaking, the occupant undergoes greater forces due to secondary collisions with the vehicle interior and restraint systems if the crash pulse g's are higher at the peak, or the duration of the crash pulse is shorter, which would lead to higher overall average g levels.

In a relatively ''hard'' pulse crash, a vehicle's occupant compartment decelerates relatively abruptly, creating a high risk of death or serious injury. In a relatively ''soft'' pulse crash, there is a lower rate of deceleration and proportionately lower risk of death or serious injury. The nature of the crash pulse for a vehicle in a given frontal crash is affected by a number of factors, including vehicle speed, the extent to which the vehicle structure forward of the occupant compartment collapses in a controlled manner so that some of the crash energy is absorbed, whether the struck object is fixed in place, the extent to which the struck object collapses and absorbs energy, and, in the case of non-fixed struck objects, the relative mass of the vehicle and the struck object. Large cars typically have relatively mild crash pulses, while small cars and utility vehicles typically have more severe crash pulses.

an analysis of the readiness of advanced air bag technologies.

Also, in April 1998, the agency sent an information request concerning advanced air bag technology to nine air bag suppliers. This effort supplemented NHTSA's other efforts to obtain information in this area and was intended to ensure that the agency had the most up-to-date information possible for this rulemaking.

The agency considered the information obtained in these various endeavors, as well as other available information, in developing this proposal.

To minimize air bag risks, the proposed amendments specify alternative options that would allow use of the differing kinds of technological solutions being developed or considered by the manufacturers to effectively address this problem. For example, the agency is proposing options that would test the performance of air bags designed to inflate in a manner so they do not cause injuries. These options, which are based on an approach recommended by the American Automobile Manufacturers Association (AAMA), specify static out-of-position tests. The agency is proposing use of several child dummies (representing an infant, a 3-year-old, and a 6-year-old) and the Hybrid III 5th percentile adult female dummy in these tests. Injury criteria would be specified for each of the new dummies. The agency is also proposing options that would test the performance of systems designed to suppress air bag deployment in the presence of children and/or out-of-position occupants.

NHTSA believes the proposed amendments would permit the vehicle manufacturers to use any technology or design which can effectively address the problem of adverse effects of air bags to out-of-position occupants, without detracting from the ability of the vehicle to meet Standard No. 208's other occupant protection requirements. The design changes that can be used to meet the proposed requirements range from relatively simple changes in the way air bags deploy to advanced systems incorporating sensors which vary air bag deployment depending on the size, weight and dynamic position of an occupant and crash severity.

In addition to proposing requirements to address air bag risks to out-of-position occupants, NHTSA is proposing to add to the standard's dynamic frontal crash test requirements to ensure that improved protection is provided to teenagers and adults of different sizes, belted and unbelted, especially ones of smaller stature. Under Standard No. 208's longstanding dynamic crash requirements, vehicles must meet specified injury criteria, including ones for the head and chest, measured on 50th percentile adult male test dummies (both belted and unbelted) during rigid barrier crashes at any speed up to and including 48 km/h (30 mph) and at any angle up to ± 30 degrees.[2] Thus, manufacturers are required to assure compliance with occupant protection requirements in full scale vehicle crashes representing a wide range of severities and crash pulses that could potentially cause fatal injuries.

However, despite their compliance with requirements specifying the use of 50th percentile adult male dummies, some current air bags may not provide appropriate protection to small adult occupants. Most significantly, some designs do not take account of the special needs of occupants who must sit relatively close to the air bag, such as small-statured women drivers. In order to provide protection to someone who sits close to the air bag, an air bag must deploy early in a crash event. However, the air bags of some vehicles deploy late in certain kinds of crashes (such as ones with soft pulses), after a small-statured driver, even though belted, has struck the steering wheel. In such a situation, the air bag cannot provide protection and may cause harm. This same problem is faced by persons who sit close to the passenger-side air bag.

To address this problem, NHTSA is proposing to add new dynamic crash test requirements using 5th percentile adult female dummies. Protection would be required to be demonstrated in a new ''offset deformable barrier crash test,'' a test which replicates a kind of real world crash likely to result in late deployment of many current air bags. This test measures the performance of the sensor system as well as the air bag in a 25-mph crash with a ''soft'' pulse, and would use restrained dummies only. In addition, 5th percentile adult female dummies would be added to the standard's existing 30-mph dynamic crash test requirements, using both restrained and unrestrained dummies.

The agency has developed injury criteria and seat positioning procedures that it believes are appropriate for small females. Among other things, the agency is including neck injury criteria, since persons close to the air bag at deployment are at greater risk of neck injury. NHTSA notes that it is also proposing to upgrade the current injury criteria specified for 50th percentile adult male dummies, and to add neck injury criteria, to make them consistent with what the agency is proposing for 5th percentile adult female dummies.

NHTSA recognizes that adding additional sizes of dummies would increase testing costs, but believes that their addition is needed to ensure that air bag performance is appropriate for occupants of different sizes. NHTSA notes that upgrading Standard No. 208 by adding a greater array of dummy sizes would parallel the agency's recent upgrading of Standard No. 213, *Child Restraint Systems,* through the addition of a greater array of sizes and weights of child test dummies.[3] Just as that final rule improved the safety of child restraint systems by providing for evaluation of performance in a more thorough manner, the addition of different size test dummies to Standard No. 208 would improve protection for all occupants by requiring more thorough evaluation of a vehicle's occupant protection system.

The agency notes that it may issue a separate document proposing to add the Hybrid III 95th percentile adult male dummy to Standard No. 208. With the addition of that dummy, occupant protection would be measured for adult occupant sizes ranging from small-statured females to large-statured males. The agency is not proposing to add the Hybrid III 95th percentile adult male dummy in this notice because development of that dummy has not yet reached the stage where it is appropriate for incorporation into a Federal motor vehicle safety standard.

NHTSA also notes that during calendar year 1999 it expects to propose a higher speed frontal offset requirement than that specified for the current barrier test. The agency is still conducting research regarding such a requirement. In addition, as more advanced technology is developed, the agency may develop proposals to require further enhancements in occupant protection under Standard No. 208.

To provide vehicle manufacturers sufficient time to complete development of advanced air bag designs meeting the new requirements proposed in today's notice, and implement them into their cars and light trucks, NHTSA is proposing a phase-in of the upgraded requirements beginning September 1, 2002, with full implementation required effective September 1, 2005. The agency is proposing to provide credits for early compliance with the rule. To address

[2] As discussed elsewhere in this notice, Standard No. 208 currently includes an option for manufacturers to certify their vehicles to an unbelted sled test as an alternative to the unbelted barrier test requirement.

[3] 60 FR 35126, July 6, 1995.

the special problems faced by limited line manufacturers in complying with phase-ins, the agency is proposing to permit manufacturers which produce two or fewer carlines [4] the option of omitting the first year of the phase-in if they achieve full compliance effective September 1, 2003.

NHTSA notes that Standard No. 208 contains several provisions, noted above, that were added as temporary measures to address air bag risks. One is the provision permitting manufacturers to provide manual on-off switches for passenger air bags in vehicles without rear seats or with rear seats too small to accommodate a rear facing infant seat. It expires on September 1, 2000.

The other is the provision permitting certification based on the unbelted sled test alternative to the unbelted barrier test requirements. It was scheduled to expire on September 1, 2001. However, notwithstanding the expiration date currently specified in the standard for the unbelted sled test option, the NHTSA Reauthorization Act of 1998 provides that the sled test option ‘‘shall remain in effect unless and until changed by [the final rule for advanced air bags].’’ The Conference Report states that the current sled test certification option remains in effect ‘‘unless and until phased out according to the schedule in the final rule.’’

In this notice, the agency is proposing to amend Standard No. 208 so that both the sled test option and the manual on-off switch provision are phased out as the new requirements for advanced air bags are phased in. During the phase-in, the sled test option and manual cutoff provision would not apply to any vehicles certified to the upgraded requirements, but would be available for vehicles not so certified under the same conditions as they are currently available. Thus, as manufacturers develop advanced air bags, they would need to ensure that vehicles equipped with these devices meet all of Standard No. 208’s longstanding performance requirements as well as the new ones being proposed today.

The agency is similarly proposing to amend its regulation permitting the installation of retrofit on-off switches to specify that these devices cannot be installed in vehicles that have been certified to the new requirements for advanced air bags.

NHTSA notes that, as discussed later in this notice, the auto industry and other commenters have raised a number of objections to the existing unbelted barrier test requirements.[5] While the agency is not proposing alternatives to those requirements in this notice, it is requesting comments on whether it should develop alternative unbelted crash test requirements.

This notice also provides the agency’s response to all outstanding petitions concerning air bag performance.

III. Statutory Requirements

As part of the NHTSA Reauthorization Act of 1998,[6] Congress required the agency to conduct rulemaking to improve air bags. The Act directed NHTSA to issue, not later than September 1, 1998, ‘‘a notice of proposed rulemaking to improve occupant protection for occupants of different sizes, belted and unbelted, under Federal Motor Vehicle Safety Standard No. 208, while minimizing the risk to infants, children, and other occupants from injuries and deaths caused by air bags, by means that include advanced air bags.’’

The Act directs the agency to issue the final rule not later than September 1, 1999. However, if it determines that the final rule cannot be completed by that date, the final rule must be issued no later than March 1, 2000. The final rule must be consistent both with the provisions of the NHTSA Reauthorization Act of 1998 and with 49 U.S.C. § 30111, which specifies the requirements for Federal motor vehicle safety standards.

The final rule must become effective in phases as rapidly as practicable, beginning not earlier than September 1, 2002, and no sooner than 30 months after the issuance of the final rule, but not later than September 1, 2003. The final rule must become fully effective by September 1, 2005. However, if the phase-in of the final rule does not begin until September 1, 2003, NHTSA is authorized to delay making the final rule fully effective until September 1, 2006.

To encourage early compliance, NHTSA is directed to include in the NPRM means by which manufacturers may earn credits toward future compliance. Credits, on a one-vehicle for one-vehicle basis, may be earned for vehicles which are certified as being in full compliance with the final rule and which are so certified before the beginning of the phase-in period. They may also be earned during the phase-in if a manufacturer’s production of complying vehicles for a model year exceeds the percentage of vehicles required to comply in that year.

In a paragraph titled ‘‘Coordination of Effective Dates,’’ the Act provides that the unbelted sled test option ‘‘shall remain in effect unless and until changed by [the final rule for advanced air bags].’’ The Conference Report states that the current sled test certification option remains in effect ‘‘unless and until phased out according to the schedule in the final rule.’’

IV. Safety Problem and the Agency’s Remedial Actions

A. Introduction

While air bags are providing significant overall safety benefits, NHTSA is concerned that current air bags have adverse effects on certain groups of people in limited situations. Of particular concern, NHTSA has confirmed 105 primarily low speed crashes in which the deployment of an air bag resulted in fatal injuries to an occupant, as of June 1, 1998. NHTSA believes that none of these occupants would have died if the air bag had not deployed.[7]

The primary factor linking these deaths is the proximity of occupants to the air bag when it deployed. These deaths occurred under circumstances in which the occupant’s upper body was very near the air bag when it deployed.

There were two other factors common to many of the deaths. First, apart from 13 infants fatally injured while riding in rear-facing infant seats, most of the fatally injured people were not using any type of child seat or seat belt. This allowed the people to move forward more readily than properly restrained occupants under conditions of pre-impact braking or low level crashes. Second, the air bags involved in those deaths were, like all current air bags, so-called ‘‘one-size-fits-all’’ air bags that

[4] The term ‘‘carline’’ refers to a group of vehicles which has a degree of commonality in construction (e.g., body, chassis). The term is used in NHTSA’s automobile parts content labeling program and is defined at 49 CFR § 583.4.

[5] The most significant objection is the argument that air bags designed to enable vehicles to meet the unbelted barrier test at 30 mph will be too powerful for occupants, especially children, who are extremely close to the air bag at time of deployment. The agency notes, however, that this objection has been made primarily in the context of the continued use of current, single inflation level air bags, instead of the advanced ones that are the subject of this proposal. Another significant objection concerns how representative the barrier test is of real world crashes. As discussed later in this notice, NHTSA is placing in the docket a technical paper which analyzes the representativeness of those requirements with respect to real-world crashes which have a potential to cause serious injury or fatality.

[6] The NHTSA Reauthorization Act of 1998 is part of P.L. 105–178.

[7] The vast majority of the deaths appear to have occurred in crashes in which the vehicle had a change in velocity of less than 15 mph. Almost all occurred in crashes with a change of velocity less than 20 mph.

have a single inflation level.[8] These air bags deploy with the same force in very low speed crashes as they do in higher speed crashes.

The most direct behavioral solution to the problem of child fatalities from air bags is for children to be properly belted in the back seat whenever possible, while the most direct behavioral solution for the adult fatalities is to use seat belts and move the driver seat as far back as practicable. Implementing these solutions necessitates increasing the percentage of children who are seated in the back and properly restrained in child safety seats. It also necessitates improving the current 69 percent rate of seat belt usage by a combination of methods, including the enactment of State primary seat belt use laws.[9]

The most direct technical solution to the problem of fatalities from air bags is to require that motor vehicle manufacturers install advanced air bags that protect occupants from the adverse effects that can occur from being too close to a deploying air bag.

All of these solutions are being pursued by the agency. However, until advanced air bags are incorporated into the vehicle fleet, behavioral changes based on better information and communication about potential hazards and simple, non-automatic technology are the best means of addressing fatalities from air bags, especially those involving children.

To partially implement these solutions, and preserve the benefits of air bags, while reducing the risk of injury to certain people, NHTSA issued several final rules in the past year-and-a-half.

One rule requires new passenger cars and light trucks to bear new, enhanced air bag warning labels. (61 FR 60206; November 27, 1996)

Another rule provided vehicle manufacturers with the temporary option of certifying compliance based on a sled test using an unbelted dummy, instead of conducting a vehicle-to-barrier crash test using an unbelted dummy. (62 FR 12960; March 19, 1997) While vehicle manufacturers could have depowered many or most of their vehicles' air bags without changes to Standard No. 208, the final rule expedited this process. In view of concerns that the gentler crash pulse of the sled test would enable many vehicles to meet Standard No. 208's existing injury criteria without an air bag deploying, the agency added neck injury criteria to help ensure that air bags deploy and are not depowered so much as to be ineffective. Unless the air bags deployed, a vehicle would be very unlikely to be able to pass the neck injury criteria limits. The agency concluded that depowering current single-inflation level air bags would most likely reduce the adverse effects of these air bags, although it also expressed concern that depowering could result in less protection being provided to occupants in higher speed crashes, especially for those who are unbelted and/or heavier than average.

NHTSA has also issued two final rules related to manual on-off switches. One extends the temporary time period during which vehicle manufacturers are permitted to offer manual on-off switches for the passenger air bag for vehicles without rear seats or with rear seats that are too small to accommodate rear facing infant seats. (62 FR 798; January 6, 1997) The other final rule exempts motor vehicle dealers and repair businesses from the statutory prohibition against making federally-required safety equipment inoperative so that they may install retrofit manual on-off switches for driver and passenger air bags in vehicles owned by or used by persons who are in groups at special risk from air bags and whose requests for switches have been authorized by the agency. (62 FR 62406; November 21, 1997)

On the behavioral side, the agency has initiated a national campaign to increase usage of seat belts through the enactment of primary seat belt use laws, more public education, and more effective enforcement of existing belt use and child safety seat use laws.

In conjunction with the National Aeronautical and Space Administration, as well as Transport Canada, and in cooperation with domestic and foreign vehicle manufacturers, restraint system suppliers and others through the Motor Vehicle Safety Research Advisory Committee (MVSRAC), NHTSA has undertaken data analysis and research to address remaining questions concerning the development and introduction of advanced air bags.

In today's notice, the agency is proposing to require advanced air bags.

B. Background

1. Air Bags: Safety Issues

a. Lives saved and lost. Air bags have proven to be highly effective in reducing fatalities from frontal crashes, the most prevalent fatality and injury-causing type of crash. Frontal crashes cause 64 percent of all driver and right-front passenger fatalities.

NHTSA estimates that, between 1986 and June 1, 1998, air bags have saved about 3,148 drivers and passengers (2,725 drivers (87 percent) and 423 passengers (13 percent)).[10] Of the 3,148, 2,267 (72 percent) were unbelted and 881 (28 percent) were belted. These agency estimates are based on comparisons of the frequency of front seat occupant deaths in vehicles without air bags and in vehicles with air bags. Approximately half of those lives were saved in the last two years. These savings occurred primarily in moderate and high speed crashes.

Pursuant to the mandate in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) for the installation of air bags in all passenger cars and light trucks, the number of air bags in vehicles on the road will increase each year. As a result, the annual number of lives saved by air bags will continue to increase each year. Based on current levels of effectiveness, air bags will save more than 3,200 lives each year in passenger cars and light trucks when all light vehicles on the road are equipped with dual air bags. This estimate is based on current seat belt use rates (about 69 percent, according to State-reported surveys).

While air bags are saving large numbers of people in moderate and high speed crashes, they sometimes cause fatalities, especially to children, in lower speed crashes. As of June 1, 1998, NHTSA's Special Crash Investigation program had confirmed a total of 105 crashes in which the deployment of an air bag resulted in fatal injuries. Sixty-one of those fatalities involved children. Four adult passengers have also been fatally injured. Forty drivers are known to have been fatally injured.

Just as the number of lives saved per year will rise as more vehicles are

[8] The Federal safety standards do not require a "one-size-fits-all" approach to designing air bags. They permit a wide variety of technologies that would enable air bags to deploy with less force in lower speed crashes or when occupants are out of position or suppress deployment altogether in appropriate circumstances.

[9] In States with "secondary" seat belt use laws, a motorist may be ticketed for failure to wear a seat belt only if there is a separate basis for stopping the motorist, such as the violation of a separate traffic law. This hampers enforcement of the law. In States with primary laws, a citation can be issued solely because of failure to wear seat belts.

[10] Studies published in the November 5, 1997 issue of the *Journal of the American Medical Association* by the Insurance Institute for Highway Safety (IIHS) and by the Center for Risk Analysis at the Harvard School of Public Health confirm the overall value of passenger air bags, while urging action be taken quickly to address the loss of children's lives due to those air bags. IIHS found that passenger air bags were associated with a substantial reduction in crash deaths. The Center evaluated the cost-effectiveness of passenger air bags and concluded that they produce savings at costs comparable to many well-accepted medical and public health practices.

equipped with air bags, so will the number of fatalities caused by air bags, absent either advanced air bags or changes in occupant behavior. Using the year 2000 as a point of reference, if all passenger vehicles on the road were equipped with air bags, air bags would save 3,215 lives annually. However, there would be 214 fatalities annually—33 infants in rear facing child seats, 129 other children, 41 drivers, and 11 adult passengers.

It is important to note that these estimates are based on pre-model year 1998 air bags and on the assumption that there are no changes in occupant demographics, driver/passenger behavior, belt use, child restraint use, or the percent of children sitting in the front seat. However, as noted above, changes have already occurred that have reduced the potential number of fatalities. Manufacturers redesigned most air bags for model year 1998 to reduce the adverse effects of air bags. Moreover, additional changes are anticipated. As public education programs succeed in creating better awareness of occupant safety issues, and as auto manufacturers voluntarily continue to improve their air bags, the potential adverse effects of air bags will be further reduced. Nonetheless, the agency believes that the air bag fatalities that have occurred to date, and the potentially much larger number of air bag fatalities that could occur when all light vehicles are equipped with air bags, demonstrate the need for regulatory action in this area.

b. Causes of air bag fatalities. Air bag fatalities are caused by a combination of proximity to deploying air bags and the current designs of those air bags. The one fact that is common to all persons who died is *not* their height, weight, gender, or age. Instead, it is the fact that they were too close to the air bag when it started to deploy. For some, this occurred because they were initially sitting too close to the air bag. More often, this occurred because they were not restrained by seat belts or child safety seats and were thrown forward during pre-crash braking.

Air bags are designed to save lives and prevent injuries by cushioning occupants as they move forward in a frontal crash. They keep an occupant's head, neck, and chest from hitting the steering wheel or instrument panel. To accomplish this, an air bag must move into place quickly. The force of a deploying air bag is greatest as the air bag begins to inflate. The force decreases as the air bag inflates further.

Occupants who are very close to or in contact with the cover of a stored air bag when the air bag begins to inflate can be hit with enough force to suffer serious injury or death. In general, a driver can avoid this risk by sitting at least 10 inches away from the air bag (measured from the breastbone to the center of the air bag cover) and wearing safety belts. Teenage and adult passengers can avoid this risk by moving their seat back and wearing their safety belts. Children should ride in the rear seat whenever possible.

The confirmed fatalities involving children have a number of fairly consistent characteristics. First, 13 infants were in rear-facing infant seats that were installed in front of a passenger side air bag. Second, the vast majority of the older children were not using any type of restraint.[11] Third, as noted above, the crashes occurred at relatively low speeds. If the passenger air bag had not deployed in those crashes, the children would probably not have been killed or seriously injured. Fourth, the infants and older children were very close to the instrument panel when the air bag deployed. A rear-facing infant seat which is installed in the front seat of a vehicle with a passenger side air bag will always position the infant's head very close to the air bag. For essentially all of the older children, the non-use or improper use of occupant restraints or the failure to use the restraints most appropriate to the child's weight and age, in conjunction with pre-impact braking, resulted in the forward movement of the children prior to the actual crash. As a result, they were very close to the air bag when it deployed. Because of their proximity, the children sustained fatal head or neck injuries from the deploying passenger air bag.

As in the case of the children fatally injured by air bags, the key factor regarding the confirmed adult deaths has been their proximity to the air bag when it deployed. The most common reason for their proximity was failure to use seat belts. Only 11 of the 40 drivers were known to be properly restrained by lap and shoulder belts at the time of the crash. As in the case of children, the deaths of drivers have occurred primarily in low speed crashes.

The other cause of air bag fatalities is the design of current air bags. Air bag fatalities are not a problem inherent in the concept of air bags or in the agency's occupant restraint standard. That standard has always permitted, but not required, vehicle manufacturers to use a variety of design features that would reduce or eliminate the fatalities that have been occurring, e.g., higher deployment thresholds that will prevent deployment in low speed crashes, sensors that adjust the deployment threshold depending on whether the occupant is belted,[12] different folding patterns and aspiration designs, dual stage inflators,[13] new air bag designs like the Autoliv ''Gentle Bag'' that deploys first radially and then toward the occupant, and advanced air bags that either adjust deployment force or suppress deployment altogether in appropriate circumstances. While some of these features are new or are still under development, others have been around (at least conceptually) for more than a decade. The agency identified a number of these features in conjunction with its 1984 decision concerning automatic occupant protection and noted that vehicle manufacturers could choose among those features to address the problems reported by those manufacturers concerning out-of-position occupants.

Although Standard No. 208 permits vehicle manufacturers to install air bags incorporating those advanced features, very few current air bags do so. Instead, vehicle manufacturers have thus far used designs that inflate with the same force under all circumstances. Although the vehicle manufacturers are now working to incorporate advanced features in their air bags, the introduction of air bags with those features is only just beginning.

Partly in view of the lead time needed to incorporate those advanced features, vehicle manufacturers first took the quicker step of depowering their air bags. Under a recent temporary amendment to Standard No. 208, vehicle manufacturers have expedited their introduction of depowered or otherwise redesigned air bags. While these modified air bags will reduce, but not eliminate, the incidence of air bag-

[11] 39 of the 48 forward-facing children who were fatally injured by air bags were not using any type of belt or other restraint. The remaining children included some who were riding with their shoulder belts behind them and some who were wearing lap and shoulder belts but who also should have been in booster seats because of their small size and weight. Booster seat use could have improved shoulder belt fit and performance. These various factors and pre-crash braking allowed the children to get too close to the air bag when it began to inflate.

[12] For example, Mercedes-Benz offers passenger air bags whose deployment threshold is 12 mph if the passenger is unbelted and 18 mph if the passenger is belted.

[13] The passenger-side air bags installed in approximately 10,000 GM cars in the 1970's were equipped with dual stage inflators. Today, for example, Autoliv, a Swedish manufacturer of air bags, has a ''gas generator that inflates in two steps, giving the bag time to unfold and the vent holes to be freed before the second inflation starts. Should the bag then encounter an occupant, any excessive gas—and indeed bag pressure—will exit through the vent holes.''

caused deaths, they still deploy with the same force in all crashes, regardless of severity, and regardless of occupant weight or location. Many manufacturers introduced substantial numbers of these less powerful air bags in model year 1998.

2. Air Bag Requirements

Today's air bag requirements evolved over a 25-year period. NHTSA issued its first public notice concerning air bags in the late 1960's. Although vehicle manufacturers began installing air bags in 1986, it was not until the fall of 1996 that manufacturers were first required to install air bags in any motor vehicles.[14]

When the requirements for automatic protection (i.e., protection by means that require no action by the occupant) were adopted in 1984 for passenger cars, they were expressed in broad performance terms that provided vehicle manufacturers with choices of a variety of methods of providing automatic protection, including automatic belts and air bags. Further, the requirements gave vehicle manufacturers broad flexibility in selecting the performance characteristics of air bags. Later, those requirements were extended to light trucks. While vehicle manufacturers initially installed automatic belts in many of their vehicles, ultimately, strong market preference for air bags led manufacturers to move toward installing them in all of their passenger cars and light trucks.

In 1991, Congress included a provision in ISTEA directing NHTSA to amend Standard No. 208 to require that all passenger cars and light trucks provide automatic protection by means of air bags. ISTEA required at least 95 percent of each manufacturer's passenger cars manufactured on or after September 1, 1996, and before September 1, 1997, to be equipped with an air bag and a manual lap/shoulder belt at both the driver and right front passenger seating positions. Every passenger car manufactured on or after September 1, 1997, must be so equipped. The same basic requirements were phased in for light trucks one year later.[15] The final rule implementing this provision of ISTEA was published in the Federal Register (58 FR 46551) on September 2, 1993.

Standard No. 208's automatic protection requirements are performance requirements. The standard does not specify the design of an air bag. Instead, when tested under specified test conditions, vehicles must meet specified limits for injury criteria, including criteria for the head, chest and thighs, measured on 50th percentile male test dummies. Until recently, these criteria limits had to be met for air bag-equipped vehicles in barrier crashes at speeds up to 48 km/h (30 mph), both with the dummies belted and with them unbelted.

However, on March 19, 1997, the agency published a final rule temporarily amending Standard No. 208 to provide the option of testing air bag performance with an unbelted dummy in a sled test incorporating a 125 millisecond standardized crash pulse instead of in a vehicle-to-barrier crash test. This amendment was made primarily to expedite manufacturer efforts to reduce the force of air bags as they deploy.

Standard No. 208's current automatic protection requirements, like those established 14 years ago in 1984, apply to the performance of the vehicle as a whole, and not to the air bag as a separate item of motor vehicle equipment. The broad vehicle performance requirements permit vehicle manufacturers to ''tune'' the performance of the air bag to the specific attributes of each of their vehicles.

The Standard's requirements also permit manufacturers to design seat belts and air bags to work together. Before air bags, seat belts had to do all the work of restraining an occupant and reducing the likelihood that the occupant will strike the interior of the vehicle in a frontal crash. Another consequence of not having air bags was that vehicle manufacturers had to use relatively rigid and unyielding seat belts that can concentrate a lot of force along a narrow portion of the belted occupant's body in a serious crash. This concentration of force created a risk of bone fractures and injury to underlying organs. The presence of an air bag increases the vehicle manufacturer's ability to protect belted occupants. Through using force management devices, such as load limiters, a manufacturer can design seat belts to extend or release additional belt webbing before the belts concentrate too much force on the belted occupant's body. When these new belts stretch or extend, the deployed air bag is there to prevent the belted occupant from striking the vehicle interior.

Further, as noted above, Standard No. 208 permits, but does not require, vehicle manufacturers to design their air bags to minimize the risk of serious injury to unbelted, out-of-position occupants, including children and small drivers. The standard gives the manufacturers significant freedom to select specific attributes to protect all occupants, including attributes such as (1) the crash speeds at which the air bags deploy, (2) the force with which they deploy, (3) air bag tethering and venting to reduce inflation force when a deploying air bag encounters an occupant close to the steering wheel or the instrument panel, (4) the use of sensors to both detect the presence of rear-facing child restraints and the presence of small children and prevent air bag inflation, (5) the use of sensors to detect occupant position and prevent air bag inflation if appropriate, and (6) the use of multi-stage versus single stage inflators. Multi-stage inflators enable air bags to deploy with lower force in low speed crashes, the type of crashes in which children and drivers have been fatally injured, and with more force in higher speed crashes.

C. Comprehensive Agency Plan To Address Air Bag Fatalities

In late November 1996, NHTSA announced that it would be implementing a comprehensive plan of rulemaking and other actions (e.g., consumer education and encouragement of State seat belt use laws providing for primary enforcement of their requirements) addressing the adverse

[14] *Air bag firsts*—In view of the confusion evident in some public comments in recent rulemakings and even in some media accounts about when air bags were first required, and by whom, the agency has set forth a brief chronology below:

- 1972 *First year* in which vehicle manufacturers had the *option of installing air bags* in passenger cars as a means of complying with Standard No. 208. Prior to that year, vehicle manufacturers had to comply means of installing manual lap and shoulder belts. GM installed driver and passenger air bags in approximately 10,000 passenger cars in the mid-1970's.
- 1986 *First year* in which vehicle manufacturers no longer had the option of installing manual belts and were *required instead to install some type of automatic protection* (either automatic belts or air bags) in some passenger cars. This requirement was issued by Secretary Dole in 1984. At the time of that issuance, the agency expressly noted that vehicle manufacturers had expressed concerns about air bags and out-of-position occupants. In response to those concerns, NHTSA identified a variety of technological remedies whose use was permissible under the Standard. Between 1986 and 1996, vehicle manufacturers chose to comply with the automatic protection requirements by installing over 35 million driver air bags and over 18 million passenger air bags in passenger cars. Another 12 million driver air bags and almost 3 million passenger air bags were installed in light trucks in that same time period.
- 1996 *First year* in which vehicle manufacturers were *required to install air bags* in some passenger cars. This requirement was mandated by the 1991 Intermodal Surface Transportation Efficiency Act of 1991.

[15] At least 80 percent of each manufacturer's light trucks manufactured on or after September 1, 1997 and before September 1, 1998 must be equipped with an air bag and a manual lap/shoulder belt. Every light truck manufactured on or after September 1, 1998 must be so equipped.

effects of air bags.[16] While there is a general consensus that the best approach to preserving the benefits of air bags while preventing air bag fatalities will ultimately be the introduction of advanced air bag systems, those air bags are not immediately available. Accordingly, the agency has focused on rulemaking and other actions to help reduce the adverse effects of air bags in existing vehicles as well as in vehicles produced during the next several model years. The actions which have been taken, or are being taken, include the following:

1. Interim Rulemaking Solutions

a. Existing and future vehicles-in-use. On November 11, 1997, NHTSA published in the **Federal Register** (62 FR 62406) a final rule exempting, under certain conditions, motor vehicle dealers and repair businesses from the ''make inoperative'' prohibition in 49 U.S.C. § 30122 by allowing them to install retrofit manual on-off switches for air bags in vehicles owned by people whose request for a switch is authorized by NHTSA. The purpose of the exemption is to preserve the benefits of air bags while reducing the risk that some people have of being seriously or fatally injured by current air bags. The exemption also allows consumers to have new vehicles retrofitted with on-off switches after the purchase of those vehicles. It does not, however, allow consumers to purchase new vehicles already equipped with on-off switches. (Another rule, discussed below, allows manufacturers to ''factory install'' manual on-off switches for vehicles with no, or small, rear seats.)

b. New vehicles. On November 27, 1996, the agency published in the **Federal Register** (61 FR 60206) a final rule amending Standards No. 208 and No. 213 to require improved labeling on new vehicles and child restraints to better ensure that drivers and other occupants are aware of the dangers posed by passenger air bags to children, particularly to children in rear-facing infant restraints in vehicles with operational passenger air bags. The improved labels were required on new vehicles beginning February 25, 1997, and were required on child restraints beginning May 27, 1997.

On January 6, 1997, the agency published in the **Federal Register** (62 FR 798) a final rule extending until September 1, 2000, an existing provision in Standard No. 208 permitting vehicle manufacturers to offer manual on-off switches for the passenger air bag for new vehicles without rear seats or with rear seats that are too small to accommodate rear-facing infant restraints.

On March 19, 1997, NHTSA published in the **Federal Register** (62 FR 12960) a final rule temporarily amending Standard No. 208 to facilitate efforts of vehicle manufacturers to depower their air bags quickly so that they inflate less aggressively. This change, coupled with the broad flexibility already provided by the standard's existing performance requirements, provided the vehicle manufacturers maximum flexibility to quickly reduce the adverse effects of current air bags. Vehicle manufacturers provided air bags that were depowered or otherwise redesigned for a large number of model year 1998 vehicles.

2. Longer-Term Rulemaking Solution

In today's notice, NHTSA is proposing to require advanced air bags. The agency is proposing new performance requirements to improve occupant protection for occupants of different sizes, belted and unbelted, while minimizing the risk to infants, children, and other occupants from injuries and deaths caused by air bags.

3. Educational Efforts; Child Restraint and Seat Belt Use Laws

In addition to taking these actions, and conducting extensive public education efforts, the Department of Transportation announced in the spring of 1997 a national strategy to increase seat belt and child seat use. Higher use rates would decrease air bag fatalities and the chance of adverse safety tradeoffs occurring as a result of turning off air bags. The plan to increase seat belt and child seat use has four elements: stronger public-private partnerships; stronger State seat belt and child seat use laws (e.g., laws providing for primary enforcement of seat belt use requirements); active, high-visibility enforcement of these laws; and effective public education. Substantial benefits could be obtained from achieving higher seat belt use rates. For example, if observed belt use increased from 69 percent to 90 percent, an estimated additional 5,400 lives would be saved annually over the estimated 10,414 lives currently being saved by seat belts. In addition, an estimated 129,000 injuries would be prevented annually. The economic savings from these incremental reductions in both fatalities and injuries would be $8.5 billion annually.

V. Technological Opportunities

The air bag suppliers and vehicle manufacturers are working on a wide range of advanced technologies to upgrade air bag system performance, including but not limited to addressing adverse effects of air bags to out-of-position occupants. To illustrate the kinds of technological opportunities that are available, NHTSA is including a discussion on this subject presented by JPL in the Executive Summary of its Advanced Air Bag Technology Assessment. For additional information, interested persons are referred to the full JPL report, NHTSA's Preliminary Economic Assessment for this proposal and the references it cites, and the docket for this and other notices relating to Standard No. 208.

The JPL Executive Summary includes the following discussion of technological opportunities (section numbers are omitted):

Model year 2001. The technologies that are being developed and that may be available for model year 2001 provide both improved information and improved response.[17]

Information

- Crash sensor/control systems with improved algorithms will better discriminate when air bag deployment is necessary for occupant crash protection, will provide better threshold control, and will determine the appropriate inflation level for two-stage inflators.
- Belt use status sensors can detect when an occupant is belted so that the air bag deployment threshold can be raised when belts are in use. (These are currently in use in some cars.)
- Seat position sensors provide an approximate surrogate measure of occupant size and proximity to the air bag module. They can be used in combination with belt status sensors to determine the appropriate inflator output.
- Seat belt spool-out sensors could provide additional information about an occupant's size and proximity to the air bag module. These sensors were not mentioned as being part of any current industry use strategy and therefore may not be available by model year 2001.
- Static proximity (occupant position) sensors could identify occupants in the keep-out zone, but will be available only if an aggressive development program is

[16] For a discussion of the actions taken by NHTSA before November 1996 to address the adverse effects of air bags, see pp. 40787–88 of the agency's NPRM published August 6, 1996 (61 FR 40784).

[17] NHTSA notes that JPL, in identifying and analyzing parameters to reflect the functions that may be required of advanced technology, classified those parameters by the information provided about the crash and the occupants and the air bag system response.

undertaken. They would not reduce injuries to all out-of-position occupants, and they could be ''fooled'' some of the time.

Response

• Automatic suppression can prevent inflation when sensors determine that an ccupant is in a keep-out zone where injuries could occur.

• Two-stage inflators can permit relatively soft inflation for crashes of lower threshold velocity, and full inflation when necessary for crashes of high threshold velocity.

• Compartmented air bags, radial deployments, and bags with lighter-weight fabrics may reduce the size of the keep-out zone.

• Advanced belts can improve restraint system safety and protectiveness. They may include pretensioners that can provide better coupling of the occupant to the seat for improved ride-down during the crash. Also, they can, to some degree, limit occupant proximity to the air bag module. Load limiters can also improve belt performance by reducing maximum belt loads on the occupant. (Pretensioners and load limiters are currently in some vehicles.)

Model year 2003. By model year 2003, there could be evolutionary changes in some of the systems and the possibility of the introduction of occupant and proximity sensors.

Information

• Crash sensor/control system algorithms will continue to be improved.

• Belt use sensors will be widely used already.

• Integrated occupant and proximity sensors could be available that would identify occupants in the keep-out zone or those who would enter it.

• Precrash sensors may be available, but their application requires further investigation.

Response

• Automatic suppression to prevent inflation will be available for use with proximity sensors.

• Multistage inflators to provide more tailored responses for a variety of occupants and crash severities could be available, if needed.

• Bag designs will continue to be improved, permitting a reduction of the keep-out zone.

• Pretensioners and load limiters will be placed in increasing numbers of vehicles. Air belts will be available to improve safety belt effectiveness.

NHTSA notes that the JPL report presents tables listing specific technologies for advanced safety restraint systems and providing a summary of advanced technology characteristics. The technology items discussed in the JPL report include:

Sensors

—Pre-Crash Sensing
—Crash Severity Sensors
—Sensing Diagnostic Modules/Crash Algorithms
—Belt Use Sensors
—Belt Spool-Out Sensors
—Seat Position Sensors
—Occupant Classification Sensors
—Occupant Proximity Motion Sensors
—Computational Systems/Algorithms

Inflators

—Non-Azide Propellants
—Hybrid Inflators
—Heated Gas Inflators
—Multistage Inflators
—Inflators With Tailorable Mass Flow Rate

Air Bags

—New Fabrics and Coatings
—New Woven Fabrics and Bag Construction
—New Bag Shapes and Compartmented Bags
—New Air Bag Venting Systems

Seat Belt Systems

—Pretensioners
—Load Limiting Devices
—Inflatable Seat Belts

The JPL report also presents an assessment of the merits of advanced technologies.

The JPL report cautioned that expected improvements in the safety and protectiveness of air bags must be tempered by the understanding that there are key technology developments that need to be accomplished, namely:

• Air bag deployment time variability must be reduced by improvements in the vehicle crush/crash sensor system.

• Inflator variability must be reduced so that dual-stage inflators can be applied effectively.

• System and component reliability must receive diligent attention to achieve the high levels required under field conditions.

• Occupant sensors must be developed that can distinguish with high accuracy small, medium, and large adults; children; and infant seats.

• Position sensors to measure occupant proximity to the air bag module with the required response time and accuracy must be demonstrated.

The JPL report noted that all of the above are the subject of current development, but development, test, and integration of the advanced technologies needs to be accelerated to enable their incorporation into production vehicles.

The JPL report also notes that its projections of technology availability are based on limited contacts with a limited number of vehicle manufacturers and suppliers, and that the state of the art of advanced air bag technologies is in a high state of flux. The report notes that the projected technologies, as well as other technologies, may advance more or less rapidly than indicated.

NHTSA has had more extensive contacts than JPL with suppliers and vehicle manufacturers, and more recent ones. Based on confidential information shared with the agency during those contacts, NHTSA believes that the JPL report is conservative in its assessment of the stages that some suppliers have reached in developing new technologies and the model year in which some of the very highly advanced air bag designs will first be introduced.

NHTSA recognizes, however, that different suppliers and vehicle manufacturers are at different stages in their development of advanced air bags, and also face different constraints and challenges, e.g., different states-of-the-art of their current air bag systems, engineering resources, number of vehicles for which air bags need to be redesigned, etc. The agency believes the proposed date for the beginning of the phase-in, the phase-in itself, and also the proposal of a number of manufacturer options to reflect different available design choices, would accommodate these differing situations.

VI. Proposal for Advanced Air Bags

A. Introduction

NHTSA's goals in this rulemaking are to enhance the benefits of air bags for all occupants while eliminating or minimizing risks from air bags, and to ensure that the needed improvements in occupant protection are made expeditiously, and in accordance with the recently adopted statutory deadlines. As discussed in the preceding section of this notice, the vehicle manufacturers and their suppliers are already pursuing a wide variety of technological opportunities that can be used to achieve these goals.

The sheer number and variety of available technological opportunities creates special challenges from a regulatory perspective. While the availability of multiple technologies generally makes it easier to solve the current problems with air bags quickly, it also means that the agency must take special care to ensure that the regulatory language it adopts will not be unnecessarily design-restrictive.

Among other things, the agency wishes to avoid:

• Inadvertently preventing the use of superior air bag designs;

• Favoring one viable technology or design over another, where either would meet the need for safety;

• Requiring an expensive solution, where an inexpensive one will work; or

• Requiring implementation of a particular technology before it can be appropriately developed.

In seeking to ensure that its proposal is not unnecessarily design-restrictive, the agency has sought to develop requirements that are as performance-oriented as possible, and to include manufacturer options that accommodate for the kinds of technological solutions that the agency knows are under development.

Moreover, since the ultimate question for regulators, industry, and the public is how the required safety features will work in the real world, NHTSA has sought to specify test procedures that most closely replicate the real world conditions that affect the possibility of traffic deaths and injuries.

As a result, NHTSA is proposing to require manufacturers to meet improved performance criteria in additional tests using a wider array of test dummies. The existing and proposed tests are identified in Figures 1 and 2, below. Figure 1 shows tests for requirements to preserve and improve occupant protection for different size occupants, belted and unbelted. Figure 2 shows tests for requirements to minimize the risk to infants, children, and other occupants from injuries and deaths caused by air bags.

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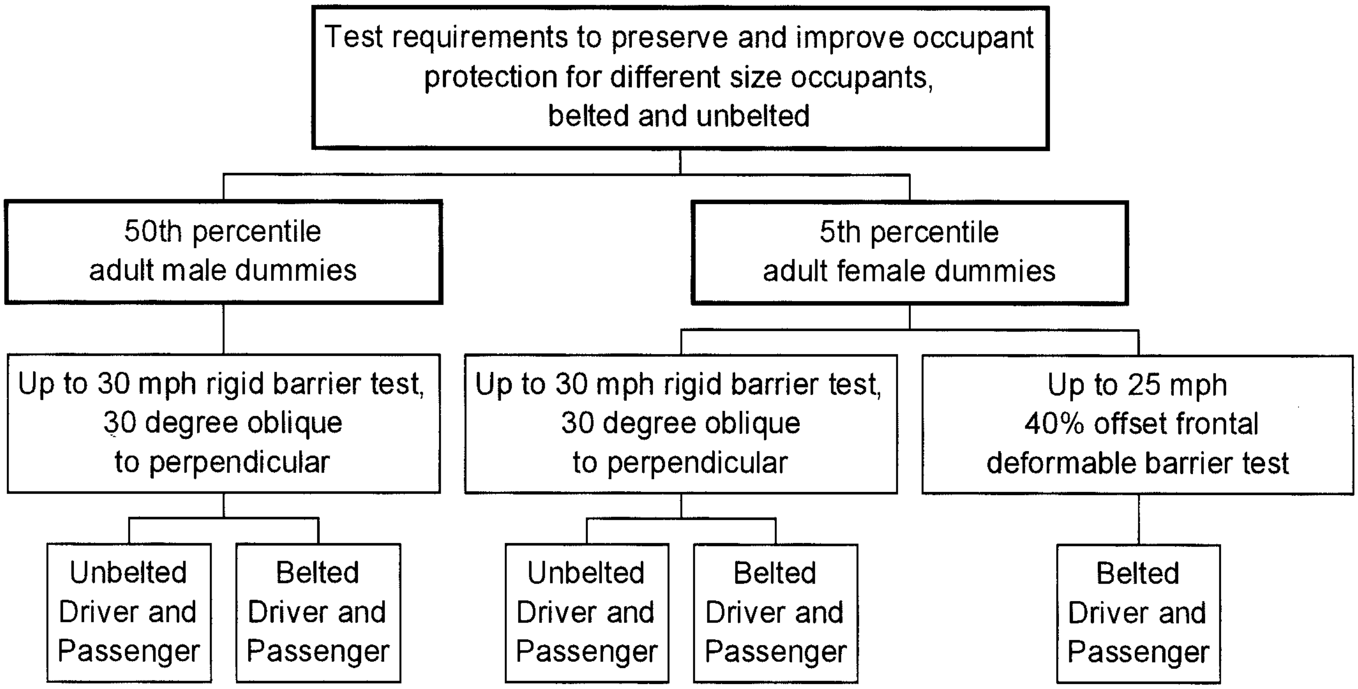

Figure 1. Test Requirements to Preserve and Improve Occupant Protection for Different Size Occupants, Belted and Unbelted

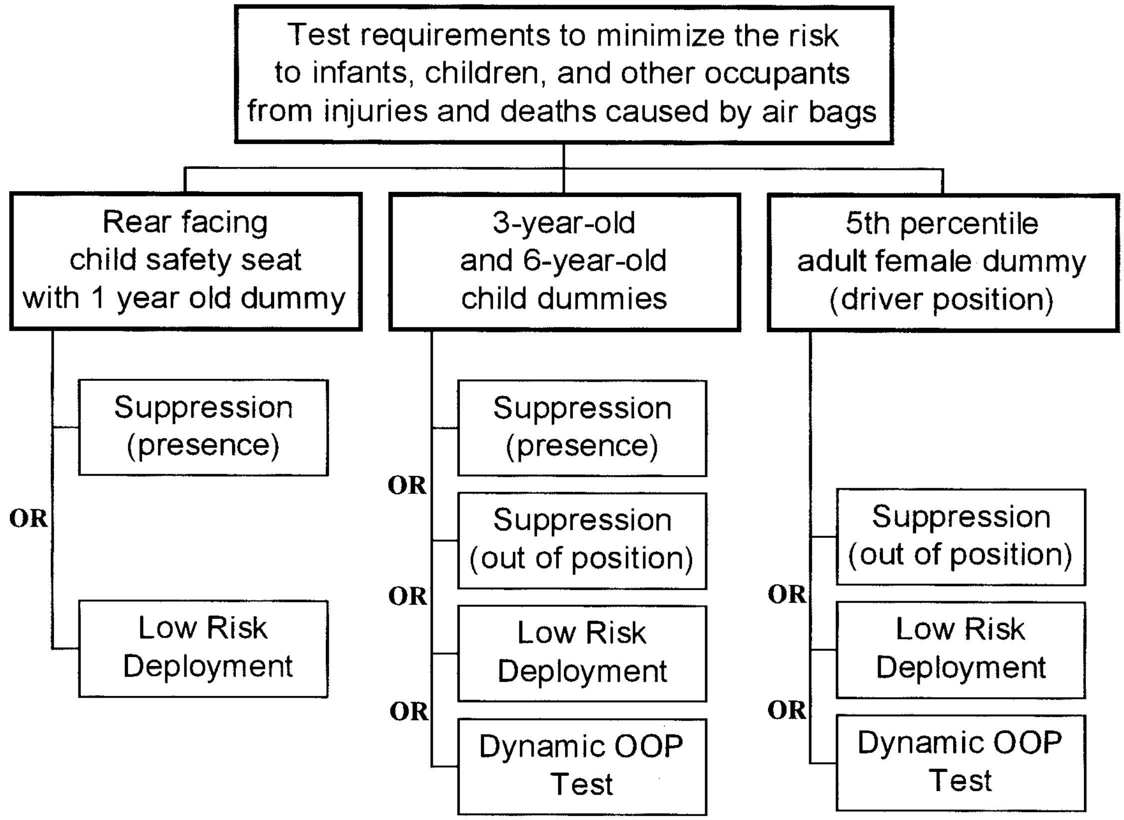

Figure 2. Test Requirements to Minimize the Risk to Infants, Children, and Other Occupants from Injuries and Deaths Caused by Air Bags

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NHTSA notes that, in the future, it expects to propose a higher speed frontal offset test requirement and also is considering proposing one or more tests using 95th percentile adult male dummies. The agency is not proposing a higher speed frontal offset test requirement at this time because it is still conducting research regarding such a requirement.[18] The agency is not proposing tests using 95th percentile adult male dummies at this time because the development of that dummy is not expected to be completed until sometime next year.

Under the proposed performance requirements identified in Figures 1 and 2, vehicle manufacturers would be required to show that the air bags in their vehicles provide protection to small stature occupants as well as to average size males, and to adopt one or more of a number of available design features that will minimize the risk caused by air bags to infants in rear-facing child restraints, out-of-position children, or other out-of-position occupants in low speed crashes.

The test matrix identified in Figures 1 and 2 represents a natural evolution and refinement of Standard No. 208's current requirements. The agency has always sought to include in the standard test procedures that replicate the real world factors that affect the possibility of traffic deaths and injuries. This is the best way to ensure that required safety features will perform well not only in compliance tests, but also in the real world.

Among other things, the agency has long specified full scale vehicle crash tests using instrumented dummies because it is only through such tests that the protection provided by a vehicle and its occupant protection *system* can be fully measured. Different vehicle models have different crash pulses. The results of crash tests reflect not only the performance of the air bag, but how a particular vehicle model crumples and absorbs energy in a crash, i.e., its individual crash pulse. The use of crash tests necessitates that vehicle manufacturers take into account the crash pulse of their vehicles, the air bag design, occupant compartment design features, seat belt design (for belted tests) and specific attributes of each of their subsystems.

[18] For information concerning the agency's research program, interested persons are referred to the agency's Report to Congress, Status Report on Establishing a Federal Motor Vehicle Safety Standard for Frontal Offset Crash Testing, April 1997. This report is available on NHTSA's web site. The address for the section of the web site where this report is located is "http://www.nhtsa.dot.gov/cars/rules/CrashWorthy/".

Also, the agency has long included tests for air bag-equipped vehicles using both belted and unbelted dummies, since a large number of occupants in the United States continue to ride unbelted. Even today, nearly half of all occupants in potentially fatal crashes do not wear their seat belts. Teenagers are particularly likely to ride unbelted.

Moreover, the Standard has long included test conditions that replicate a variety of different types of crashes. Of particular note, the standard's longstanding barrier test requirements specify crash tests at any speed up to and including 48 km/h (30 mph), and at a range of impact angles.

NHTSA has also always sought to maximize manufacturer flexibility in providing effective occupant protection. As the agency has stated many times, Standard No. 208 has never specified the design of an air bag. Manufacturers have been free to design their air bags in any manner they like, e.g., any size, any inflation level, etc. so long as the standard's injury criteria limits are not exceeded in specified crash tests.

Today's proposal follows these longstanding practices by proposing to add new tests that replicate additional real world factors that affect the possibility of deaths and injuries which are not directly addressed by the standard's current requirements. Manufacturers would continue to be permitted maximum design freedom in designing their air bags, so long as the standard's injury criteria performance limits are met in specified tests.

Manufacturers can use many different technologies and designs to meet the proposed requirements. One approach is for manufacturers to develop air bags that inflate in a manner that does not cause injuries to out-of-position occupants. Several air bag suppliers have recently demonstrated air bags that incorporate improved folding patterns and internal tethering and venting to reduce the risk of injury to out-of-position occupants. For example, Autoliv has demonstrated an "umbrella" air bag that deploys first radially and then toward the vehicle occupant. It also may be possible to design air bags that use vents or other means of preventing further deployment if the air bag is blocked by the occupant during inflation. Again, under today's proposal, manufacturers would be permitted flexibility in designing their air bags as long as all of the standard's performance requirements are met in specified tests.

A discussion of each of the specific proposed test requirements follows, in the general order presented in Figures 1 and 2.

B. Existing and Proposed Test Requirements

1. Tests for Requirements To Preserve and Improve Occupant Protection for Different Size Occupants, Belted and Unbelted

a. *Safety of medium to large teenagers and adults.* Standard No. 208 has long required vehicles to meet specified injury criteria, including criteria for the head and chest, measured on 50th percentile adult male test dummies during a rigid barrier crash test at any speed up to 48 km/h (30 mph) and over the range of angles from −30 degrees to +30 degrees. The standard has required air-bag-equipped vehicles to meet the criteria both with the dummies belted and unbelted.

If a vehicle crash test is to measure the overall ability of a vehicle and its occupant protection system to prevent fatalities and serious injuries, the crash test must have the severity of a potentially fatal crash. It is also important that the crash test make it necessary for vehicle manufacturers to design and equip their vehicles so that they provide protection in a range of potentially fatal crashes, recognizing that no single type of crash test can be directly representative of all the myriad potentially fatal crashes that occur in the real world.

The longstanding barrier test requirement specified in Standard No. 208 simulates a wide range of potentially fatal crashes, both with respect to severity and crash pulse. The test is conducted at any speed up to 48 km/h (30 mph), meaning that protection must be provided at all such speeds, e.g., 32 km/h (20 mph) and 40 km/h (25 mph), as well as 48 km/h (30 mph). The test is also conducted at any angle between 30 degrees to the left and 30 degrees to the right. While the perpendicular rigid barrier test results in crash pulses of short duration, e.g., the kind of pulse that a vehicle experiences when it strikes a bridge abutment or fully engages another similar-sized or larger vehicle directly head-on, the angled rigid barrier tests result in crash pulses of longer duration, i.e., a softer crash pulse.

The rigid barrier test requirements have been an integral part of the standard's automatic crash protection requirements and have resulted in enormous savings of lives. As noted above, NHTSA estimates that air bags have saved about 3,148 drivers and passengers. Of these, 2,725 were unbelted and 423 were belted. If these levels of effectiveness are maintained, i.e., 21 percent in frontal crashes for restrained occupants and 34 percent in frontal crashes for unrestrained occupants, air bags will save more than 3,000 lives each year in passenger cars and light trucks when all light vehicles on the road are equipped with dual air bags. Standard No. 208's current requirements thus represent one of NHTSA's most effective regulations in terms of the numbers of lives saved.

As also noted earlier in this notice, the agency amended Standard No. 208 in March 1997 to provide a temporary option for manufacturers to certify their vehicles to an unbelted sled test as an alternative to the unbelted barrier test requirement. NHTSA established the sled test option to ensure that the vehicle manufacturers could quickly depower all air bags so that they inflate less aggressively.[19] While vehicle manufacturers could have depowered many or most of their vehicles' air bags without changes to Standard No. 208, the final rule expedited this process.

Under the March 1997 final rule, the sled test option was scheduled to terminate on September 1, 2001. The agency explained that there was no need to permanently reduce Standard No. 208's performance requirements to enable manufacturers to fully address the adverse effects of air bags. This is because there were various alternatives already allowed by the standard to address the problem that did not necessitate reducing the standard's performance requirements. While the agency specified a several year duration for the alternative sled test, it indicated that it would revisit the end date, to the extent appropriate, in its future rulemaking on advanced air bags. See 62 FR 12968; March 19, 1997.

The September 1, 2001 termination date for the sled test option has been superseded by the NHTSA Reauthorization Act of 1998. In a paragraph titled ''Coordination of Effective Dates,'' the Act provides that the unbelted sled test option ''shall remain in effect unless and until changed by [the final rule for advanced air bags].'' The Conference Report states that the current sled test certification option remains in effect ''unless and until phased out according to the schedule in the final rule.''

In light of the Act, the agency is proposing to phase out the sled test option as the requirements for advanced air bags are phased in. While NHTSA believes the sled test option has been an expedient and useful temporary measure to ensure that the vehicle manufacturers could quickly depower all of their air bags and to help ensure that some protection would continue to be provided, the agency does not consider sled testing to be an adequate long-term means of assessing the extent of occupant protection that a vehicle and its air bag will afford occupants in the real world. The sled test, first, excludes vehicle factors that can significantly affect the level of protection received in the real world and, second, is insufficiently representative of potentially fatal real world crashes.

Unlike a full scale vehicle crash test, a sled test does not, and cannot, measure the actual protection an occupant will receive in a crash. The current sled test measures limited performance attributes of the air bag, but cannot measure the performance provided by the vehicle structure in combination with the air bags or even the full air bag system by itself.

Among other shortcomings, the sled test does not evaluate the actual timing of air bag deployment. Deployment timing is a critical component of the safety afforded by an air bag. If the air bag deploys too late, the occupant may already have struck the interior of the vehicle before deployment begins.

Air bag timing is affected by parts of the air bag system which are not tested during a sled test, i.e., the crash sensors and computer crash algorithm. A barrier crash test evaluates the ability of sensors to detect a crash and the ability of an algorithm to predict, on the basis of initial sensing of the rate of increase in force levels, whether crash forces will reach levels high enough to warrant deployment. However, the sled test does not evaluate these critical factors. The ability of an algorithm to correctly, and quickly, predict serious crashes is critical. The signal for an air bag to deploy must come very early in a crash, when the crash forces are just beginning to be sensed by the air bag system. A delay in an air bag's deployment could mean that the air bag deploys too late to provide any protection. In a sled test, the air bag is artificially deployed at a predetermined time. The time of deployment in a sled test is artificial and may differ significantly from the time when the air bag would deploy during an actual crash involving the same vehicle.

Second, the current generic sled pulse does not replicate the actual crash pulse of a particular vehicle model, i.e., the specific manner in which the front of the vehicle deforms during a crash, thereby absorbing energy. The actual crash pulse of a vehicle is a critical factor in occupant protection. A crash pulse affects the timing of air bag deployment and the ability of an air bag to cushion and protect an occupant. However, the current sled test does not use the crash pulse of the vehicle being tested. In many cases, the crash pulse used in the sled test is not even one approximately representative of the test vehicle. The sled test uses the crash pulse of a large passenger car for all vehicles, regardless of their type or size. This crash pulse is appropriate for large passenger cars, but not for light trucks and smaller cars since they typically have much ''stiffer'' crash pulses than that of the sled test. In the real world, deceleration of light trucks and smaller cars, and their occupants, occurs more quickly than is simulated by the sled test. Thus, the sled test results may overstate the level of occupant protection that would be provided by a vehicle and its air bag system in the real world. An air bag that can open in a timely fashion and provide adequate cushioning in a soft pulse crash may not be able to do so in a stiffer pulse crash. This is because an occupant of a crashing vehicle moves forward, relative to the vehicle, more quickly in stiffer pulse crash than in a softer pulse crash.

Third, a sled test does not measure the potential for harm from vehicle components that are pushed back into the occupant compartment during a crash. Examples of components that may intrude into the occupant compartment include the steering wheel, an A-pillar and the toe-board. Since a sled test does not involve any kind of crash or deformation of the vehicle, it implicitly assumes that such intrusion does not occur in crashes. Thus, the sled test may indicate that a vehicle provides good protection when, as a result of steering wheel or other intrusion in a real world, the vehicle will actually provide poor protection in a real world crash.

Fourth, the sled test does not measure how a vehicle performs in angled crashes. It only tests vehicles in a perpendicular crash. In the real world, frontal crashes occur at varying angles, resulting in occupants moving toward the steering wheel and instrument panel in a variety of trajectories. The specification of angled tests in conjunction with the barrier test requirement ensures that a vehicle is tested under these real world conditions.

As noted below in the appendix to this preamble, NHTSA received several petitions for reconsideration concerning the sled test's sunset date (subsequently superseded by the NHTSA Reauthorization Act of 1998). The

[19] The agency's initial steps regarding technological solutions focused on depowering primarily because the lead time needed for depowering was significantly shorter than the lead time for the technological solutions that are the subject of this proposal.

agency notes that its proposal to phase the option out as the requirements for advanced air bags are phased in will provide additional time for the vehicle manufacturers to redesign their air bags to avoid causing harm and to provide improved protection for all occupants, belted and unbelted. In the appendix, the agency provides additional reasons supporting its proposal for terminating the sled test option, including a discussion of the importance for safety of maintaining effective unbelted frontal crash test requirements.

NHTSA is requesting comments on whether it should develop potential alternative unbelted crash test requirements. The auto industry and other parties have raised a number of objections to the existing unbelted barrier test requirements. NHTSA is willing to consider alternatives and to that end is placing a technical paper on this subject in the docket. Among other things, the paper compares the existing rigid barrier test to tests using a stationary deformable barrier and a movable deformable barrier.

With respect to the current barrier test requirements, and as discussed later in this notice in a section titled ''Injury Criteria,'' the agency is proposing to upgrade the standard's chest injury criteria and to add neck injury criteria. NHTSA notes that, as part of developing this proposal for advanced air bags, it considered the latest available information concerning injury criteria for both the existing 50th percentile adult male dummy and for each of the proposed new dummies. The agency is placing in the public docket a technical paper which explains the basis for each of the proposed injury criteria and the proposed performance limits.

NHTSA is also proposing to include, for all crash tests specified by Standard No. 208, certain vehicle integrity requirements. These requirements would specify that vehicle doors may not open during the crash test. For many years the agency has monitored whether doors open during 30 mph frontal barrier crash tests. In the agency's experience, doors remain closed in these crash tests. Since vehicles already can and do comply with this requirement, this proposal would establish this norm as a minimum level of safety. This requirement would support the agency goal of mitigating the fatalities and serious injuries attributable to complete and partial ejections.

This proposal would also specify that, after crash testing, vehicles having a roof of rigid construction (i.e., vehicles other than convertibles), must meet the following requirements. It must be possible, without the use of tools, to open at least one door, if there is one, per each row of seats. Further, where there is no such door, it must be possible to move the seats or tilt their backrests as necessary to allow the evacuation of all the occupants. This post crash door opening check has always been a demonstration part of the agency's compliance test procedure. The purpose is to demonstrate the potential for entrapment. After each test, the technicians approach the vehicle and try to open the vehicle doors. In the majority of these full frontal crash tests conducted by the agency, the technicians are able to open the vehicle doors without the use of tools. This process is recorded on the test films. The agency is proposing to add this door opening requirement to the regulation. NHTSA does not have any information indicating that there would anything other than a minimal cost impact associated with this proposed requirement, but requests comments on this issue.

b. Safety of small teenagers and small adults. Another part of the agency's proposal that is intended to enhance the benefits of air bags is to require vehicles to meet performance requirements for 5th percentile adult female dummies in the same tests long specified for 50th percentile adult male dummies.

Accordingly, the agency is proposing to require vehicles to meet specified injury criteria, including criteria for the head, neck, chest, and femurs, measured on 5th percentile adult female test dummies during a rigid barrier crash test at any speed up to 48 km/h (30 mph) and at the same range of angles applicable to the tests using 50th percentile male dummies. Under the proposal, vehicles must meet the criteria both with the dummies belted and unbelted.

Certain of the proposed injury criteria differ from those specified or proposed for 50th percentile adult male dummies to reflect the different injury risks faced by 5th percentile adult females. Dummy seating positions are also adjusted to reflect 5th percentile adult females. The agency is proposing that tests be conducted with the dummies seated in a full forward position. While many 5th percentile adult females can sit further back, the proposed test will ensure that protection is provided in a more extreme position, but one where air bags can still provide protection.

NHTSA is proposing to specify the use of the Hybrid III 5th percentile adult female dummy. The Society of Automotive Engineers has guided the development of this dummy, and that work is nearly complete. Therefore, the motor vehicle industry is familiar with this dummy. NHTSA has not, however, yet proposed to add this dummy to Part 572, the agency's regulation containing specifications for the various dummies it specifies in the Federal motor vehicle safety standards. The agency expects to propose adding the Hybrid III 5th percentile adult female dummy to Part 572 later this year.[19a]

NHTSA is also proposing one additional barrier test requirement using 5th percentile adult female dummies, an up to 40 km/h (25 mph) offset deformable barrier test requirement, using restrained dummies.

Research conducted by Transport Canada has shown that one of the causes of adverse effects of air bags is late deployment of some air bags in crashes with a ''soft crash pulse.'' In order to reproduce the softer, longer duration crash pulse, it selected the 40 percent offset barrier. It conducted crash tests into the barrier at 8 km/h (5 mph) increments up to 40 km/h (25 mph). These tests were conducted with a 5th percentile adult female belted dummy in a full-forward position, to simulate short stature drivers and the high belt use pattern in Canada. It found that at 40 km/h (25 mph), all the air bag systems of the vehicles tested would deploy. It also found that even for a belted driver, the deployment of the air bag frequently was so late that the test dummy would be right on the steering wheel, a ''worst case'' condition. The test procedure was shown to be a good test for the head, neck and chest loading on the dummy by the air bag.

NHTSA notes that the timing of air bag deployment is determined by a vehicle's crash sensing system, including both the crash sensing hardware and associated computer algorithm, i.e., the software. The decision to deploy an air bag is necessarily predictive, that is, the decision that a crash will be severe enough to warrant air bag deployment must be made very early in the crash if the air bag is to deploy in time to provide protection. The work done by Transport Canada, as well as other research, has indicated that the crash sensing systems of some vehicles need to be improved to better evaluate some crash pulses.

The agency is proposing a 40 km/h (25 mph) offset deformable barrier crash test requirement to help ensure that vehicle manufacturers upgrade their crash sensing and software systems, as necessary, to better address soft crash pulses. The proposed test is essentially

[19a] The proposed rule to add Hybrid III 5th percentile adult female dummy to Part 572 published in the **Federal Register** September 3, 1998.

the one that Transport Canada has been conducting for purposes of research. Restrained 5th percentile adult female dummies would be positioned in the same full forward position being proposed for the rigid barrier test discussed above, and the same injury criteria limits would apply. Since this is a relatively low energy test, it should be very easy to meet the injury criteria limits so long as the air bag deploys early in the crash event before the dummy moves very far forward.

Based on the testing conducted by Transport Canada, the problem of late deployments appears to be a problem with only some vehicles, at least in the environment measured in this particular crash test. The agency expects that the problem can be solved using a number of readily available approaches. These include improving computer algorithms, and adding crash sensors, e.g., using extra sensors mounted in the crush zone of the vehicle to provide additional, and earlier, information to use in the decision making algorithm. A longer term means of ensuring that air bags deploy early in a crash would be to use anticipatory crash sensors.

The agency is also proposing specifications for the deformable barrier to be used in this test. The specifications for this barrier would be included in Part 587.

2. Tests for Requirements To Minimize the Risk to Infants, Children and Other Occupants From Injuries and Deaths Caused by Air Bags

The one fact that is common to all persons who are at risk from air bags is that they are extremely close to the air bag at time of deployment. Behavioral changes, such as ensuring that children ride in the back seat and that all occupants are properly restrained, can sharply reduce the number of persons who are in such positions.

However, to minimize or eliminate air bag risks for the remaining persons who may be close to the air bag at time of deployment, one of two things must be done: either air bag deployment must be suppressed, or the air bag must be designed to deploy in such a manner that it does not cause a significant risk of injury to persons in such positions. All of the technologies to minimize or eliminate air bag risks follow one of these approaches.

As NHTSA developed test requirements to minimize or eliminate air bag risks, it needed to account for the fact that the persons who are potentially at risk vary from infants to adults, and have different potentials for injury. The agency therefore found it necessary to develop requirements using a variety of test dummy sizes. Moreover, since the agency wished to avoid requirements that are unnecessarily design-restrictive, it was necessary to develop a variety of manufacturer options that account for the kinds of effective technological solutions that the agency knows are under development.

Each of the test requirements being proposed by the agency is discussed below.

a. Safety of infants. Infants in rear facing child seats are at significant risk from deploying air bags, since the rear facing orientation of the child seat places their heads extremely close to the air bag cover. This is why NHTSA emphasizes that rear facing infant seats must never be placed in the front seat unless the air bag is turned off.

In order to address the risks air bags pose to infants in rear facing child seats, NHTSA is proposing two alternative test requirements, the selection of which would be at the option of the manufacturer. The two manufacturer options are: (1) test requirements for an automatic air bag suppression feature or (2) test requirements for low-risk deployment involving deployment of the air bag in the presence of a 12-month old Crash Restraints Air Bag Interaction (CRABI) dummy in a rear facing child restraint.

If the automatic suppression feature option were selected, the air bag would need to be suppressed during several static tests using, in the right front passenger seat, a 12 month old child dummy in a rear facing infant seat, and also during rough road tests. The rear facing infant seat would be placed in a variety of different positions during the static tests. In order to ensure that the suppression feature does not inappropriately suppress the air bag for small statured adults, the air bag would need to be activated during several static tests using a 5th percentile adult female dummy in the right front passenger seat, and also during rough road tests using that dummy.

The agency is proposing rough road tests to address the possibility that some types of automatic suppression features, e.g., weight sensors, might be ‘‘fooled’’ by occupant movement associated with riding on rough roads. For example, depending on the design of the sensor, occupant movement such as bouncing might cause the weight sensor to read a higher weight or lower weight. The agency believes that such devices should be designed so they do not turn on the air bag in the presence of a small child who is bouncing as a result of riding on a rough road, and so that they do not turn off the air bag in the presence of a small-statured adult who is bouncing as a result of riding on a rough road.

If the automatic suppression feature option were selected, a manufacturer would be required to provide a telltale light on the instrument panel which is illuminated whenever the passenger air bag is deactivated and not illuminated whenever the passenger air bag is activated. This telltale would advise vehicle occupants of the operational status of the air bag. In addition, the agency would use the telltale to determine, during the tests discussed above, whether the air bag is appropriately activated or deactivated.

If the low risk deployment option were selected, a vehicle would be required to meet specified injury criteria when the passenger air bag is deployed in the presence of a 12 month old child dummy placed in a rear facing infant seat. The agency is proposing injury criteria appropriate for a 12 month old child. In the case of air bags with multiple inflation levels, the injury criteria would need to be met for all levels.

NHTSA notes that there are uncertainties associated with all of the injury criteria proposed by this notice, especially those for children. Because experimental test data are generally not available from children, it is necessary to estimate injury tolerances by other means, e.g., by applying scaling methods to adult data. Particularly because injury mechanisms may differ in some respects between adults and children, there are necessarily some uncertainties associated with injury criteria developed by these means.

NHTSA requests comments on how to take account of these uncertainties in this rulemaking. For example, the agency is proposing a HIC limit of 660 for the 12-month old CRABI dummy in a rear facing child restraint. However, there are uncertainties as to how much risk of injury is represented by this value. The agency requests commenters to address the appropriateness of the proposed value, and on whether the agency should permit a low risk deployment option or instead require suppression for infants in rear facing child restraints.

With respect to that part of the proposed low risk deployment option that would require injury criteria limits to be met for all levels of a multi-level air bag, NHTSA notes that a child in a rear facing infant seat would be extremely close to the passenger air bag in any crash, regardless of crash severity. Moreover, based on discussions with suppliers and vehicle manufacturers, the agency believes that the development of technologies which suppress the passenger air bag in the presence of a rear facing infant seat is nearing completion. Thus, it appears reasonable to expect advanced air bag designs to essentially eliminate risk of serious injury or fatality resulting from air bag deployment to children in rear facing infant seats. Of course, even with advanced air bags, children in rear facing infant seats, like other children, will be safer in the back seat.

Under both test procedures, manufacturers would be required to assure compliance in tests using any child restraint capable of being used in the rear facing position which was manufactured for sale in the United States between two years and ten years prior to the date the first vehicle of the model year carline of which the vehicle is a part was first offered for sale to a consumer. This would ensure that vehicle manufacturers take account of the variety of different rear facing child restraints in use as they design their systems. The restraints used for compliance testing could be unused or used; however, if used, there could not be any visible damage prior to the test. The agency requests comments on whether there are alternative means of achieving this result, e.g., specifying use of several representative devices.

NHTSA is proposing to specify use of the 12 month old CRABI dummy. The motor vehicle industry is familiar with this dummy, and the agency expects to propose adding it to Part 572 later this year.

b. Safety of 3-year-old children. Young children are at special risk from air bags because, when unbelted, they are easily propelled close to the air bag as a result of pre-crash braking. NHTSA strongly recommends that young children ride in the back seat, which is a much safer location whether or not a vehicle has air bags.

In order to address the risks air bags pose to young children who do ride in the front seat, NHTSA is proposing requirements using both 3-year old and 6-year old child dummies. While there are both similarities and overlap between the requirements using the different dummies, the agency will discuss them separately (and cover them separately in the proposed regulatory text) because a manufacturer might choose to select different compliance options for the two dummies.

As to 3-year-old child dummies, the agency is proposing four alternative test requirements, the selection of which would be at the option of the manufacturer. The four manufacturer options are: (1) test requirements for an air bag suppression feature that suppresses the air bag when a child is present, i.e., a weight or size sensor, (2) test requirements for an air bag suppression feature that suppresses the air bag when an occupant is out of position, (3) test requirements for low risk deployment involving deployment of the air bag in the presence of out-of-position 3-year old child dummies, and (4) full scale dynamic out-of-position test requirements, which include pre-impact braking as part of the test procedure.

NHTSA is proposing to specify use of the Hybrid III 3-year-old child dummy. The motor vehicle industry is familiar with this dummy, and the agency expects to propose adding it to Part 572 later this year.

Requirements for an air bag suppression feature (weight or size sensor) that suppresses the air bag when a child is present. These requirements would mirror those being proposed with respect to a suppression feature for infants in rear facing child seats. If this option were selected, the air bag would need to be deactivated during several static tests using, in the right front passenger seat, a 3-year old child dummy, and also during rough road tests.

The child dummy would be placed in a variety of different positions during the static tests. Because the effectiveness of such a feature depends on the air bag being suppressed regardless of how a child may be positioned, and given the ease of conducting such tests, the agency is specifying a relatively large number of such positions. Some of the positions specify placing the dummy in a forward-facing child seat or booster seat.

In order to ensure that the suppression feature does not inappropriately suppress the air bag for small statured adults, the air bag would need to be activated during several static tests using a 5th percentile adult female dummy in the right front passenger seat, and also during rough road tests using that dummy. A manufacturer would also be required to provide a telltale light on the instrument panel which is illuminated whenever the passenger air bag is deactivated and not illuminated whenever the passenger air bag is activated.

Test requirements for an air bag suppression feature that suppresses the air bag when a child is out-of position. The agency believes that a suppression feature that suppresses the air bag when an occupant is out-of-position would need to be tested very differently than one which suppresses the air bag whenever a child is present. While various static and rough road tests can be used to determine whether the latter type of suppression device is effective, they would be of limited utility in testing a feature that suppresses the air bag when an occupant is out of position. This is because one of the key criteria in determining whether the latter type of suppression feature is effective is whether it works quickly enough in a situation where an occupant is propelled out of position as a result of pre-crash braking (or other pre-crash maneuvers) before a crash. The agency has accordingly developed separate test requirements for such devices.

If this option is selected by the vehicle manufacturer, the manufacturer would be required to provide a telltale indicating whether the air bag was activated or deactivated. Operation of the suppression feature would be tested through the use of a moving test device which would be guided toward the area in the vehicle where the air bag is located.

This test device would begin its course of travel in a forward direction toward a target area inside the vehicle. This target area, the air bag suppression zone, consists of a portion of a circle centered on the geometric center of the vehicle's air bag cover. The function of the air bag suppression system would be tested through the use of a headform propelled toward the air bag suppression zone at any speed up to 11 km/h (7 mph)—equivalent to a typical speed that the head of an occupant attains in pre-crash braking. When the test fixture enters the area near the air bag—the air bag suppression zone—where injuries are likely to occur if the air bag deploys, the telltale is monitored to determine if the suppression feature has disabled the air bag.

Apparatus that could be used to conduct this test would include a pneumatically operated ram whose stroke is sufficient to propel a 165 mm (6.5 inch) headform from a point of origin to a point forward of the automatic suppression plane of the test vehicle. Once activated, the pneumatic ram will propel the headform toward the air bag at up to 11 km/h (7 mph). The test headform consists simply of a 165mm (6.5 inch) outside diameter hemispherical shell. This headform is not instrumented nor is it intended to impact with the interior of the vehicle. Therefore, the agency is not specifying that it have a particular mass in an effort to provide maximum flexibility in configuring a test apparatus.

The automatic suppression plane of the vehicle, the point at which the air bag suppression feature must be activated when the plane is crossed by the headform, is located at that point rearward of the air bag and forwardmost of the center of gravity of the head of a seated occupant which the manufacturer determines to be that point where, if the air bag is deployed, a 3-year-old child dummy would meet specified injury criteria.

NHTSA notes that the test procedure it is proposing for air bag suppression features that suppress the air bag when an occupant is out-of-position is similar to one developed by GM. The agency is placing a copy of the GM procedure in the docket.

The agency requests comments as to whether the proposed test procedure would accommodate air bag suppression systems under development. In particular, the agency requests comments as to whether these suppression systems would ''recognize'' the test device. Additional questions concerning this proposed test procedure are included in a section titled ''Questions'' later in this notice.

Static tests involving deployment of the air bag in the presence of out-of-position 3-year old child dummies. If the low risk deployment option were selected, a vehicle would be required to meet specified injury criteria when the passenger air bag is deployed in the presence of out-of-position 3-year-old child dummies. Because this test is relatively difficult to run (it requires deployment of an air bag), the agency is proposing that it be conducted at two positions which tend to be ''worst case'' positions in terms of injury risk. The agency is also proposing more detailed positioning procedures for these two tests than for many of those proposed for the static suppression tests, since injury measures may vary considerably with position. The agency is proposing injury criteria appropriate for a 3-year-old child.

In the case of air bags with multiple inflation levels, the injury criteria would need to be met only for the levels that would be deployed in lower severity crashes, e.g., crashes of 32 km/h (20 mph) or below. The agency notes that while an infant in a rear facing child seat would always be extremely close to the passenger air bag, this is not true for older children. An older child would most likely be extremely close to the air bag in lower severity crashes, following pre-crash braking. Of the 46 older children NHTSA has confirmed as having been killed by a passenger air bag, 38, or 83 percent, were in crashes with a delta V of 24 km/h (15 mph) or below, and all were in crashes with a delta V of 32 km/h (20 mph) or below.

NHTSA requests comments concerning the threshold below which air bag deployment levels should be required to meet injury criteria and above which the injury criteria would not apply. The agency also requests comments concerning test procedures.

Full scale dynamic out-of-position test requirements, which include pre-impact braking as part of the test procedure. Under this option, a vehicle would be required to meet injury criteria in a rigid barrier crash test that included pre-impact braking as part of the test procedure, using an unrestrained 3-year-old child dummy.

Pre-crash braking would be simulated by a vehicle, initially accelerated to the predetermined pretest speed, that is retarded by application of a suitable pre-crash deceleration prior to contact with the rigid barrier. The agency believes that a 24 km/h (15 mph) impact speed with the rigid barrier would generate the crash pulse necessary to evaluate occupant crash protection to the out-of-position occupant. Further details on this alternative test procedure are set forth in the proposed regulatory text (see proposed S29 and S30 for Standard No. 208).

The agency is requesting comments on what impact speed should be specified, as well as on other aspects of the test procedure for this requirement, including dummy seating procedures. Depending on the comments, the agency may modify the test speeds, dummy seating procedures, or other aspects of the test procedure for the final rule.

c. Safety of 6-year-old children. These test requirements would include the same basic tests and options as specified for 3-year old child dummies, except that 6-year-old child dummies would be used in place of 3-year old child dummies. The agency believes it is necessary to specify requirements for 6-year-old child dummies as well as 3-year-old child dummies because a device that worked for one might not work for the other. For example, an automatic suppression feature that suppressed air bag deployment in the presence of a 3-year-old child dummy, based on information about size and/or weight, might not suppress air bag deployment in the presence of the larger, heavier 6-year-old child dummy.

The agency notes that, with respect to requirements for an air bag suppression feature (weight or size sensor) that suppresses the air bag when a child is present, some of the positions specified for the 3-year-old child dummy would not apply to the 6-year-old child dummy. This is because the 6-year-old child dummy is too large to be placed in those positions.

NHTSA is proposing to specify use of the Hybrid III 6-year-old child dummy. The Society of Automotive Engineers has guided the development of this dummy, and recently completed that work. Therefore, the motor vehicle industry is familiar with this dummy. The agency published an NPRM in the **Federal Register** (63 FR 35171) to add the Hybrid III 6-year-old child dummy to Part 572 on June 29, 1998.

d. Safety of small teenage and adult drivers. Out-of-position drivers are at risk from air bags if they are extremely close to the air bag at time of deployment. While any driver could potentially become out of position, small statured drivers are more likely to become out of position because they sit closer to the steering wheel than larger drivers.

In order to address the risks air bags pose to out-of-position drivers, NHTSA is proposing requirements using 5th percentile adult female dummies. The agency is proposing three alternative test requirements, the selection of which would be at the option of the manufacturer.

The manufacturer options are similar to those using 3-year-old and 6-year-old child dummies, with one significant exception. Since air bags provide safety benefits to small statured female drivers, it is obviously not appropriate to permit manufacturers to suppress air bag deployment under all conditions in the presence of such occupants. Therefore, this type of suppression feature would not be permitted for 5th percentile adult female dummies.

The three manufacturer options being proposed by the agency are: (1) test requirements for an air bag suppression feature that suppresses the driver air bag when the driver is out of position, (2) test requirements for low risk deployment involving deployment of the air bag in the presence of out-of-position 5th percentile adult female dummies, and (3) full scale dynamic out-of-position test requirements, which include pre-impact braking as part of the test procedure.

Again, the manufacturer options which the agency is proposing largely mirror the similar ones being proposed for 3-year-old and 6-year old child dummies. The test procedures are adjusted to reflect the driver, rather than the right front passenger position, and the different dummy. The proposed injury criteria are the same as being proposed for other tests using the 5th percentile adult female dummy.

The agency also notes that the option specifying test requirements for an air bag suppression feature that suppresses the driver air bag when an occupant is out of position would include both static tests and tests using a moving test device. The static tests are needed to, among other things, ensure that the driver air bag is not inappropriately deactivated because the driver's arms are near the air bag. Further details on this alternative test procedure are set forth in the proposed regulatory text (see proposed S25.2, S27 and S28 for Standard No. 208).

The agency also notes that the proposed full scale dynamic out-of-position test requirements, which include pre-impact braking as part of the test procedure, represent a surrogate for a variety of crash situations where the driver might be essentially against the steering wheel, in addition to directly addressing situations involving pre-crash braking. These other situations include ones where small-statured persons drive in a position where they are extremely close to the air bag all of the time.

C. Injury Criteria

NHTSA is proposing injury criteria and performance limits that it believes are appropriate for each size dummy. The agency is placing in the public docket a technical paper which explains the basis for each of the proposed injury criteria, and for the proposed performance limits. The title of the paper is ''Development of Improved Injury Criteria for the Assessment of Advanced Automotive Restraint Systems.''

Standard No. 208 currently specifies five injury criteria for the Hybrid III 50th percentile adult male dummy in barrier crash tests: (1) dummy containment—all portions of the dummy must be contained in the vehicle passenger compartment throughout the test, (2) HIC (Head Injury Criterion) must not exceed 1,000, (3) chest acceleration must not exceed 60 g's, (4) chest deflection must not exceed 76 mm (3 inches), and (5) upper leg forces must not exceed 2250 pounds.

Under today's proposal, NHTSA would generally apply these and certain additional injury criteria to all of the dummies covered by the proposal. However, the criteria would be adjusted to maintain consistency with respect to the injury risks faced by different size occupants. Also, with respect to some types of injuries, the agency is considering alternative injury criteria.

For chest injury, NHTSA is considering two alternatives. Under the first, or primary, alternative, the agency would add a new criterion, Combined Thoracic Index (CTI), which was recently developed by the agency. New analyses of cadaver test data using a variety of restraint system combinations indicate that thoracic injury prediction can be improved by considering a linear combination of chest deflection and chest acceleration rather than solely by considering the criteria independently. CTI links the combined effect of both parameters with the risk of injury.

In proposing to add CTI, the agency has considered whether to adjust the existing limits on chest deflection and/or chest acceleration. In the absence of the existing injury criteria, the proposed CTI limit (CTI = 1) would permit (for the Hybrid III 50th percentile adult male dummy) chest deflection to exceed 76 mm (3 inches) when acceleration is very low, and acceleration to exceed 60 g's when chest deflection is very low.

NHTSA notes that, in the case of chest deflection, the current 76 mm (3 inch) limit is very close to the limit capable of being measured by the Hybrid III 50th percentile adult male dummy. Therefore, it does not appear to be possible to adjust this parameter in a meaningful way. In the case of chest acceleration, the agency notes that it does not have any cadaver data concerning injury risk associated with very low deflection and chest acceleration above 60 g's. The agency requests comments on this issue. NHTSA is especially interested in data and/or analyses concerning the risk of injury associated with low deflection and high acceleration.

As the second alternative for chest injury, the agency would simply continue to maintain separate limits on chest acceleration and chest deflection.

NHTSA is also proposing to add neck injury criteria. The agency notes that it added neck injury criteria as part of the temporary sled test alternative, although the standard does not otherwise specify neck injury criteria. The neck injury criteria for the sled test alternative include separate limits on flexion, extension, tension, compression and shear.

NHTSA has recently developed an improved neck injury criterion, called Nij. The agency believes that a disadvantage associated with specifying separate limits for flexion, extension, tension, compression, and shear is that it does not account for the superposition of loads and moments, and the additive effects on injury risk. The agency developed Nij to take account of these effects.

NHTSA is considering two alternatives with respect to neck injury criteria. Under the first, or primary alternative, the agency would add Nij to Standard No. 208. In terms of performance limits, the agency is requesting comments on Nij=1.4 and on Nij=1. As discussed in the technical paper concerning injury criteria, Nij=1 reflects certain critical values developed using biomechanical data. However, based on concerns about practicability, particularly with respect to tests specifying use of the 5th percentile adult female dummy, as well as concerns about correlations between biomechanical data and real-world crash data, the agency believes that Nij=1.4 might be a more appropriate performance limit. NHTSA requests comments on this issue.

As an alternative to Nij, NHTSA is also requesting comments on establishing separate limits on flexion, extension, tension, compression and shear, i.e., the approach adopted for the sled test alternative. The proposed regulatory text includes this second alternative as well as Nij.

As indicated earlier in this section, NHTSA is generally proposing to apply the same injury criteria to all of the dummies covered by today's proposal, adjusted to maintain consistency with respect to the injury risks faced by different size occupants. There are, however, some exceptions to this. The agency is not proposing to apply the dummy containment injury criterion to the 12 month old CRABI dummy since that criterion does not appear to be relevant to the low risk deployment test using that dummy. The agency is not proposing chest deflection or CTI requirements for the 12 month old CRABI dummy because that dummy does not measure chest deflection. (As indicated above, chest deflection is needed to calculate CTI.)

The agency requests comments on the proposed injury criteria, on how they are calculated, and on the proposed performance limits. To help facilitate focused comments, the agency is including specific values for each performance limit in the proposed regulatory text. However, NHTSA is considering a range of limits above and below each specified value. Depending on the public comments, the agency may adopt for the final rule values higher or lower than the ones included in the proposed regulatory text. The agency requests commenters to address what values should be selected for the final rule, their rationale for their recommendation, and the implications of adopting lower or higher values than those specified in the proposed regulatory text.

D. Dummy Recognition

The agency has explained many times that, in developing crash test dummies for regulatory and research purposes, it seeks to ensure insofar as possible that the measurements obtained on the dummy for measuring injury risk are the same as would be obtained on a human being. In other words, the dummy is used as a surrogate for determining how a human being would fare in a particular crash situation.

As the agency proposes to specify the use of dummies and an out-of-position occupant simulator to test suppression devices, it is similarly necessary to ensure that the test results using these devices will be as close as possible to those that would occur when a human being is present. NHTSA notes, however, that test dummy compatibility with air bag occupant presence and range sensors is not possible in all cases using the currently available dummies. Some technologies, e.g., ultrasonic and active infrared, can be used to recognize human beings but may not recognize current dummies or the out-of-position occupant simulator.

NHTSA notes that it is monitoring research, funded by General Motors, by the Johns Hopkins University Applied Physics Laboratory that specifically investigates and addresses this subject. The project objectives compare the characteristic output signals generated by both human subjects and test dummies, in response to current and projected air bag sensors of the following general types: ultrasonic/ acoustic, active infrared, passive infrared, capacitive, and electric field. However, this is a longer-range research project, and is not expected to be completed by the time of the final rule.

Specialized dummy treatments may be required to enable the test dummy and out-of-position occupant simulator to properly interface with the full range of projected sensor technologies. However, it is possible that relatively straightforward surface treatments or clothing selection may suffice for compatibility with ultrasonic and active infrared sensor types.

The agency requests comments on this issue.

E. Lead Time and Proposed Effective Date

NHTSA has sought information by a variety of means to help it determine when the vehicle manufacturers can provide advanced air bag systems to consumers. This is known as lead time. Vehicle lead time is a complex issue, especially when it involves technology and designs that are still under development.

In three different formal actions, the agency has gathered information concerning lead time. First, the agency held a public meeting on advanced air bags on February 11 and 12, 1997, in Washington D.C. The proceedings of that meeting are included in Docket NHTSA–97–2814. Next, and as discussed earlier in this notice, JPL conducted, at NHTSA's request, a survey of the automotive industry and independent analysis concerning the readiness of the advanced air bag technologies. Finally, the agency contracted Management Engineering Associates (MEA), an engineering management consulting company, to conduct a feasibility study on advanced air bag technologies.

These three sources of information indicated the same basic time schedules: currently available technological solutions such as seat sensors, seat belt buckle sensors, dual-stage inflators and advanced air bag fold patterns, can be and will be in production between model year 1999 and model year 2002. More sophisticated systems such as dynamic occupant position sensing systems and pre-crash sensors, will be available after September 1, 2001.

NHTSA has also held numerous meetings with the vehicle manufacturers and suppliers during the past two years. The companies have shared confidential information with the agency about their ongoing development efforts and future product plans.

The agency notes that lead time for technology still under development typically depends on two things: initial development to demonstrate that a concept is feasible, and then further development to apply the technology to a specific vehicle design. These typically involve efforts both by suppliers and by vehicle manufacturers. In this field of technology, it appears that much of the innovative development is being borne by the component suppliers, based on performance specifications defined by the vehicle manufacturers. First the systems are designed, tested and produced in limited quantities by the component manufacturers. Next these systems are turned over to the vehicle manufacturers. The vehicle manufacturers then conduct prototype design verifications, conduct production level equipment verification and finally complete production and include the systems in their new vehicles. MEA estimates the vehicle manufacturers' cycle could take an average of 36 months.

The suppliers and vehicle manufacturers have, however, been working on various advanced technologies for several years. Thus, to a large degree, lead time is dependent on where the suppliers and vehicle manufacturers are currently in their development and implementation efforts. As discussed earlier in this notice, NHTSA believes that different suppliers and vehicle manufacturers are at different stages with respect to designing advanced air bags, and also face different constraints and challenges, e.g., different states-of-the-art of their current air bag systems, engineering resources, number of vehicles for which air bags need to be redesigned, etc. NHTSA believes that these differing situations can best be accommodated by phasing in requirements for advanced air bags.

Taking account of all available information, including but not limited to the wide variety of available technologies that can be used to improve air bags (and thereby meet the proposed requirements) and information concerning where the different suppliers and vehicle manufacturers are in developing and implementing available technologies, the agency is proposing to phase in the new requirements in accordance with the following implementation schedule:

25 percent of each manufacturer's light vehicles manufactured during the production year beginning September 1, 2002;

40 percent of each manufacturer's light vehicles manufactured during the production year beginning September 1, 2003;

70 percent of each manufacturer's light vehicles manufactured during the production year beginning September 1, 2004;

All vehicles manufactured on or after September 1, 2005.

The agency is proposing a separate alternative to address the special problems faced by limited line manufacturers in complying with phase-ins. The agency notes that a phase-in generally permits vehicle manufacturers flexibility with respect to which vehicles they choose to initially redesign to comply with new requirements. However, if a manufacturer produces a very limited number of lines, e.g., one or two, a phase-in would not provide such flexibility.

NHTSA is accordingly proposing to permit manufacturers which produce two or fewer carlines the option of omitting the first year of the phase-in if they achieve full compliance effective September 1, 2003. The agency is proposing to limit this alternative to manufacturers which produce two or fewer carlines in light of the statutory requirement concerning when the phase-in is to begin. Without such a limitation, it would technically be possible for the industry as a whole to delay introducing any advanced air bags for a year. However, the agency doubts that any full-line vehicle manufacturers would want to take advantage of the alternative, given the need to achieve full compliance by September 1, 2003.

As with previous phase-ins, the agency is proposing to exclude vehicles manufactured in two or more stages and altered vehicles from the phase-in requirements. These vehicles would be subject to the advanced air bag requirements effective September 1, 2005. They would, of course, be subject to Standard No. 208's existing requirements before and throughout the phase-in.

Also as with previous phase-ins, NHTSA is proposing reporting requirements to accompany the phase-in. The agency is proposing to include the reporting requirements in 49 CFR Part 585, which currently specifies automatic restraint phase-in reporting requirements. Since the phase-ins currently addressed by Part 585 are complete, effective September 1, 1998, the agency is proposing to replace the existing language with regulatory text addressing the phase-in of Standard No. 208's requirements for advanced air bags.

NHTSA believes that the proposed phase-in addresses two potential concerns. First, the agency believes that it would not be possible for manufacturers which produce large numbers of models of passenger cars and lights trucks to simultaneously design and implement advanced air bags in all of their vehicles at once. All manufacturers have limited engineering resources, and the same resources are often used for different models. The proposed phase-in will address this concern.

Second, NHTSA wishes to see advanced air bags implemented expeditiously, but wants to encourage the vehicle manufacturers to adopt the best designs possible. The agency believes the proposed phase-in balances these competing concerns.

The new air bag designs having the potential to offer the greatest safety benefits, e.g. designs that would tailor inflation based on the widest variety of relevant information including dynamic occupant proximity, also have the longest lead times. If an effective date were too early, it might force manufacturers working on such advanced designs to drop those plans and adopt designs with shorter lead times. At the same time, the agency recognizes that relatively simple solutions, with shorter lead times, can be used to solve current problems with air bags. The agency therefore does not want endless quests for the ''perfect'' air bag to unnecessarily delay solving the current problems.

An issue which is closely related to lead time for advanced air bags is the time when amendments providing temporary reductions in Standard No. 208's performance requirements should expire. The amendment permitting manufacturers to provide manual on-off switches for air bags in vehicles without rear seats or with rear seats too small to accommodate a rear facing infant seat is scheduled to expire on September 1, 2000. The amendment providing a generic sled test alternative to Standard No. 208's unbelted barrier test requirements originally had an expiration date of September 1, 2001, although, as discussed earlier in this notice, this date has been superseded by the NHTSA Reauthorization Act of 1998.

The agency received petitions objecting to the expiration dates for these temporary amendments. In an appendix to this notice, NHTSA is denying the petition concerning on-off switches to the extent that it requests making the switch amendment permanent. However, the agency is granting it to the extent that it is proposing phase out the switch amendment as the upgraded requirements are phased in. The petitions concerning the sled test option were mooted by the NHTSA Reauthorization Act. As in the case of the switch amendment, the agency is proposing to phase out the sled test option as the new requirements are phased in.

During the proposed phase-in, the temporary amendments (sled test alternative and OEM manual on-off switches for certain vehicles) would not be available for vehicles certified to the upgraded requirements, but would be available for other vehicles under the same conditions as they are currently available. Thus, as manufacturers developed advanced air bags, they would need to ensure that vehicles equipped with these devices meet all of Standard No. 208's longstanding performance requirements as well as the new ones being proposed today.

F. Selection of Options

NHTSA notes that, where a safety standard provides manufacturers more than one compliance option, the agency needs to know which option has been selected in order to conduct a compliance test. Moreover, based on previous experience with enforcing standards that include compliance options, the agency is aware that a manufacturer confronted with an apparent noncompliance for the option it has selected (based on a compliance test) may respond by arguing that its vehicles comply with a different option for which the agency has not conducted a compliance test. This response creates obvious difficulties for the agency in managing its available resources for carrying out its enforcement responsibilities, e.g., the possible need to conduct multiple compliance tests (possibly involving full-scale vehicle crash tests) for first one compliance option, then another, to determine whether there is a noncompliance.

To address this problem, the agency is proposing to require that where manufacturer options are specified, the manufacturer must select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle. This will mean that failure to comply with the selected option will constitute a noncompliance with the standard regardless of whether a vehicle complies with another option.

Similarly, for manufacturers which select the option for an automatic suppression feature that suppresses the air bag when an occupant is out of position, the agency is proposing to require that the manufacturer must select the passenger side automatic suppression plane and the driver side automatic suppression plane by the time it certifies the vehicle, and may not thereafter select different planes. This is to avoid situations where the agency conducts compliance tests using the automatic suppression planes selected by the manufacturer and is later told, after a test indicates an apparent noncompliance, that the vehicle may comply for different automatic suppression planes.

G. Availability of Retrofit Manual On-Off Switches

As discussed earlier in this notice, on November 11, 1997, NHTSA published in the **Federal Register** (62 FR 62406) a final rule exempting, under certain conditions, motor vehicle dealers and repair businesses from the ''make inoperative'' prohibition in 49 U.S.C. § 30122 by allowing them to install retrofit manual on-off switches for air bags in vehicles owned by people whose request for a switch is approved by NHTSA. The final rule is set forth as Part 595, *Retrofit On-Off Switches for Air Bags.*

The purpose of the exemption is to preserve the benefits of air bags while reducing the risk of serious or fatal injury that current air bags pose to identifiable groups of people. In issuing that final rule, NHTSA explained that although vehicle manufacturers are beginning to replace current air bags with new air bags having some advanced attributes, i.e., attributes that will automatically minimize or avoid the risks created by current air bags, an interim solution is needed now for those groups of people at risk from current air bags in existing vehicles.

Just as NHTSA is proposing to phase out the temporary amendments to Standard No. 208 as the upgraded requirements are phased in, the agency is also proposing to phase out the availability of this exemption. Under the proposal, retrofit on-off switches would not be available for vehicles which have been certified to the advanced air bag requirements being proposed in today's notice.

NHTSA requests comments, however, on whether retrofit on-off switches should continue to be available under eligibility criteria revised to be appropriately reflective of the capabilities of advanced air bag technology. The agency observes that if such switches were to be available at all, the criteria would need to be much narrower since the risks would be smaller than they are currently. For example, the passenger side air bag in a vehicle with a weight sensor would not deploy at all in the presence of young children. Therefore, there would no safety reason to permit a retrofit passenger side on-off switch because of a need for a young child to ride in the front seat. The agency requests any commenters who advocate any continued availability of retrofit on-off switches to discuss how the existing eligibility criteria should be tailored to the specific technologies that would be used in vehicles certified to the advanced air bag requirements being proposed in today's notice.

H. Warning Labels

As indicated in an earlier section of this notice, on November 27, 1996, the agency published in the **Federal Register** (61 FR 60206) a final rule which, among other things, amended Standard No. 208 to require improved labeling on new vehicles to better ensure that drivers and other occupants are aware of the dangers posed by passenger air bags to children. These warning label requirements did not apply to vehicles with passenger air bags meeting specified criteria. The agency is similarly proposing that vehicles certified to the advanced air bag requirements being proposed today would not be subject to those warning label requirements. The agency requests comments, however, concerning whether any of the existing labeling requirements should be retained for vehicles with advanced air bags and/or whether any other labeling requirements should be applied to these vehicles.

I. Questions

As discussed earlier in this notice, NHTSA has sought to develop requirements that are as performance-oriented as possible, and to include options for manufacturers that account for the kinds of technologies and designs that may be used. It is the agency's intent to permit the vehicle manufacturers to use any technology or design which can solve the problem of adverse effects of air bags to out-of-position occupants, so long as all of the standard's performance requirements can be met.

To aid the agency in obtaining useful comments, NHTSA is setting forth in this section a specific list of questions for commenters relating to a number of issues including, among other things: (1) whether the agency's overall proposal, and whether each of the proposed manufacturer options, would achieve an appropriate level of safety, and (2) whether additional manufacturer options or test procedures are needed to accommodate some technologies or designs. NHTSA notes that the vehicle manufacturers and air bag suppliers are in the best position to evaluate whether the proposed manufacturer options and test procedures are appropriate for the technologies and designs they have under development. Depending on the comments, the agency may issue a final rule providing some but not all of the proposed options, and/or provide additional manufacturer options or test procedures to accommodate some technologies or designs.

For easy reference, the questions are numbered consecutively. NHTSA encourages commenters to provide specific responses to each question for which they may have information or views. In addition, in order to facilitate tabulating the comments by issue, the agency encourages commenters to respond to the questions in sequence, and to identify the number of each question to which they are responding.

NHTSA requests that commenters provide as specific and documented a rationale as possible, including an analysis of safety consequences, for any positions that are taken. Commenters with a technical background are encouraged to provide scientific analysis of these matters.

The list of questions does not purport to be an all inclusive list of items or information which the public may have available and believe is valuable in assessing the issues. Commenters are encouraged to provide any other data that they believe are relevant.

1. *Overall safety.* Does the agency's overall proposal achieve an appropriate level of safety with respect to risks from air bags for out-of-position occupants?

a. Please address this question separately for the driver side and for the passenger side.

b. If a commenter believes that the proposal does not ensure an appropriate level of safety, please provide a detailed explanation of why. Please also describe in detail what additional or alternative requirements the agency should consider, and the kind of technologies, designs and lead time that would be needed to meet those requirements.

2. *Adequacy of each proposed manufacturer option.* Does each proposed manufacturer option ensure an appropriate level of safety with respect to the specific problem it addresses? How do the different options differ with respect to benefits and costs? If a commenter believes that a particular option should be changed or deleted for the final rule, please explain why. Also, please explain the consequences of changing or deleting the option, e.g., would greater lead time be needed to meet one of the remaining options?

3. *Accommodation of all effective designs.* Do the proposed manufacturer options accommodate all designs under development that would effectively address air bag-induced injuries and/or fatalities, and designs that are expected to be under development in the foreseeable future? More specifically, is there a need to either modify or add test procedures to the proposed options to accommodate particular technologies or designs, or to add additional options? If a commenter believes there is such a need, please provide a detailed explanation of why, both with respect to why the technology is not accommodated by the proposed options and why the technology will ensure an appropriate level of safety. Please also provide a detailed recommendation concerning what specific regulatory text the agency should adopt to accommodate the technology.

4. *Possible unintended consequences.* To what extent could the advanced technologies the manufacturers might adopt result in unintended adverse consequences? For example, could some occupants face higher risks than now? How should the agency consider that possibility in this rulemaking? Are there any additional or alternative requirements the agency should adopt to prevent such consequences?

5. *Likely manufacturer responses.* How would vehicle manufacturers likely respond to the proposed requirements, i.e., what technologies and design changes would they actually

adopt? (Vehicle manufacturers are asked to provide a specific response to this question, with respect to their future product plans.)

6. *Necessity of all proposed manufacturer options.* Are any of the proposed manufacturer options unnecessary because no manufacturer would ever select the option?

7. *Proposed test procedures—in general.* NHTSA notes that some of the proposed test procedures are new. The agency requests specific comments on each of the proposed test procedures, including whether any of them should be made more specific and whether any additional conditions should be specified.

8. *Proposed injury criteria.* As discussed earlier in this notice, NHTSA is placing a technical paper in the docket which discusses the proposed injury criteria. The agency requests comments on each of the proposed injury criteria, the proposed calculation methods, and the proposed performance limits. The agency also requests comments on alternatives to the proposed criteria. Among other things, NHTSA requests commenters to address what risk levels are acceptable, what factors should be considered in selecting performance limits for different test requirements, and whether the same limits should be established for all test requirements, e.g., out-of-position tests, low speed tests, high speed tests. The agency also requests commenters to address how it should take account of uncertainties relating to the injury criteria, especially with respect to children.

9. *Dummy recognition.* a. How should the agency address the suitability of test dummies and out-of-position occupant simulators (e.g., headforms) for testing technologies (e.g., weight sensors) for detecting the presence of occupants and technologies (e.g., infrared and ultra sound) for sensing the distance of occupants from an air bag? To what extent can the addition of simple surface treatments or clothing selection be used to solve this problem?

b. If full resolution of this or any other potential test procedure problems should necessitate the performance of longer range (multi-year) research, what interim approaches should the agency use for assessing performance? For example, one possible approach would be to permit vehicle manufacturers to specify the attributes of their suppression devices, e.g., the size of the suppression zone and to require out-of-position-type test requirements to be met for those conditions. If, for example, a manufacturer specified that the suppression zone for a vehicle's passenger-side air bag extended five inches from the centerpoint of the air bag cover, injury criteria performance limits would need to be met for infant and child dummies located anywhere outside that zone. Under such an interim approach, the introduction of effective suppression devices would not be delayed by potential problems related to completing the development of test procedures. While such an approach would not test the performance of the suppression device itself, vehicle manufacturers would have strong incentives, e.g., product liability considerations, to design the device so that it works properly under real world conditions. While the agency is hopeful that any potential test problems can be resolved in a timely manner before the final rule, it requests comments on adopting this type of interim approach, and on other potential interim approaches, should the need rise.

10. *Seating procedure for 5th percentile adult female dummy.* NHTSA notes that the seating procedure for the 5th percentile adult female dummy set forth in the proposed regulatory text is based on the equipment and procedures in SAE J826, ''Devices for Use in Defining and Measuring Vehicle Seating Accommodations.'' The seating procedure is similar to that specified in Standard No. 208 for the Hybrid III 50th percentile adult male dummy. However, the agency is proposing, with respect to the SAE J826 equipment, certain adjustments in the lengths of the lower leg and thigh (femur) segments to make it appropriate for the 5th percentile adult female dummy. The agency is also aware that the SAE Hybrid III 5th Percentile Dummy Seating Procedures Task Group is developing specialized seating equipment to locate the 5th percentile adult female dummy. This equipment was expected to become available by mid-summer 1998, and the agency will place specifications for the equipment in the docket. NHTSA recognizes that this new equipment might be used as an alternative to that specified in the proposed regulatory text. The agency seeks comments on this issue.

11. *Rough road tests.* Are the proposed requirements and test procedures for the rough road tests appropriate? The agency is especially interested in comments concerning proposed specifications for road surface, speed, and distance of travel.

12. *Telltales for automatic suppression.* For vehicles which have automatic suppression features, are there both pros and cons to requiring telltale lights on the instrument panel to advise vehicle occupants of the operational status of the air bag? Please address this question separately for the driver position and the passenger position, and for rear facing infant seats and older children. If the agency did not require a telltale light, what procedure should it use in testing for determining whether an air bag is activated or deactivated?

13. *Proposed automatic suppression test.* The agency observes that the proposed automatic suppression test is new and may require further refinement. NHTSA therefore requests comments on all aspects of the proposed test procedure, including, but not limited to, the following issues. Is the proposed 165mm (6.5 inch) outside diameter hemispheric headform an appropriate simulator of an out-of-position occupant for the purposes of assessing the performance of an air bag suppression device? What other characteristics should the headform possess if the proposed headform is not sufficient? Should the agency specify the surface and other material of the headform? Will the hemispheric headform be recognized as a vehicle occupant by each of the various suppression systems under development? If not, are there changes in the headform that would make it recognizable?

14. *Proposed dynamic out-of-position test.* NHTSA notes that the proposed dynamic out-of-position test is newly developed. The agency requests commenters to address the following issues.

(a) When the proposed dynamic out-of-position test procedure is conducted for various vehicles, what are the likely trajectories of the dummies? Does the procedure result in the dummy moving directly toward a ''worst-case'' position in terms of potential air bag risk for each vehicle? If not, should any changes be made in the test procedure, e.g., changing initial dummy position? Please address this question separately for the 3-year old child, 6-year old child, and 5th percentile adult female dummies.

(b) The proposed seating procedures for the dummies specify the use of low friction material between the dummies and the seat. The agency has proposed to specify the use of certain readily available fabrics that could be used for this purpose. Comments are requested on other means of achieving a low friction condition, such as specifying a coefficient of static or sliding friction and the conditions for which the coefficients would apply. Specific values of a friction factor are solicited, as appropriate.

(c) Should the proposed dynamic out-of-position test be run at different speeds or angles? NHTSA notes that if a 24 km/h (15 mph) impact were specified, it is conceivable that manufacturers might be able to certify to this requirement by raising their deployment thresholds to, or slightly above, that level. The agency requests comments on whether higher deployment thresholds alone could be used to meet this test, and, if so, the safety implications of this type of countermeasure.

(d) What are reasonable tolerances on final impact speed and deceleration in order to ensure that a test is repeatable? Should a specific methodology be adopted to ensure an appropriate degree of repeatability?

15. *Tests with child dummies.* (a) NHTSA is proposing that tests using infant dummies be conducted with any rear facing child restraint which was manufactured for sale in the United States between two years and ten years prior to the date the first vehicle of the model year carline of which the vehicle is a part was first offered for sale to a consumer. The agency is proposing the same approach, with respect to forward-facing child seats and booster seats, for tests using older child dummies. The agency requests comments on this approach. Is there an effective alternative means of ensuring that vehicle manufacturers take account of the variety of different child restraints in use as they design their systems?

(b) NHTSA is proposing to specify use of the 12-month-old CRABI dummy for tests using rear facing infant restraints. However, some rear facing infant restraints may only be certified for use with smaller infants, e.g., 9-month-olds. This raises the issue of whether the proposed dummy could be placed into these child restraints. The agency requests comments on how to address this issue.

(c) Some rear facing child seats are now produced for children older than 12 months. Should the agency specify additional test requirements to address this situation?

(d) Should the agency specify test requirements using car beds and, if so, what specific requirements?

16. *Older children.* Standard No. 208 currently defines advanced air bag to include, among other things, a passenger air bag that provides an automatic means to ensure that the air bag does not deploy when a child seat or child with a total mass of 30 kg (66 pounds) or less is present on the front outboard passenger seat. That definition was included because vehicles with such air bags are not required to have certain warning labels.[20] NHTSA notes that the part of the definition referring to a child with a total mass of 30 kg (66 pounds) or less was included to reflect the possible use of weight sensors. The 30 kg (66 pound) threshold was originally suggested by Mercedes-Benz and corresponds to the weight of a 50th percentile 10-year-old and a 95th percentile 7-year-old. The agency stated that the threshold was far enough below the weight of a 5th percentile adult female (approximately 46 kg (101 pounds)) to avoid inadvertently deactivating the air bag when a small adult is occupying the seat. In today's proposal, the agency is not proposing a threshold as such but is instead proposing tests using specified dummies. The heaviest child dummy that would be used in testing a weight sensor intended to suppress air bag deployment for children would be the Hybrid III 6-year-old child dummy, which has a weight of approximately 24 kg (51.8 pounds). No Hybrid III child dummies are available that correspond a 9-year-old or 10-year-old. A similar issue would exist with respect to a sensor intended to suppress air bag deployment based on size, i.e., the largest size child dummy tested would be the 6-year-old. The agency requests comments on the potential gap between the size/weight of the 6-year-old child dummy and the largest/heaviest child for which suppression might be appropriate (based on presence as opposed to being out-of-position) and how the agency should deal with this issue. For example, should the agency ballast the 6-year-old child dummy to a greater weight when testing weight sensors?

17. *Possible information for consumers.* NHTSA notes that, during the phase-in of new requirements for advanced air bags, consumers may be interested in knowing which vehicles are certified to the new requirements. The agency requests comments on whether a means should be provided so that consumers can easily determine whether a vehicle has been certified to these requirements and, if so, which option(s) were selected. NHTSA also requests comments on what means should be established for communicating such information to consumers, should the agency decide to do so, e.g., a required statement on the certification label. The agency notes that such a statement or other means could also be used to determine whether the vehicle is permitted to have a retrofit on-off switch under Part 595.

18. *Temperature.* NHTSA notes that it is asking several questions related to temperature and air bag performance in connection with its consideration of a petition for rulemaking submitted by Parents for Safer Air Bags. A discussion of the petition is included in an appendix to this notice.

Does temperature have a significant effect on air bag deployment performance? Is there a need to address this variable in Standard No. 208? If so, what specific performance requirements and test procedures should be considered? How are vehicle manufacturers and suppliers currently addressing this issue? The agency specifically requests data related to temperature effects on sled and vehicle crash testing.

19. *Possible requirements relating to turning off cruise controls upon air bag deployment.* NHTSA notes that cruise controls are turned off when a vehicle is braked. Many crashes, however, do not involve braking. The agency requests comments on a possible requirement to require cruise controls to be turned off upon air bag deployment.

20. *Possible requirements related to preventing air bag deployments during rescue operations following a crash.* As the agency has monitored the real world performance of air bag deployments, it has noted scattered reports of air bags deploying during rescue operations following a crash. This can result in injury to rescue personnel and also cause further injury to occupants. In NHTSA's Emergency Rescue Guidelines for Air Bag Equipped Vehicles,[21] the agency explains that deactivating the vehicle's electrical system prevents deployment of all electrically initiated air bags after a specific time period. The specific times for different vehicles are identified as part of the guidelines. The times vary significantly for different vehicles, ranging from 0 seconds to 10 and even 20 minutes.

The agency requests comments on possible requirements relating to preventing air bag deployments during rescue operations following crashes. Should the agency specify requirements concerning air bag deactivation times relative to deactivation of the vehicle's electrical system for electrically initiated air bags, or some other means of deactivation? Should the agency specify any other requirements for these and/or other kinds of air bags?

21. *Organization of Standard No. 208.* Do commenters have any specific recommendations concerning the

[20] See 61 FR 40784, 40791–92, August 6, 1996; 61 FR 60206, November 27, 1996.

[21] These guidelines are available on NHTSA's website at http://www.nhtsa.dot.gov/people/injury/ems/airbag/.

organization of the regulatory text for Standard No. 208, with respect to either or both the existing and the proposed text? The agency notes that one way of simplifying the standard would be to remove outdated text and to separate seat belt requirements from crash test requirements. NHTSA is especially interested in specific comments concerning how all of the crash test requirements, existing and proposed, could be organized in a simple manner.

22. *Possible development of alternative unbelted crash test requirements.* The vehicle manufacturers have raised various objections to the existing unbelted barrier test requirements. As discussed earlier in this notice, NHTSA is placing in the docket a technical paper which discusses the representativeness of those requirements with respect to real-world frontal crashes which have a potential to cause serious injury or fatality. NHTSA requests comments on that paper and on whether the agency should develop alternative unbelted crash test requirements. NHTSA requests commenters that advocate alternative unbelted crash test requirements to recommend specific alternative requirements and to address the following questions:

a. How do the recommended alternative requirements compare to the existing unbelted barrier test requirements (tests at any speed up to 48 km/h (30 mph), and at angles ranging from ±30 degrees oblique to perpendicular, into a rigid barrier) with respect to representing the range of frontal crashes which have a potential to cause serious injuries or fatalities? In answering this question, please consider the entire range of tests incorporated into the existing requirements and the recommended alternative requirements. Please specifically address representativeness with respect to (1) crash pulses, (2) crash severities, and (3) occupant positioning, and provide separate answers for crashes likely to cause fatalities and crashes likely to cause serious but not fatal injuries.

b. How do the recommended alternative requirements compare to the existing requirements with respect to repeatability, reproducibility, and objectivity?

c. To what extent can it be concluded that a countermeasure needed to meet the recommended alternative would ensure protection in frontal crashes not directly represented by the test, e.g., crashes with different pulses (harder or softer) or different severities (more severe or less severe)? Please quantify the amount of protection that would be ensured in other types of crashes, i.e., what the injury criteria measurements would be. Please answer this same question for the existing unbelted barrier test requirements.

d. Commenters are asked to specifically address why they believe the recommended alternative is superior to the current requirements. In providing this answer, commenters are asked to respond to the following questions:

1. If the recommended alternative is believed to be representative of crashes not directly represented by the current requirements, should it be added to Standard No. 208 rather than replace the existing requirements?

2. If a commenter believes that air bag designs needed to meet the existing unbelted barrier test requirements provide less-than-optimum protection in other types of crashes, please provide specific examples and explain why advanced technologies permitting tailored air bag response cannot be used to meet the existing performance requirements and provide appropriate protection in the examples at issue.

23. *Possibility of more children sitting in the front seat with advanced air bags.* As vehicle manufacturers install advanced air bags which minimize the risks air bags pose to children, the public may believe that the front seat is now safe for children, and more children would then sit in the front seat. However, the back seat has always been safer for children, even before there were air bags. NHTSA conducted a study of children who died in crashes in the front and back seats of vehicles, very few of which had passenger air bags. The study concluded that placing children in the back reduces the risk of death in a crash by 27 percent, whether or not a child is restrained.[22] NHTSA requests comments on what steps it and others can take to address the possible problem of more children riding in the front seat with advanced air bags.

VII. Costs and Benefits

NHTSA is placing in the docket a Preliminary Economic Assessment (PEA) which analyzes the potential impact of the proposed new performance requirements and associated test procedures for advanced air bag systems. The Executive Summary of that document summarizes its conclusions as follows.

Compliance scenarios. This analysis identified and analyzed three groups of possible compliance scenarios that combine the mandatory and optional test procedures for each risk group. Each scenario includes the three mandatory 5th percentile female dummy tests, as well as the existing 50th percentile male dummy frontal barrier tests with upgraded injury criteria. One scenario (Option #1) assumes that out-of-position children and driver requirements will be met with the out-of-position suppression test, while infant requirements will be met with the infant presence suppression test. A second scenario (Option #2) assumes that requirements for all three groups will be met with the low risk deployment test. A third scenario (Option #3) assumes that child and adult requirements are met with the dynamic out-of-position test, and the infant requirements are met with the infant presence suppression test.

Methodology. The analysis estimates the benefits and costs of incremental improvements in safety compared to two different baselines. The first is a baseline of pre-MY 1998 air bag vehicles. Tables E–1 and E–2 provide cost and benefits estimates assuming a pre-MY 1998 air bag vehicle baseline. The second baseline assumes that all vehicles are designed to the sled test and provide benefits in full frontal impacts (12 o'clock strikes), but no benefit in partial frontal impacts (10, 11, 1, and 2 o'clock strikes). Table E–3 provides costs and benefits assuming a baseline of vehicles designed to the sled test. Neither of these baselines reflect potential shifts in occupant demographics, driver/passenger behavior, belt use, child restraint use, or the percent of children sitting in the front right seat due to education efforts and labeling. The agency requests comments on alternative baselines, including ways to predict future changes in occupant behavior, and including the likely evolution of air bag designs in the absence of this rulemaking.

While primary and alternative injury criteria performance limits are proposed and analyzed in this assessment, only the primary proposal results are discussed in this executive summary.

Safety impacts. Potential safety impacts of this proposal are dependent on the specific method chosen by manufacturers to meet the proposed test requirements. Some countermeasures reach a larger target population and potentially provide more benefits than others, although each might adequately meet test requirements. For example, a weight sensor could suppress the air bag up to its design limit for weight, but would not suppress the air bag for heavier occupants. Thus, in Table E–1, it is assumed that a 54 pound weight

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[22] For a further discussion of this subject, see NHTSA's final rule concerning on-off switches, 62 FR 62406, 62420 (footnote 23), November 21, 1997.

sensor would be utilized to meet the ''Suppression When Presence'' test with the 6 year-old dummy. While it could potentially save 102 children ages 1 to 12, it could not save all 129 children in that age category, because it is estimated that the remaining children will weigh more than 54 pounds. Multi-stage inflation systems are an example of a system that could potentially impact a wider range of injuries than do proximity sensors.

The ranges of potential safety impacts by test type are shown in Table E–1 and total fatality benefits for the three examined compliance options are shown in Table E–2. The estimated range of fatalities prevented from the three scenarios is 226–239 annually. Of these, 25 are in high speed tests and the remainder are in tests to minimize risks to out-of-position occupants. These estimated lives saved can also be broken into 167–175 passengers and 59–64 drivers. Injuries were not examined in this preliminary analysis because research to establish injury impacts has not been completed. However, the agency believes there will be significant injury reductions, particularly chest injuries.

TABLE E–1.—ESTIMATED TARGET POPULATION AND LIVES SAVED ANNUALLY FOR THE PRIMARY PROPOSAL COMPARED TO PRE-MY 1998 AIR BAGS

Tests	Drivers	Passengers			Total
		RFCSS	1–12 year old children	Adult	
Out-of-Position Target Population	41	33	129	11	214
Estimated Lives Saved by Different Tests (These are *not* additive):					
Suppression When Presence	NA	33	102	NA	135
Suppression When Out-of-Position	41	NP	129	11	181
Low Risk Deployment	36–39	31–33	114–122	10	191–204
Dynamic Out-Of-Position	36–39	NP	114–122	10	160–171
25 mph Offset Barrier	36–39	0	0	10	46–49
In-Position Target Population	6,778	NP	NP	1,501	8,279
Estimated Lives Saved by Different Tests (These are additive):					
30 MPH, Belted/Unbelted 50th Male	11	NP	NP	0	11
30 MPH, Belted/Unbelted 5th Percentile Female	5	NP	NP	1	6
25 MPH Offset Barrier	7	NP	NP	1	8

NP: Not proposed test for this group.

Costs. Potential compliance costs for this proposal vary considerably and are dependent on the method chosen by manufacturers to comply. Methods such as modified fold patterns and inflator adjustments can be accomplished for little or no cost. More sophisticated solutions such as proximity sensors can increase costs significantly. Table E–2 lists the range of compliance costs for each compliance option. The range of potential costs for the compliance scenarios examined in this analysis is $22–$162. This amounts to a total potential annual cost of up to $2.5 billion, based on 15.5 million vehicle sales per year.

Property damage savings. Compliance methods that involve the use of suppression technology have the potential to produce significant property damage cost savings because they prevent air bags from deploying unnecessarily. This saves repair costs to replace the passenger side air bag, and frequently to replace windshields damaged by the air bag deployment. Property damage savings are shown in Table E–2. Property damage savings from these requirements could total up to $158 over the lifetime of an average vehicle. This amounts to a total potential cost savings of nearly $2.5 billion over the lifetime of a complete model year's fleet.

Net cost per fatality Prevented. Table E–2 summarizes the cost per fatality prevented of each compliance option. Property damage savings have the potential to offset all, or nearly all of the cost of meeting this proposal. The maximum range of cost per fatality saved from the scenarios examined in this analysis is a savings of $9.4 million per fatality saved to a cost of $4.8 million per fatality saved. The range for passenger-side impacts is more favorable than for driver-side impacts. This is due to the potential property damage savings from suppressing air bags for children, and because there are far fewer out-of-position drivers at risk than there are passengers, particularly children. Passenger side costs vary from a *savings* of $14.7 million per fatality to a cost of $4.5 million per fatality. On the driver's side, costs range from zero to a cost of $21.2 million per fatality prevented.

TABLE E–2.—SUMMARY OF COSTS AND BENEFITS COMPARED TO PRE-MY 1998 AIR BAGS

	Cost per vehicle (1997 dollars)	Annual total costs (billions)	Annual fatalities prevented (after 7% discount)	Lifetime property damage savings per vehicle	Net cost (net savings) per vehicle	Net cost (net savings) per discounted fatality saved (millions) **
Compliance Option #1 OOP Suppression*, Child Suppression.	$75–$162	$1.16–$2.51	239 (172)	$21–$158	$4–$53	$0.3–$4.8M.
Compliance Option #2 Low Risk Deployment.	$22–$56	$0.34–$0.86	226–233 (163–168)	$21–$158	$1–$(102)	$(9.4)–$0.1.

TABLE E–2.—SUMMARY OF COSTS AND BENEFITS COMPARED TO PRE-MY 1998 AIR BAGS—Continued

	Cost per vehicle (1997 dollars)	Annual total costs (billions)	Annual fatalities prevented (after 7% discount)	Lifetime property damage savings per vehicle	Net cost (net savings) per vehicle	Net cost (net savings) per discounted fatality saved (millions) **
Compliance Option #3 Dynamic OOP*, Child Suppression.	$24–$162	$0.37–$2.51	228–233 (165–168)	$21–$158	$2–$4	$0.2–$0.4.

* Note: OOP = out-of-position. All three options include offset barrier and frontal barrier tests.
** Net cost per discounted fatality saved is computed by taking the net cost per vehicle times 15.5 million vehicles divided by discounted fatalities prevented.

Sled tests. Sled tests were temporarily allowed as an alternative method to certify compliance with FMVSS 208 in March 1997 in order to facilitate introduction of depowered air bags. A provision of the NHTSA Reauthorization Act (P.L. 105–178) provided that this method would remain in effect until changed by rule. This analysis thus addresses the relative merits of full frontal barrier tests and the sled test alternative. NHTSA is proposing to eliminate the sled test alternative because it is not representative of real world crashes that have the potential for serious injury or fatality, and it does not adequately test how well the vehicle and its restraint system protect outboard front seat occupants in those situations. Relatively modest changes have occurred thus far in air bag designs that use the sled test for compliance. However, NHTSA is concerned that potentially, air bag systems designed only to pass the sled test would expose occupants in higher speed crashes to significant increases in crash forces. For example, because the sled test is only a ''12 o'clock'' test, there is concern that it could lead to decreased air bag volume, which would provide less protection in frontal crashes at offset angles and to unbelted passengers in any frontal high speed crash. NHTSA examined air bag data supplied by nine auto manufacturers in response to an information request issued by the agency in December 1997. The agency found that of 42 passenger side model year 1998 systems examined, 10 had decreased air bag volume. Eight of these ten decreased the width of the air bag. This demonstrates that air bags designed to meet the sled test may provide protection to a smaller area of the occupant compartment, or in a narrower set of collision angles.

The effectiveness of air bags decreases as the crash moves further away from direct frontal impacts—31 percent effective at 12 o'clock, 9 percent effective in 11 and 1 o'clock impacts and 5 percent effective in 10 and 2 o'clock impacts. If air bag designs provided no benefit in partial frontal impacts (10, 11, 1, and 2 o'clock), an estimated 319 lives would not be saved annually by air bags. In addition, the agency's analysis of limited test data of MY 1998 air bag vehicles versus pre-MY 1998 air bag vehicles estimated that 16 to 86 lives may not be saved in full frontal impacts by MY 1998 air bags that have been certified to the sled test. In total, 335 to 405 lives potentially would not be saved by vehicles designed to the sled test, rather than to the barrier test. Table E–3 shows that the net cost per fatality saved ranges from a savings of $3.4 million per fatality saved to a cost of $2.0 million per fatality saved.

In designing a low risk air bag, it will be more difficult for the manufacturers to meet all of the test conditions with an unbelted rigid barrier test than with a sled test. Many more sled tests than barrier tests can be run in a day and sled tests are less expensive to run than vehicle tests into a barrier. The development effort to design to the unbelted barrier test is more complex because many more factors have to be accounted for, including the angle test. The agency is not sure what would be the difference in vehicle costs between the two tests. If air bags are made smaller with the sled test, some minor savings in the air bag and sodium azide pellets would accrue. No additional cost has been added to Table E–3. However, since air-bag equipped vehicles have met the unbelted test in the past, there is little need to redesign air bags when suppression is the technology of choice.

TABLE E–3.—SUMMARY OF COSTS AND BENEFITS COMPARED TO AIR BAGS DESIGNED TO THE SLED TEST

	Cost per vehicle (1997 dollars)	Annual total costs (billions)	Annual fatalities prevented (after 7% discount)	Lifetime property damage savings per vehicle	Net cost (net savings) per vehicle	Net cost (net savings) per discounted fatality saved (millions)**
Compliance Option #1 OOP Suppression*, Child Suppression.	$75–$162	$1.16–$2.51	574–644 (414–465)	$21–$158	$4–$53	$0.1–$2.0M.
Compliance Option #2 Low Risk Deployment.	$22–$56	$0.34–$0.86	561–638 (405–460)	$21–$158	$1–$(102)	$(3.4)–$0.3.
Compliance Option #3 Dynamic OOP*, Child Suppression.	$24–$162	$0.37–$2.51	563–638 (406–460)	$21–$158	$2–$4	$0.09–$0.1.

* Note: OOP = out-of-position. All three options include offset barrier and frontal barrier tests. There would be additional unquantified minor costs between the sled test and the unbelted rigid barrier test.
** Net cost per discounted fatality saved is computed by taking the net cost per vehicle times 15.5 million vehicles divided by discounted fatalities prevented.

VIII. Rulemaking Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

NHTSA has considered the impact of this rulemaking action under Executive Order 12866 and the Department of Transportation's regulatory policies and procedures. This rulemaking document was reviewed by the Office of Management and Budget under E.O. 12866, ''Regulatory Planning and Review.'' The rulemaking action has been determined to be significant under the Department's regulatory policies and procedures. NHTSA is placing in the public docket a Preliminary Economic Assessment (PEA) describing the costs and benefits of this rulemaking action. The costs and benefits are summarized earlier in this document.

B. Regulatory Flexibility Act

NHTSA has considered the effects of this rulemaking action under the Regulatory Flexibility Act (5 U.S.C. § 601 *et seq.*) I hereby certify that the proposed amendment would not have a significant economic impact on a substantial number of small entities.

The proposed rule would directly affect motor vehicle manufacturers and indirectly affect air bag manufacturers and dummy manufacturers.

For passenger car and light truck manufacturers, NHTSA estimates that there are only about four small manufacturers in the United States. These manufacturers serve a niche market, and the agency believes that small manufacturers do not manufacture even 0.1 percent of total U.S. passenger car and light truck production per year. The agency notes that these manufacturers are already required to provide air bags and certify compliance to Standard No. 208's dynamic impact requirements. Since the proposal would add additional test requirements for air bags, it would increase compliance costs for these, as well as other, vehicle manufacturers.

The agency does not believe that there are any small air bag manufacturers. There are several manufacturers of dummies and/or dummy parts which are considered small businesses. While the proposed rule would not impose any requirements on these manufacturers, it would be expected to have a positive impact on these types of small businesses by increasing demand for dummies.

NHTSA notes that final stage vehicle manufacturers and alterers could also be affected by this proposal. However, since the agency believes that final stage manufacturers and alterers receive vehicles which are already equipped with air bags, the proposal would not have any significant effect on final stage manufacturers or alterers.

Small organizations and small governmental units would not be significantly affected since the potential cost impacts associated with this proposed action should only slightly affect the price of new motor vehicles.

For the reasons discussed above, the small entities which would most likely be affected by this proposal are small vehicle manufacturers and dummy manufacturers. The number of such manufacturers is so small that, regardless of whether the economic impact on them was significant or not, the proposed rule would not have a significant economic impact on a substantial number of small entities.

The agency believes, further, that the economic impact on these manufacturers would be small. While the small vehicle manufacturers would face additional compliance costs, the agency believes that air bag suppliers would likely provide much of the engineering expertise necessary to meet the new requirements, thereby helping to keep the overall impacts small. The agency also notes that, in the unlikely event that a small vehicle manufacturer did face substantial economic hardship, it could apply for a temporary exemption for up to three years. See 49 CFR Part 555. It could subsequently apply for a renewal of such an exemption. While the proposed requirements would increase the demand for dummies, thereby having a positive impact on dummy manufacturers, the agency does not believe that such increased demand would be sufficient to create a significant economic impact on the dummy manufacturers. However, the agency requests comments concerning the economic impact on small vehicle manufacturers and dummy manufacturers.

Additional information concerning the potential impacts of the proposed requirements on small entities is presented in the PEA.

C. National Environmental Policy Act

NHTSA has analyzed this proposed amendment for the purposes of the National Environmental Policy Act and determined that it would not have any significant impact on the quality of the human environment.

D. Executive Order 12612 (Federalism)

The agency has analyzed this proposed amendment in accordance with the principles and criteria set forth in Executive Order 12612. NHTSA has determined that the proposed amendment does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

E. Unfunded Mandates Act

The Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually (adjusted for inflation with base year of 1995). This assessment is included in the PEA.

F. Executive Order 12778 (Civil Justice Reform)

This proposed rule does not have any retroactive effect. Under section 49 U.S.C. 30103, whenever a Federal motor vehicle safety standard is in effect, a state may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard, except to the extent that the state requirement imposes a higher level of performance and applies only to vehicles procured for the State's use. 49 U.S.C. 30161 sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

G. Paperwork Reduction Act

The Department of Transportation is submitting the following information collection request (ICR) to the Office of Management and Budget (OMB) for review and clearance under the Paperwork Reduction Act of 1995 (P.L. 104–13, 44 U.S.C. Chapter 35).

For further information contact: Complete copies of each request for collection of information may be obtained from Mr. Michael Robinson, NHTSA Information Collection Clearance Officer, NHTSA, 400 Seventh Street, SW, Room 6123, Washington, DC. Mr. Robinson's telephone number is (202) 366–9456. Please identify the relevant collection of information by referring to ''Phase-in Production Reporting Requirements for Advanced Air Bags.''

Agency: National Highway Traffic Safety Administration (NHTSA).

Title: Phase-in Production Reporting Requirements for Advanced Air Bags.

Type of Request: Routine.

OMB Clearance Number: 2127–New.

Form Number: This collection of information would use no standard forms.

Affected Public: The respondents are manufacturers of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less. The agency estimates that there are about 21 such manufacturers.

Estimate of the Total Annual Reporting and Recordkeeping Burden Resulting from the Collection of Information: NHTSA estimates that the total annual hour burden is 1260 hours.

Estimated Costs: NHTSA estimates the total annual cost burden, in dollars, to be $37,800.

Summary of the Collection of Information: This collection would require manufacturers of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less to annually submit a report, and maintain records related to the report, concerning the number of such vehicles that meet the advanced air bag requirements of Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208) during the phase-in of those requirements. The phase-in would be completed in three years.

Description of the Need for the Information and Proposed use of the Information: The purpose of the reporting requirements would be to aid the National Highway Traffic Safety Administration in determining whether a manufacturer of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less has complied with the advanced air bag requirements of Standard No. 208 during the phase-in of those requirements.

IX. Request for Comments

Interested persons are invited to submit comments on this proposal. Two copies should be submitted to Docket Management at the address given at the beginning of this document.

In addition, for those comments of four or more pages in length, it is requested but not required that 10 additional copies, as well as one copy on computer disc, be sent to: Mr. Clarke Harper, Chief, Light Duty Vehicle Division, NPS–11, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590. This would aid the agency in expediting its review of all the comments. The copy on computer disc may be in any format, although the agency would prefer that it be in WordPerfect 8.

All comments must not exceed 15 pages in length (49 CFR 553.21). Necessary attachments may be appended to these submissions without regard to the 15-page limit. This limitation is intended to encourage commenters to detail their primary arguments in a concise fashion.

If a commenter wishes to submit certain information under a claim of confidentiality, three copies of the complete submission, including purportedly confidential business information, should be submitted to the Chief Counsel, NHTSA, at the street address given above, and two copies from which the purportedly confidential information has been deleted should be submitted to Docket Management. A request for confidentiality should be accompanied by a cover letter setting forth the information specified in the agency's confidential business information regulation. 49 CFR Part 512.

All comments received before the close of business on the comment closing date indicated above will be considered, and will be available for examination in the docket at the above address both before and after that date. To the extent possible, comments filed after the closing date will also be considered. Comments received too late for consideration in regard to this action will be considered as suggestions for further rulemaking action. Comments will be available for inspection in the docket. The NHTSA will continue to file relevant information as it becomes available in the docket after the closing date, and recommends that interested persons continue to examine the docket for new material.

Those persons desiring to be notified upon receipt of their comments in the rules docket should enclose a self-addressed, stamped postcard in the envelope with their comments. Upon receiving the comments, the docket supervisor will return the postcard by mail.

List of Subjects

49 CFR Part 571

Imports, Motor vehicle safety, Motor vehicles, Rubber and rubber products, Tires.

49 CFR Part 585

Motor vehicles, Motor vehicle safety, Reporting and recordkeeping requirements.

49 CFR Part 587

Motor vehicle safety.

49 CFR Part 595

Imports, Motor vehicle safety, Motor vehicles.

In consideration of the foregoing, NHTSA proposes to amend 49 CFR Chapter V as follows:

PART 571—FEDERAL MOTOR VEHICLE SAFETY STANDARDS

1. The authority citation for Part 571 of Title 49 would continue to read as follows:

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

2. Section 571.208 would be amended by revising S3, S4.5.1 introductory text, and S4.5.4, adding S6.6 through S6.7, revising S8.1.5 and S13, and adding S14 through S30.2.4, to read as follows:

§ 571.208 Standard No. 208; Occupant crash protection.

* * * * *

S3. *Application.*

(a) This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses. In addition, S9, *Pressure vessels and explosive devices,* applies to vessels designed to contain a pressurized fluid or gas, and to explosive devices, for use in the above types of motor vehicles as part of a system designed to provide protection to occupants in the event of a crash.

(b) Notwithstanding any language to the contrary, any vehicle manufactured after March 19, 1997 and before September 1, 2005 that is subject to a dynamic crash test requirement conducted with unbelted dummies may meet the requirements specified in S13 instead of the applicable unbelted requirement, unless the vehicle is certified to meet the requirements specified in S15, S17, S19, S21, S23, and S25.

(c) For vehicles which are certified to meet the requirements specified in S13 instead of the otherwise applicable dynamic crash test requirement conducted with unbelted dummies, compliance with S13 shall, for purposes of Standards No. 201, 203 and 209, be deemed as compliance with the unbelted frontal barrier requirements of S5.1 of this section.

(d) Wherever tolerances are specified, requirements shall be met at all values within the tolerances.

* * * * *

S4.5.1 *Labeling and owner's manual information.* The labels specified in S4.5.1 (b), (c), and (e) of this standard are not required for vehicles that have a passenger side air bag meeting the criteria specified in S4.5.5 of this standard or which are certified to the requirements specified in S15, S17, S19, S21, S23, and S25 of this standard.

* * * * *

S4.5.4 *Passenger Air Bag Manual Cut-off Device.* Passenger cars, trucks, buses, and multipurpose passenger vehicles manufactured before September 1, 2005 and not certified to meet the requirements specified in S15, S17, S19, S21, S23, and S25 may be equipped with a device that deactivates the air bag installed at the right front passenger position in the vehicle, if all the conditions in S4.5.4.1 through S4.5.4.4 are satisfied.

* * * * *

[Proposed Alternative One—Chest includes existing requirements for chest acceleration (S6.3) and chest deflection (S6.4) plus Combined Thoracic Index (proposed S6.6); Proposed Alternative Two—Chest includes existing requirements for chest acceleration and chest deflection]

S6.6 (This only applies to vehicles manufactured on or after September 1, 2005 and to vehicles manufactured before that time which are certified to the requirements specified in S15, S17, S19, S21, S23, and S25 of this standard.) Combined Thoracic Index (CTI) shall not exceed 1.0. The equation for calculating the CTI criterion is given by

$CTI = (A_{max}/A_{int}) + (D_{max}/D_{int})$

where A_{int} and D_{int} are intercept values defined as

A_{int} = 85 g's for spine acceleration intercept, and D_{int} = 102 mm (4.0 in.) for sternal deflection intercept.

Calculation of CTI requires measurement of upper spine triaxial acceleration filtered at SAE class 180 and sternal deflection filtered at SAE class 600. From the measured data, a 3-msec clip maximum value of the resultant spine acceleration (A_{max}) and the maximum chest deflection (D_{max}) shall be determined.

S6.7

[Proposed Alternative One—Neck]

The biomechanical neck injury predictor, Nij, shall not exceed a value of [the agency is considering values of 1.4 and 1.0] at any point in time. The following procedure shall be used to compute Nij. The axial force (Fz) and flexion/extension moment about the occipital condyles (My) shall be used to calculate four combined injury predictors, collectively referred to as Nij. These four combined values represent the probability of sustaining each of four primary types of cervical injuries; namely tension-extension (N_{TE}), tension-flexion (N_{TF}), compression-extension (N_{CE}), and compression-flexion (N_{CF}) injuries. Axial force shall be filtered at SAE class 1000 and flexion/extension moment (My) shall be filtered at SAE class 600. Shear force, which shall be filtered at SAE class 600, is used only in conjunction with the measured moment to calculate the effective moment at the location of the occipital condyles. The equation for calculating the Nij criteria is given by

Nij = (Fz/Fzc) + (My/Myc)

where Fzc and Myc are critical values corresponding to:

Fzc = 3600 N (809 lbf) for tension
Fzc = 3600 N (809 lbf) for compression
Myc = 410 Nm (302 lbf-ft) for flexion about occipital condyles
Myc = 125 Nm (92 lbf-ft) for extension about occipital condyles

Each of the four Nij values shall be calculated at each point in time, and all four values shall not exceed [the agency is considering values of 1.4 and 1.0] at any point in time. When calculating N_{TE} and N_{TF}, all compressive loads shall be set to zero. Similarly, when calculating N_{CE} and N_{CF}, all tensile loads shall be set to zero. In a similar fashion, when calculating N_{TE} and N_{CE}, all flexion moments shall be set to zero. Likewise, when calculating N_{TF} and N_{CF}, all extension moments shall be set to zero.

[Proposed Alternative Two—Neck]

Neck injury criteria. Using the six axis upper neck load cell (ref. Denton drawing C–1709) that is mounted between the bottom of the skull and the top of the neck as shown in drawing 78051–218, the peak forces and moments measured at the occipital condyles shall not exceed:

Axial Tension = 3300 N (742 lbf)
Axial Compression = 4000 N (899 lbf)
Fore-and-Aft Shear = 3100 N (697 lbf)
Flexion Bending Moment = 190 Nm (140 lbf-ft)
Extension Bending Moment = 57 Nm (42 lbf-ft)

SAE Class 1000 shall be used to filter the axial tension, axial compression, and fore-and-aft shear. SAE Class 600 shall be used to filter the measured moment and fore-and-aft shear used to compute the flexion bending moment and extension bending moment at the occipital condyles.

* * * * *

S8.1.5 Movable vehicle windows and vents are placed in the fully closed position, unless the vehicle manufacturer chooses to specify a different adjustment position.

* * * * *

S13 *Alternative unbelted test available, under S3(b) of this standard, for certain vehicles manufactured before September 1, 2005.*

* * * * *

S14 *Advanced air bag requirements for passenger cars and for trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less, except for walk-in van-type trucks or vehicles designed to be sold exclusively to the U.S. Postal Service.*

S14.1 *Vehicles manufactured on or after September 1, 2002 and before September 1, 2005.*

(a) For vehicles manufactured on or after September 1, 2002 and before September 1, 2005, a percentage of the manufacturer's production, as specified in S14.1.1, shall meet the requirements specified in S15, S17, S19, S21, S23, and S25 (in addition to the other requirements specified in this standard). Where manufacturer options are specified, the manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(b) Manufacturers which manufacture two or fewer carlines, as that term is defined at 49 CFR 583.4, may, at the option of the manufacturer, meet the requirements of this paragraph instead of paragraph (a) of this section. Each vehicle manufactured on or after September 1, 2003 and before September 1, 2005 shall meet the requirements specified in S15, S17, S19, S21, S23, and S25 (in addition to the other requirements specified in this standard). Where manufacturer options are specified, the manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(c) Each vehicle that is manufactured in two or more stages or that is altered (within the meaning of § 567.7 of this chapter) after having previously been certified in accordance with part 567 of this chapter is not subject to the requirements of S14.1.

S14.1.1 *Phase-in Schedule.*

S14.1.1.1 *Vehicles manufactured on or after September 1, 2002 and before September 1, 2003.* Subject to S14.1.2(a), for vehicles manufactured by a manufacturer on or after September 1, 2002 and before September 1, 2003, the amount of vehicles complying with S15, S17, S19, S21, S23 and S25 shall be not less than 25 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 2000 and before September 1, 2003, or

(b) The manufacturer's production on or after September 1, 2002 and before September 1, 2003.

S14.1.1.2 *Vehicles manufactured on or after September 1, 2003 and before September 1, 2004.* Subject to S14.1.2(b), for vehicles manufactured by a manufacturer on or after September 1, 2003 and before September 1, 2004, the amount of vehicles complying with S15, S17, S19, S21, S23 and S25 shall be not less than 40 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 2001 and before September 1, 2004, or

(b) The manufacturer's production on or after September 1, 2003 and before September 1, 2004.

S14.1.1.3 *Vehicles manufactured on or after September 1, 2004 and before September 1, 2005.* Subject to S14.1.2(c), for vehicles manufactured by a manufacturer on or after September 1, 2004 and before September 1, 2005, the amount of vehicles complying with S15, S17, S19, S21, S23 and S25 shall be not less than 70 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 2002 and before September 1, 2005, or

(b) The manufacturer's production on or after September 1, 2004 and before September 1, 2005.

S14.1.2 *Calculation of complying vehicles.*

(a) For the purposes of complying with S14.1.1.1, a manufacturer may count a vehicle it if is manufactured on or after [the date 30 days after publication of the final rule would be inserted], but before September 1, 2003.

(b) For purposes of complying with S14.1.1.2, a manufacturer may count a vehicle if it:

(1) Is manufactured on or after [the date 30 days after publication of the final rule would be inserted], but before September 1, 2004, and

(2) Is not counted toward compliance with S14.1.1.1.

(c) For purposes of complying with S14.1.1.3, a manufacturer may count a vehicle if it:

(1) Is manufactured on or after [the date 30 days after publication of the final rule would be inserted], but before September 1, 2005, and

(2) Is not counted toward compliance with S14.1.1.1 or S14.1.1.2.

S14.1.3 *Vehicles produced by more than one manufacturer.*

S14.1.3.1 For the purpose of calculating average annual production of vehicles for each manufacturer and the number of vehicles manufactured by each manufacturer under S14.1.1, a vehicle produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S14.1.3.2.

(a) A vehicle which is imported shall be attributed to the importer.

(b) A vehicle manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

S14.1.3.2 A vehicle produced by more than one manufacturer shall be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR part 585, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S14.1.3.1.

S14.2 *Vehicles manufactured on or after September 1, 2005.* Each vehicle shall meet the requirements specified in S15, S17, S19, S21, S23, and S25 (in addition to the other requirements specified in this standard). Where manufacturer options are specified, the manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

S14.3 *Vehicle integrity requirements.* Each vehicle certified to the requirements of S15, S17, S19, S21, S23, and S25 of this standard shall meet the following vehicle integrity criteria during the crash and/or at the conclusion of each crash test, as specified, that is part of a requirement under this standard to which the vehicle is certified (this includes the crash tests that are part of requirements other than those identified earlier in this paragraph):

(a) The latching mechanism of each door shall hold the door closed throughout the test.

(b) After the impact, it must be possible, without the use of tools, to open at least one door, if there is one, per row of seats and, where there is no such door, to move the seats or tilt their backrests as necessary to allow the evacuation of all the occupants; this is, however, only applicable to vehicles having a roof of rigid construction.

S15 *Rigid barrier test requirements using 5th percentile adult female dummies.*

S15.1. Each vehicle shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 of this standard when the vehicle is crash tested in accordance with the procedures specified in S16 of this standard with the anthropomorphic test dummy unbelted.

S15.2 Each vehicle shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 of this standard when the vehicle is crash tested in accordance with the procedures specified in S16 of this standard with the anthropomorphic test dummy restrained by the Type 2 seat belt assembly.

S15.3 *Injury criteria (5th percentile adult female dummy).*

S15.3.1 All portions of the test dummy shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test.

S15.3.2 The resultant acceleration at the center of gravity of the head shall be such that the expression:

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

shall not exceed 1,000 where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t1 and t2 are any two points in time during the crash of the vehicle which are separated by not more than a 36 millisecond time interval.

[Proposed Alternative One—Chest includes requirements for chest acceleration (proposed S15.3.3), chest deflection (proposed S15.3.4) and Combined Thoracic Index (proposed S15.3.6; Proposed Alternative Two—Chest includes requirements for chest acceleration and chest deflection]

S15.3.3 The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S15.3.4 Compression deflection of the sternum relative to the spine, as determined by instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 62 mm (2.5 inches).

S15.3.5 The force transmitted axially through each upper leg shall not exceed 6805 N (1530 pounds).

S15.3.6 Combined Thoracic Index (CTI) shall not exceed 1.0. The equation for calculating the CTI criterion is given by

$CTI = (A_{max}/A_{int}) + (D_{max}/D_{int})$

where A_{int} and D_{int} are intercept values defined as

A_{int} = 85 g's for spine acceleration intercept, and

D_{int} = 83 mm (3.3 in.) for sternal deflection intercept.

Calculation of CTI requires measurement of upper spine triaxial acceleration filtered at SAE class 180 and sternal deflection filtered at SAE class 600. From the measured data, a 3-msec clip maximum value of the resultant spine acceleration (A_{max}) and the maximum chest deflection (D_{max}) shall be determined. S15.3.7

[Proposed Alternative One—Neck]

The biomechanical neck injury predictor, Nij, shall not exceed a value of [the agency is considering values of 1.4 and 1.0] at any point in time. The following procedure shall be used to compute Nij. The axial force (Fz) and flexion/extension moment about the occipital condyles (My) shall be used to calculate four combined injury predictors, collectively referred to as Nij. These four combined values represent the probability of sustaining each of four primary types of cervical injuries; namely tension-extension (N_{TE}), tension-flexion (N_{TF}), compression-extension (N_{CE}), and compression-flexion (N_{CF}) injuries. Axial force shall be filtered at SAE class 1000 and flexion/extension moment (My) shall be filtered at SAE class 600. Shear force, which shall be filtered at SAE class 600, is used only in conjunction with the measured moment to calculate the effective moment at the location of the occipital condyles. The equation for calculating the Nij criteria is given by

Nij = (Fz/Fzc) + (My/Myc)

where Fzc and Myc are critical values corresponding to:

Fzc = 3200 N (719 lbf) for tension
Fzc = 3200 N (719 lbf) for compression
Myc = 210 Nm (155 lbf-ft) for flexion about occipital condyles
Myc = 60 Nm (44 lbf-ft) for extension about occipital condyles

Each of the four Nij values shall be calculated at each point in time, and all four values shall not exceed [the agency is considering values of 1.4 and 1.0] at any point in time. When calculating N_{TE} and N_{TF}, all compressive loads shall be set to zero. Similarly, when calculating N_{CE} and N_{CF}, all tensile loads shall be set to zero. In a similar fashion, when calculating N_{TE} and N_{CE}, all flexion moments shall be set to zero. Likewise, when calculating N_{TF} and N_{CF}, all extension moments shall be set to zero.

[Proposed Alternative Two—Neck]

Neck injury criteria. Using the six axis upper neck load cell [a drawing incorporated by reference in Part 572 would be identified in the final rule] that is mounted between the bottom of the skull and the top of the neck as shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule], the peak forces and moments measured at the occipital condyles shall not exceed:

Axial Tension = 2080 N (468 lbf)
Axial Compression = 2520 N (567 lbf)
Fore-and-Aft Shear = 1950 N (438 lbf)
Flexion Bending Moment = 95 Nm (70 lbf-ft)
Extension Bending Moment = 28 Nm (21 lbf-ft)

SAE Class 1000 shall be used to filter the axial tension, axial compression, and fore-and-aft shear. SAE Class 600 shall be used to filter the measured moment and fore-and-aft shear used to compute the flexion bending moment and extension bending moment at the occipital condyles.

S16. *Test procedures for rigid barrier test requirements using 5th percentile adult female dummies.*

S16.1 *General provisions.* Crash testing to determine compliance with the requirements of S15 of this standard is conducted as specified in the following paragraphs (a) and (b).

(a) *Unbelted testing.* Place a Part 572 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with procedures specified in S16.3 of this standard. No additional action, such as fastening a manual belt, is taken. Impact the vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees from the perpendicular to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. Determine whether the vehicle integrity criteria specified in S14.3 and the injury criteria specified in S15.3 of this standard are met.

(b) *Belted testing.* Place a Part 572 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with procedures specified in S16.3 of this standard. Fasten the manual Type 2 seat belt assembly at each of these positions around the dummy occupying the position, in accordance with S16.3.10 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees from the perpendicular to the line of travel of the vehicle under the applicable conditions of S16.3 of this standard. Determine whether the vehicle integrity criteria specified in S14.3 and the injury criteria specified in S15.3 of this standard are met.

S16.2 *Test conditions.*

S16.2.1 The vehicle including test devices and instrumentation, is loaded as follows:

(a) *Passenger cars.* A passenger car is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the weight of the necessary anthropomorphic test devices.

(b) *Multipurpose passenger vehicles, trucks, and buses.* A multipurpose passenger vehicle, truck, or bus is loaded to its unloaded vehicle weight plus 136 kg (300 pounds) or its rated cargo and luggage capacity weight, whichever is less, secured in the load carrying area and distributed as nearly as possible in proportion to the gross axle weight ratings, plus the weight of the necessary anthropomorphic test devices. For the purposes of S16.2.1, unloaded vehicle weight does not include the weight of the work-performing accessories. Vehicles are tested to a maximum unloaded vehicle weight of 2,495 kg (5500 pounds).

(c) *Fuel system capacity.* With the test vehicle on a level surface, pump the fuel from the vehicle's fuel tank and then operate the engine until it stops. Then, add Stoddard solvent to the vehicle's fuel tank in an amount which is equal to not less than 92 and not more than 94 percent of the fuel tank's usable capacity stated by the vehicle's manufacturer. In addition, add the amount of Stoddard solvent needed to fill the entire fuel system from the fuel tank through the engine's induction system.

(d) *Vehicle test attitude.* Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its ''as delivered'' condition. The ''as delivered'' condition is the vehicle as received at the test site, with 100 percent of all fluid capacities and all tires inflated to the manufacturer's specifications as listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's ''fully loaded condition.'' The ''fully loaded condition'' is the test vehicle loaded in accordance with S16.2.1(a) or (b) of this standard, as applicable. The load placed in the cargo area shall be centered over the longitudinal centerline of the vehicle. The pretest vehicle attitude shall be equal to either the as delivered or fully loaded attitude or between the as delivered attitude and the fully loaded attitude.

S16.2.2 Adjustable seats are in the forwardmost adjustment position and if separately adjustable in a vertical direction, are at the uppermost position.

S16.2.3 Place adjustable seat backs at an angle of 18+/−2 degrees from vertical, if adjustable. Place any manually adjustable anchorages midway between extreme positions. If there is no midway position for an adjustable anchorage, place it in the next highest position. Place each adjustable head restraint in its highest adjustment position. Adjustable lumbar supports are positioned so that the lumbar support is in its lowest adjustment position.

S16.2.4 Adjustable steering controls are adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. In the event that the adjustable steering wheel cannot be placed in the center of its movement, the wheel is placed at the next lowest position.

S16.2.5 Movable vehicle windows and vents are placed in the fully closed position, unless the vehicle manufacturer chooses to specify a different adjustment position.

S16.2.6 Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.

S16.2.7 Doors are fully closed and latched but not locked.

S16.2.8 The anthropomorphic test dummies used for crash testing shall be the 5th percentile adult female test dummy specified in Part 572 of this Chapter.

S16.2.9 The Part 572 5th percentile adult female dummy is clothed in formfitting cotton stretch garments with short sleeves and above the knee length pants. A size 8W shoe which meets the configuration and size specifications of MIL–S 13912 change ''P'' or its equivalent is placed on each foot of the test dummy.

S16.2.10 Limb joints are set at 1 g, barely restraining the weight of the limb when extended horizontally. Leg joints are adjusted with the torso in the supine position.

S16.2.11 Instrumentation does not affect the motion of dummies during impact.

S16.2.12 The stabilized temperature of the Part 572 5th percentile adult female test dummy is at any level between 20 degrees C and 22 degrees C.

S16.3 *Dummy Seating Positioning Procedures.* The Part 572 5th percentile adult female test dummy is positioned as follows.

S16.3.1 *Head.* The transverse instrumentation platform of the head shall be horizontal within ½ degree. To level the head of the dummy, the following sequences must be followed. First, adjust the position of the H point within the limits set forth in S16.3.5.1 of this standard to level the transverse instrumentation platform of the head of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the pelvic angle of the test dummy within the limits specified in S16.3.5.2 of this standard. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the dummy the minimum amount necessary from the non-adjusted ''0'' setting to ensure that the transverse instrumentation platform of the head is horizontal within ½ degree. The test dummy shall remain within the limits specified in S16.3.5.1 and S16.3.5.2 of this standard after any adjustment of the neck bracket.

S16.3.2 *Arms.*

S16.3.2.1 The driver's upper arms shall be adjacent to the torso with the centerlines as close to a vertical plane as possible.

S16.3.2.2 The passenger's upper arms shall be in contact with the seat back and the sides of the torso.

S16.3.3 *Hands.*

S16.3.3.1 The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centerline. The thumbs shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 9 N (2 pounds force) and not more than 22 N (5 pounds force), the tape shall release the hand from the steering wheel rim.

S16.3.3.2 The palms of the passenger test dummy shall be in contact with the outside of the dummy's thigh. The little finger shall be in contact with the seat cushion.

S16.3.4 *Upper torso.*

S16.3.4.1 In vehicles equipped with bench seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver dummy shall be vertical and parallel to the vehicle's longitudinal centerline, and pass through the center of the steering wheel rim. The midsagittal plane of the passenger dummy shall be vertical and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline as the midsagittal plane of the driver dummy.

S16.3.4.2 In vehicles equipped with bucket seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver and the passenger dummy shall be vertical and shall coincide with the longitudinal centerline of the bucket seat.

S16.3.5 *Lower Torso.*

S16.3.5.1 *H-point.* The H-point of the driver and passenger test dummies shall coincide within 13 mm (.5 inch) in the vertical dimension and 13 mm (.5 inch) in the horizontal dimension of a point 6 mm (.25 inch) below the position of the H-point determined using the equipment and procedures specified in SAE J826 (Apr 80) except that the length of the lower leg and thigh segments of the H-point machine shall be adjusted to 325 mm (12.8 inches) and 342 mm (13.5 inches), respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

S16.3.5.2 *Pelvic angle.* As determined using the pelvic angle gage (GM drawing 78051–532 incorporated by reference in Part 572, Subpart E of this chapter) which is inserted into the H-point gaging hole of the dummy, the angle measured from the horizontal on the 76 mm (3 inches) flat surface of the gage shall be 22½ degrees plus or minus 2½ degrees.

S16.3.6 *Legs.* The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 483 mm (19 inches). To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver dummy shall be in a vertical plane. Final adjustment to accommodate placement of feet in accordance with S16.3.7 of this standard for various passenger compartment configurations is permitted.

S16.3.7 *Feet.* The feet of the driver test dummy shall be positioned in accordance with S16.3.7.1(a) and S16.3.7.1(b) of this standard. The feet of the passenger test dummy shall be positioned in accordance with S16.3.7.2.1(a) and S16.3.7.2.1(b) of this standard or S16.3.7.2.2(a) and S16.3.7.2.2(b) of this standard, as appropriate.

S16.3.7.1 *Driver position feet placement.*

(a) Rest the right foot of the test dummy on the undepressed accelerator pedal with the rearmost point of the heel on the floor pan in the plane of the pedal. If the heels cannot reach the floor, for adjustable seats lower the seat until the heels touch the floor. For non adjustable seats and for adjustable seats that do not permit dummy heel contact in the lowest adjustment position, adjust the lower limbs until the heels touch the floor. Check the H-point location in S16.3.5.1 to maintain the least deviation from the previous setting. If the foot cannot be placed on the accelerator pedal, set it initially perpendicular to the lower leg and place it as far forward as possible in the direction of the pedal centerline with the rearmost point of the heel resting on the floor pan. Except as prevented by contact with a vehicle surface, place the right leg so that the upper and lower leg centerlines fall, as close as possible, in a vertical plane without inducing torso movement.

(b) Place the left foot on the toeboard with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toeboard and the floor pan and not on the wheelwell projection. If the foot cannot be positioned on the toeboard, set it initially perpendicular to the lower leg and place it as far forward as possible with the heel resting on the floor pan. If necessary to avoid contact with the vehicle's brake or clutch pedal, rotate the test dummy's left foot about the lower leg. If there is still pedal interference, rotate the left leg outboard about the hip the minimum necessary to avoid the pedal interference. Except as prevented by contact with a vehicle surface, place the left leg so that the upper and lower leg centerlines fall, as close as possible, in a vertical plane. For vehicles with a foot rest that does not elevate the left foot above the level of the right foot, place the left foot on the foot rest so that the upper and lower leg centerlines fall in a vertical plane.

S16.3.7.2 *Passenger position feet placement.*

S16.3.7.2.1 *Vehicles with a flat floor pan/toeboard.*

(a) Place the right and left feet on the vehicle's floor pan with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the heels cannot reach the floor, for adjustable seats lower the seat until the heels touch the floor. For non adjustable seats and for adjustable seats that do not permit dummy heel contact in the lowest adjustment position, adjust the lower limbs until the heels touch the floor. Check the H-point location in S16.3.5.1 to maintain the least deviation from the previous setting.

(b) Place the right and left legs so that the upper and lower leg centerlines fall in vertical longitudinal planes.

S16.3.7.2.2 *Vehicles with wheelhouse projections in passenger compartment.*

(a) Place the right and left feet flat in the well of the floor pan/toeboard and not on the wheelhouse projection. If the feet cannot be placed flat on the toeboard, for adjustable seats lower the seat until the heels touch the floor. For non-adjustable seats and for adjustable seats that do not permit dummy heel contact in the lowest position, set them perpendicular to the lower leg centerlines.

(b) If it is not possible to maintain vertical and longitudinal planes through the upper and lower leg centerlines for each leg, place the left leg so that its upper and lower centerlines fall, as closely as possible, in a vertical longitudinal plane and place the right leg so that its upper and lower leg centerlines fall, as closely as possible, in a vertical plane. Adjust both legs so that the foot is in contact with the floor pan and/or toe board and both knee heights deviate by no more than 10 mm.

S16.3.8 *Manual belt adjustment for dynamic testing.* With the test dummy at its designated seating position as specified by the appropriate requirements of S16.3.1 through S16.3.7 of this standard, place the Type 2 manual belt around the test dummy and fasten the latch. Remove all slack from the lap belt. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 N (2 pound force) to 18 N (4 pound force) tension load to the lap belt. If the belt system is equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer in the owner's manual for the vehicle. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

S17 *Offset frontal deformable barrier requirements using 5th percentile adult female dummies.* Each vehicle shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 of this standard when the vehicle is crash tested in accordance with the procedures specified in S18 of this standard with the anthropomorphic test dummy restrained by the Type 2 seat belt assembly.

S18 *Test procedure for offset frontal deformable barrier requirements using 5th percentile adult female dummies.*

S18.1 *General provisions.* Crash testing to determine compliance with the requirements of S17 of this standard is conducted as follows. Place a Part 572 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with procedures specified in S16.3 of this standard. Fasten the manual Type 2 seat belt assembly at each of these positions around the dummy occupying the position, in accordance with S16.3.8 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 40 km/h (25 mph), into a fixed offset deformable barrier under the conditions specified in S18.2 of this standard. Determine whether the vehicle integrity criteria specified in S14.3 and the injury criteria specified in S15.3 of this standard are met.

S18.2 *Test conditions.*

S18.2.1 *Offset frontal deformable barrier.* The offset frontal deformable barrier shall conform to the specifications set forth in Subpart B of Part 587 of this chapter.

S18.2.2 *General test conditions.* All of the test conditions specified in S16.2 of this standard apply.

S18.2.3 *Dummy seating and positioning.* The anthropomorphic test dummies are seated and positioned as specified in S16.3 of this standard.

S18.2.4 *Impact configuration.* The test vehicle shall impact the barrier specified in Subpart B of Part 587, with the longitudinal line of the vehicle parallel to the line of travel, and perpendicular to the barrier face. The test vehicle shall be aligned so that the vehicle strikes the barrier with 40 percent of the vehicle's width engaging the barrier face for any of the following conditions: the right edge of the barrier face is offset to the left of the vehicle's longitudinal centerline by 10 percent of the vehicle's width +/−20 mm (0.8 inch), or the left edge of the barrier face is offset to the right of the vehicle's longitudinal centerline by 10 percent of the vehicle's width +/−20 mm (0.8 inch). The vehicle width is defined as the maximum dimension measured across the widest part of the vehicle, excluding exterior mirrors, flexible mud flaps and marker lamps, but including bumpers, molding, sheet metal protrusions, and dual wheels, as standard equipment.

S19 *Requirements using rear facing child restraints.*

S19.1 Each vehicle shall, at the option of the manufacturer, meet the requirements specified in S19.2 or S19.3, under the test procedures specified in S20.

S19.2 *Option 1—Automatic suppression feature.* Each vehicle shall meet the requirements specified in S19.2.1 through S19.2.2.

S19.2.1 The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag after each of the static tests (using the 12 month old CRABI child dummy in a rear facing infant restraint) specified in S20.2, activation of the air bag after each of the static tests (using a 5th percentile adult female dummy) specified in S20.3, deactivation of the air bag throughout the rough road tests (using a 12 month old child dummy in a rear facing infant restraint) specified in S20.4, and activation of the air bag throughout the rough road tests (using a 5th percentile adult female dummy) specified in S20.5.

S19.2.2 The vehicle shall be equipped with a telltale light on the instrument panel which is illuminated whenever the passenger air bag is deactivated and not illuminated whenever the passenger air bag is activated. The telltale:

(a) Shall be clearly visible from all front seating positions;

(b) Shall be yellow;

(c) Shall have the identifying words ''PASSENGER AIR BAG OFF'' on the telltale or within 25 mm of the telltale; and

(d) Shall not be combined with the readiness indicator required by S4.5.2 of this standard.

S19.3 *Option 2—Low risk deployment.* Each vehicle shall meet the injury criteria specified in S19.4 of this standard when the passenger air bag is statically deployed in accordance with the procedures specified in S20 of this standard.

S19.4 *Injury criteria (12 month old CRABI dummy).*

S19.4.1 The resultant acceleration at the center of gravity of the head shall be such that the expression:

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

shall not exceed 660 where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t^1 and t^2 are any two points in time during the crash of the vehicle which are separated by not more than a 36 millisecond time interval.

S19.4.2 The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 40 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S19.4.3

[Proposed Alternative One—Neck]

The biomechanical neck injury predictor, Nij, shall not exceed a value of [the agency is considering values of 1.4 and 1.0] at any point in time. The following procedure shall be used to compute Nij. The axial force (Fz) and flexion/extension moment about the occipital condyles (My) shall be used to calculate four combined injury predictors, collectively referred to as Nij. These four combined values represent the probability of sustaining each of four primary types of cervical injuries; namely tension-extension (N_{TE}), tension-flexion (N_{TF}), compression-extension (N_{CE}), and compression-flexion (NCF) injuries. Axial force shall be filtered at SAE class 1000 and flexion/extension moment (My) shall be filtered at SAE class 600. Shear force, which shall be filtered at SAE class 600, is used only in conjunction with the measured moment to calculate the effective moment at the location of the occipital condyles. The equation for calculating the Nij criteria is given by

Nij = (Fz/Fzc) + (My/Myc)

where Fzc and Myc are critical values corresponding to:

Fzc = 2200 N (495 lbf) for tension
Fzc = 2200 N (495 lbf) for compression
Myc = 85 Nm (63 lbf-ft) for flexion about occipital condyles
Myc = 25 Nm (18 lbf-ft) for extension about occipital condyles

Each of the four Nij values shall be calculated at each point in time, and all four values shall not exceed [the agency is considering values of 1.4 and 1.0] at any point in time. When calculating N_{TE}, and N_{TF}, all compressive loads shall be set to zero. Similarly, when calculating N_{CE} and N_{CF}, all tensile loads shall be set to zero. In a similar fashion, when calculating N_{TE} and N_{CE}, all flexion moments shall be set to zero. Likewise, when calculating N_{TF} and N_{CF}, all extension moments shall be set to zero.

[Proposed Alternative Two—Neck]

Neck injury criteria. Using the six axis upper neck load cell [a drawing incorporated by reference in Part 572 would be identified in the final rule] that is mounted between the bottom of the skull and the top of the neck as shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule], the peak forces and moments measured at the occipital condyles shall not exceed:

Axial Tension = 1150 N (259 lbf)
Axial Compression = 1390 N (312 lbf)
Fore-and-Aft Shear = 1080 N (243 lbf)
Flexion Bending Moment = 39 Nm (29 lbf-ft)
Extension Bending Moment = 12 Nm (9 lbf-ft)

SAE Class 1000 shall be used to filter the axial tension, axial compression, and fore-and-aft shear. SAE Class 600 shall be used to filter the measured moment and fore-and-aft shear used to compute the flexion bending moment and extension bending moment at the occipital condyles.

S20 *Test procedure for S19.*

S20.1 *General provisions.*

S20.1.1 Tests specifying the use of a rear facing child restraint are conducted using any rear facing child restraint (including convertible types) which was manufactured for sale in the United States between two years and ten years prior to the date the model year carline of which the vehicle is a part was (or will be) first offered for sale to a consumer. The rear facing child restraint may be unused or used; if used, there must not be any visible damage prior to the test.

S20.1.2 Tests are conducted with the engine operating.

S20.2 *Static tests of automatic suppression feature which must result in deactivation of the passenger air bag.*

S20.2.1 *Test one—belted rear facing child restraint, facing rear.*

S20.2.1 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S20.2.1.2 Install the Part 572 12-month old CRABI dummy in any rear facing child restraint in accordance with the manufacturer's instructions provided with the seat pursuant to Standard No. 213.

S20.2.1.3 Install the rear facing child restraint in the right front passenger seat of the vehicle in accordance, to the extent possible, with the child restraint manufacturer's instructions provided on the seat pursuant to Standard No. 213 and with the instructions in the vehicle owner's manual. Cinch the vehicle belts to any level to secure the rear facing child restraint.

S20.2.1.4 Place the rear facing child restraint handle at any angle.

S20.2.1.5 Place any towel or blanket, with any weight up to 1 kg (2.2 pounds), on or over the rear facing child restraint in any manner.

S20.2.1.6 Start the vehicle engine and then close all vehicle doors.

S20.2.1.7 Monitor the telltale light to check whether the air bag is deactivated, i.e., the light must be illuminated.

S20.2.2 *Test two—unbelted rear facing child restraint.*

S20.2.2.1 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S20.2.2.2 Install the Part 572 12-month old CRABI dummy in any rear facing child restraint in accordance with the manufacturer's instructions provided with the seat pursuant to Standard No. 213.

S20.2.2.3 Install the rear facing child restraint with the dummy on the right front passenger seat of the vehicle in any of the following positions (without using the vehicle's seat belts):

(a) In the same position as that specified in S20.2.1.3 of this standard,

(b) In the same position as specified in (a) of this section, but rotated 180 degrees so that the dummy is facing the front of the vehicle;

(c) In the same position as specified in (a) of this section, but rotated 90 degrees so that the dummy is facing the driver position and the side of the child restraint is in contact with the front passenger seat back;

(d) In the same position as specified in (a) of this section, but rotated 90 degrees so that the dummy is facing the passenger door and the side of the child restraint is in contact with the front passenger seat back;

(e) In a position 127 mm (5 inches) forward of the position specified in (a) of this section, with the orientation specified in (c) of this section (if the child restraint is not stable, move it forward toward the edge of the seat until it can rest in equilibrium);

(f) In the same position specified in (e) of this section, but rotated 180 degrees so that the dummy is facing the passenger door.

S20.2.2.4 Place the rear facing child restraint handle at any angle.

S20.2.2.5 Place any towel or blanket, with any weight up to 1 kg (2.2 pounds), on or over the rear facing child restraint in any manner.

S20.2.2.6 Close all vehicle doors.

S20.2.2.7 Monitor the telltale light to check whether the air bag is deactivated, i.e., the light must remain illuminated for the entire time the child seat is positioned as described.

S20.3 *Static tests of automatic suppression feature which must result in activation of the passenger air bag.*

S20.3.1 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S20.3.2 Place a Part 572 5th percentile adult female test dummy at the right front seating position of a vehicle, in accordance with procedures specified in S16.3 of this standard, to the extent possible with the seat position that has been selected.

S20.3.3 Monitor the telltale light to check whether the air bag is activated for the entire time the 5th percentile adult female test dummy is positioned as described.

S20.4 *Rough road tests of automatic suppression feature, during which the passenger air bag must be deactivated.*

S20.4.1 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S20.4.2 Install the Part 572 12-month old CRABI dummy in any rear facing child restraint.

S20.4.3 Install the rear facing child restraint in the right front passenger seat of the vehicle in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat pursuant to Standard No. 213 and with the instructions in the vehicle owner's manual. Cinch the vehicle belts to any level to secure the rear facing child restraint.

S20.4.4 Drive the vehicle at any speed up to 40 km/h (25 mph) for any distance between 0.2 km (1⁄8 mile) and 0.4 km (1⁄4 mile) over any of the following types of road surfaces:

(a) *Washboard surface.* A paved lane which consists of a series of uniform bumps with a height of 16 mm ± 5 mm (0.6 inches ± 0.2 inches) and spaced 100 mm ± 5 mm (4 inches ± 0.2 inches) from center to center, perpendicular to the line of travel across the full width of the lane;

(b) *Surface with dips.* A paved lane which consists of a series of uniform mounds with a height of 76 mm ± 5 mm (3 inches ± 0.2 inches) and spaced 1650 mm ± 10 mm (65 inches ± 0.4 inches) from center to center.

S20.4.5 Monitor the telltale light during the test to check whether the air bag remains deactivated throughout the test, i.e., the light must remain illuminated.

S20.5 *Rough road tests of automatic suppression feature, during which the passenger air bag must be activated.*

S20.5.1 Place a Part 572 5th percentile adult female test dummy in the right front passenger position of a vehicle, in accordance with procedures specified in S16.3 of this standard.

S20.5.2 Drive the vehicle at any speed up to 40 km/h (25 mph) for any distance between 0.2 km (1⁄8 mile) and 0.4 km (1⁄4 mile) over any of the road surfaces specified in S20.4.4.

S20.5.3 Monitor the telltale light during the test to check whether the air bag remains activated throughout the test, i.e., the light must remain off.

S20.6 *Low risk deployment test.*

S20.6.1 Place the right front passenger vehicle seat in the full forward seat track position, the highest seat position (if adjustment is available), and any seat back angle.

S20.6.2 Install the Part 572 12-month old CRABI dummy in any rear facing child restraint in accordance with the manufacturer's instructions provided with the seat pursuant to Standard No. 213.

S20.6.3 Locate and mark the center point of the top of the rear facing child restraint. This will be referred to as ''Point A''.

S20.6.4 Install the rear facing child restraint in the right front passenger seat of the vehicle in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat pursuant to Standard No. 213 and with the instructions in the vehicle owner's manual.

S20.6.5 Locate a point on the air bag cover that is the geometric center of the air bag cover. This will be referred to as ''Point B''.

S20.6.6 Translate the rear facing child restraint system (parallel to the longitudinal axis of the vehicle) such that Point A on the child restraint system is lined up with Point B on the air bag cover to form a vertical plane parallel to the longitudinal axis of the vehicle.

S20.6.7 Cinch the vehicle belts to any level to secure the rear facing child restraint.

S20.6.8 Deploy the right front passenger air bag system. If the air bag contains a multistage inflator, any stage is fired.

S21 *Requirements using 3 year old child dummies.*

S21.1 Each vehicle shall, at the option of the manufacturer, meet the requirements specified in S21.2, S21.3, or S21.4 under the test procedures specified in S22, except that, at the option of the manufacturer, the vehicle may instead meet the requirements specified in S29.

S21.2 *Option 1—Automatic suppression feature that always suppresses the air bag when a child is present.* Each vehicle shall meet the requirements specified in S21.2.1 through S21.2.2.

S21.2.1 The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag during each of the static tests (using a 3-year-old child dummy) specified in S22.2, activation of the air bag after each of the static tests (using a 5th percentile adult female dummy) specified in S20.3, deactivation of the air bag throughout the rough road tests (using a 3-year-old child dummy) specified in S22.3, and activation of the air bag throughout the rough road tests (using a 5th percentile adult female dummy) specified in S20.5.

S21.2.2 The vehicle shall be equipped with a telltale light on the instrument panel meeting the requirements specified in S19.2.2.

S21.3 *Option 2—Automatic suppression feature that suppresses the air bag when an occupant is out of position.*

S21.3.1 The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which meets the requirements specified in S27.

S21.3.2 The vehicle shall be equipped with a telltale light on the instrument panel meeting the requirements specified in S19.2.2.

S21.4 *Option 3—Low risk deployment (Hybrid III 3-year-old child dummy).* Each vehicle shall meet the injury criteria specified in S21.5 of this standard when the passenger air bag is statically deployed in accordance with the low risk deployment test procedures specified in S22.4.

S21.5 *Injury criteria for Hybrid III 3-year-old child dummy.*

S21.5.1 All portions of the test dummy shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test.

S21.5.2 The resultant acceleration at the center of gravity of the head shall be such that the expression:

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

shall not exceed 900 where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2 are any two points in time during the crash of the vehicle which are separated by not more than a 36 millisecond time interval.

[Proposed Alternative One—Chest includes requirements for chest acceleration (proposed S21.5.3), chest deflection (proposed S21.5.4) and Combined Thoracic Index (proposed S21.5.5; Proposed Alternative Two—Chest includes requirements for chest acceleration and chest deflection]

S21.5.3 The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 50 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S21.5.4 Compression deflection of the sternum relative to the spine, as determined by instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 42 millimeters (1.7 inches).

S21.5.5 Combined Thoracic Index (CTI) shall not exceed 1.0. The equation for calculating the CTI criterion is given by

$$CTI = (A_{max}/A_{int}) + (D_{max}/D_{int})$$

where A_{int} and D_{int} are intercept values defined as A_{int} = 70 g's for spine acceleration intercept, and D_{int} = 57 mm (2.2 in.) for sternal deflection intercept.

Calculation of CTI requires measurement of upper spine triaxial acceleration filtered at SAE class 180 and sternal deflection filtered at SAE class 600. From the measured data, a 3-msec clip maximum value of the resultant spine acceleration (A_{max}) and the maximum chest deflection (D_{max}) shall be determined.

S21.5.6

[Proposed Alternative One—Neck]

The biomechanical neck injury predictor, Nij, shall not exceed a value of [the agency is considering values of 1.4 and 1.0] at any point in time. The following procedure shall be used to compute Nij. The axial force (Fz) and flexion/extension moment about the occipital condyles (My) shall be used to calculate four combined injury predictors, collectively referred to as Nij. These four combined values represent the probability of sustaining each of four primary types of cervical injuries; namely tension-extension (N_{TE}), tension-flexion (N_{TF}), compression-extension (N_{CE}), and compression-flexion (N_{CF}) injuries. Axial force shall be filtered at SAE class 1000 and flexion/extension moment (My) shall be filtered at SAE class 600. Shear force, which shall be filtered at SAE class 600, is used only in conjunction with the measured moment to calculate the effective moment at the location of the occipital condyles. The equation for calculating the Nij criteria is given by

$$Nij = (Fz/Fzc) + (My/Myc)$$

where Fzc and Myc are critical values corresponding to:

Fzc = 2500 N (562 lbf) for tension
Fzc = 2500 N (562 lbf) for compression
Myc = 100 Nm (74 lbf-ft) for flexion about occipital condyles
Myc = 30 Nm (22 lbf-ft) for extension about occipital condyles

Each of the four Nij values shall be calculated at each point in time, and all four values shall not exceed [the agency is considering values of 1.4 and 1.0] at any point in time. When calculating N_{TE} and N_{TF}, all compressive loads shall be set to zero. Similarly, when calculating N_{CE} and N_{CF}, all tensile loads shall be set to zero. In a similar fashion, when calculating N_{TE} and N_{CE}, all flexion moments shall be set to zero. Likewise, when calculating N_{TF} and N_{CF}, all extension moments shall be set to zero.

[Proposed Alternative Two—Neck]

Neck injury criteria. Using the six axis upper neck load cell [a drawing incorporated by reference in Part 572 would be identified in the final rule] that is mounted between the bottom of the skull and the top of the neck as shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule], the peak forces and moments measured at the occipital condyles shall not exceed:

Axial Tension = 1270 N (286 lbf)
Axial Compression = 1540 N (346 lbf)
Fore-and-Aft Shear = 1200 N (270 lbf)
Flexion Bending Moment = 46 Nm (34 lbf-ft)
Extension Bending Moment = 14 Nm (10 lbf-ft)

SAE Class 1000 shall be used to filter the axial tension, axial compression, and fore-and-aft shear. SAE Class 600 shall be used to filter the measured moment and fore-and-aft shear used to compute the flexion bending moment and extension bending moment at the occipital condyles.

S22 *Test procedure for S21.*

S22.1 *General provisions.*

S22.1.1 Tests specifying the use of a forward-facing child seat or booster seat are conducted using any such seat recommended for a child weighing 34 pounds which was manufactured for sale in the United States between two years and ten years prior to the date the model year carline of which the vehicle is a part was (or will be) first offered for sale to a consumer. The seat may be unused or used; if used, there must not be any visible damage.

S22.1.2 Tests are conducted with the engine operating.

S22.2 *Static tests of automatic suppression feature which must result in deactivation of the passenger air bag.*

S22.2.1 *Test one—child in a forward-facing child seat or booster seat.*

S22.2.1.1 Install any forward-facing child seat or booster seat in the right front passenger seat in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat pursuant to Standard No. 213 and with the instructions in the vehicle owner's manual.

S22.2.1.2 Position the Part 572 Hybrid III 3-year-old child dummy seated in the forward-facing child seat or booster seat such that the dummy's lower torso is centered on the forward-facing child seat or booster seat cushion and the dummy's spine is parallel to the forward-facing child seat or booster seat back or, if there is no booster seat back, the vehicle seat back. The lower arms are placed at the dummy's side.

S22.2.1.3 Attach all appropriate forward-facing child seat or booster seat belts, if any, and tighten them as specified in S6.1.2 of Standard No. 213.

S22.2.1.4 Attach all appropriate vehicle belts and tighten them as specified in S6.1.2 of Standard No. 213.

S22.2.1.5 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S22.2.1.6 Start the vehicle engine and then close all vehicle doors.

S22.2.1.7 Monitor telltale light to check whether the air bag is deactivated.

S22.2.2 *Test two—unbelted child.*

S22.2.2.1 Place the right front passenger vehicle seat in any position, i.e., any seat track location, any seat height, any seat back panel.

S22.2.2.2 Place the Part 572 Hybrid III 3-year old child dummy on the right front passenger seat, or on the floor in front of the right front passenger seat, as appropriate, in any of the following positions (without using a forward-facing child seat or booster seat or the vehicle's seat belts):

(a) *Sitting on seat with back against seat:*

(1) Position the dummy in the seated position and place it on the right front passenger seat;

(2) The upper torso of the dummy rests against the seat back. In the case of vehicles equipped with bench seats, the midsagittal plane of the dummy is vertical and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline as the center of the steering wheel rim. In the case of vehicles equipped with bucket seats, the midsagittal plane of the dummy is vertical and coincides with the longitudinal centerline of the bucket seat. The dummy's femurs are against the seat cushion.

(3) Allow the lower legs of the dummy to extend off the surface of the seat. If positioning the dummy's lower legs is prevented by contact with the instrument panel, rotate the lower leg toward the floor.

(4) Position the dummy's upper arms down until they contact the seat.

(b) *Sitting on seat with back not against seat:*

(1) Position the dummy in the seated position and place the dummy in the right front passenger seat.

(2) In the case of vehicles equipped with bench seats, the midsagittal plane of the dummy is vertical and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline as the center of the steering wheel rim. In the case of vehicles equipped with bucket seats, the midsagittal plane of the dummy is vertical and coincides with the longitudinal centerline of the bucket seat. The horizontal distance from the dummy's back to the seat back is no less than 25 mm (1 inch) and no more than 150 mm (6 inches), as measured from the dummy's mid-sagittal plane at the mid-sternum level.

(3) Lower the dummy's upper legs and dummy's femurs against the seat cushion.

(4) Allow the lower limbs of the dummy to extend off the surface of the seat.

(5) Rotate the dummy's lower arms until the dummy's hands come to rest on the seat.

(c) *Sitting on seat edge with hands on the instrument panel* (This test is conducted with the seat in any seat track positions that permit the dummy's hands to be placed on the instrument panel.):

(1) Position the dummy in the seated position and place it on the right front passenger seat with the dummy's legs positioned 90 degrees (i.e., right angle) from the horizontal.

(2) Position the dummy forward in the seat such that the lower legs rest against the front of the seat with the spine in the vertical direction. If the dummy's feet contact the floorboard, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy spine vertical.

(3) Extend the dummy's arms directly in front of the dummy parallel to the floor of the vehicle.

(4) Lower the dummy's arms such that they contact the instrument panel.

(d) *Sitting on seat edge, spine vertical, hands by the dummy's side:*

(1) Position the dummy in the seated position and place it on the right front passenger seat with the dummy's legs positioned 90 degrees (i.e., right angle) from the horizontal.

(2) Position the dummy forward in the seat such that the lower legs rest against the front of the seat with the spine in the vertical direction. If the dummy's feet contact the floorboard, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy spine vertical.

(3) Extend the dummy's arms directly in front of the dummy parallel to the floor of the vehicle.

(4) Lower the dummy's arms such that they contact the seat.

(e) *Sitting back in the seat and leaning on the right front passenger door:*

(1) Position the dummy in the seated position and place the dummy in the right front passenger seat.

(2) Place the dummy's lower torso on the outboard portion of the seat with the dummy's back against the seat back and the dummy's upper legs resting on the seat cushion.

(3) Allow the lower legs of the dummy to extend off the surface of the seat. If positioning the dummy's lower legs is prevented by contact with the instrument panel, rotate the lower leg toward the floor.

(4) Position the dummy's upper arms against the seat back by rotating the dummy's upper arms toward the seat back until they make contact.

(5) Rotate the dummy's lower arms down until they contact the seat.

(6) Lean the dummy against the outboard door.

(f) *Standing on seat, facing forward:*

(1) Position the dummy in the standing position. The arms are at any position.

(2) Center the dummy on the right front passenger seat cushion facing the front of the vehicle while placing the heels of the dummy feet in contact with the seat back.

(3) Rest the dummy against the seat back.

(g) *Standing on seat, facing rearward:*

(1) Position the dummy in the standing position. The arms are at any position.

(2) Center the dummy on the right front passenger seat cushion facing the rear of the vehicle while placing the toes of the dummy feet in contact with the seat back.

(3) Rest the dummy against the seat back.

(h) *Kneeling on seat, facing forward:*

(1) Place the dummy in a kneeling position by rotating the dummy's lower legs 90 degrees behind the dummy (from the standing position).

(2) Place the kneeling dummy in the right front passenger seat with the dummy facing the front of the vehicle. Position the dummy such that the dummy toes are in contact with the seat back. The arms are at any position.

(i) *Kneeling on seat, facing rearward:*

(1) Place the dummy in a kneeling position by rotating the dummy's lower legs 90 degrees behind the dummy (from the standing position).

(2) Place the kneeling dummy in the right front passenger seat with the dummy facing the rear of the vehicle. Position the dummy such that the dummy's head is in contact with the seat back. The arms are at any position.

(j) *Standing on floor* (This test is only conducted with the seat in its rearmost track position.):

(1) Position the dummy in the standing position.

(2) Place the dummy standing on the floor in front of the right front passenger seat, facing forward and with the dummy's midsaggital plane parallel to the longitudinal plane through the centerline of the vehicle and including the geometric center of the air bag cover, in any position from the one where the dummy contacts the instrument panel rearwards to the one where the dummy contacts the seat. The arms are at any position.

(k) *Lying on seat* (This test is only conducted with the seat in the position specified.):

(1) Lay the dummy on the right front passenger seat such that the following criteria are met:

(A) The mid-sagittal plane of the dummy is horizontal,

(B) The dummy's spine is perpendicular to the vehicle longitudinal axis,

(C) Upper arms are parallel to dummy spine,

(D) A plane passing through the two shoulder joints of the dummy is vertical and intersects the geometric center of the seat bottom (the seat bottom is the plan view part of the seat from the forward most part of the seat back to the forward most part of the seat),

(E) The anterior of the dummy is facing the vehicle front, and

(F) Leg position is not set and can be articulated to fit above conditions.

(2) Adjustable seats are in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

(3) Position the dummy so that the top of dummy head is within 10 mm of the vehicle side door structure.

(4) Rotate upper legs toward chest of dummy and rotate lower legs against the upper legs.

(5) Place dummy upper left arm parallel with the vehicle transverse plane and the lower arm 90° to the upper arm. Rotate lower arm down about the elbow joint until movement is obstructed. Final position should resemble a fetal position.

(l) *Low risk deployment test position 1.* The procedure for determining this position is set forth in S22.4.2.

(m) *Low risk deployment test position 2.* The procedure for determining this position is set forth in S22.4.3.

(n) *Sitting on seat edge, head contacting the mid-face of the instrument panel.*

(1) Locate and mark the center point of the dummy's rib cage or sternum plate. (The vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as "Point A."

(2) Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as "Point B".

(3) Locate the horizontal plane that passes through Point B. This will be referred to as "Plane 1".

(4) "Plane 2" to defined as the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis.

(5) Move the passenger seat to the full rearward seating position.

(6) Place the dummy in the front passenger seat such that:

(A) Point A is located in Plane 2.

(B) A vertical plane through the shoulder joints of the dummy is at 90° to the longitudinal axis of the vehicle.

(C) The lower legs are positioned 90° (right angle) from horizontal.

(D) The dummy is positioned forward in the seat such the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 0° forward (toward front of vehicle) of the vertical position.

(7) Rotate dummy's torso by applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints. Continue applying force until head C.G. is in Plane 1, or spine angle at the upper spine plate is 45°, whichever produces the greatest rotation.

(8) Move seat forward until contact with the forward structure of the vehicle, or seat is full forward, whichever occurs first.

(9) To keep dummy in-position, a thread with a maximum breaking strength of 311 N (70 pounds) that does not interfere with the suppression device may be used to hold dummy.

(o) *Kneeling on the floor.*

(1) Locate and mark the center point of the dummy's chest/rib plate. (The vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as "Point A".

(2) Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as "Point B".

(3) Determine the height of this point above the floorboard of the vehicle. This height defines a horizontal plane that passes through Point B. This will be referred to as "Plane 1".

(4) A second plane, "Plane 2", to be defined as a vertical plane which passes through Point B.

(5) Move the passenger seat to the full rearward seating position.

(6) Remove the dummy lower legs at the knee joint.

(7) Center the dummy laterally so that Point A is coincident with Plane 2 and the upper spine plate is in a vertical position.

(8) With the use of spacers (wooden or foam blocks, etc.) position the dummy in a seated position with the H-point located 165 mm ± 10 mm (6.5 inches ± 0.4 inches) above the floor of the vehicle. Maintain the upper spine plate orientation.

(9) Position the upper leg 90° to the spine.

(10) Move the dummy forward until contact is made with the forward structure of the vehicle. If necessary, the upper torso can be tethered with a thread with a maximum breaking strength of 311 N (70 pounds). Care should be taken that any such tether is not situated anywhere within the deployment envelope of the air bag.

(11) Position the arms parallel to the spine/torso of the dummy.

(p) *Sitting on seat edge, head contacting the lower-face of the instrument panel.*

(1) Locate and mark the center point of the dummy's rib cage or sternum plate. (The vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as "Point A."

(2) Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as "Point B".

(3) Locate the horizontal plane that passes through Point B. This will be referred to as "Plane 1".

(4) "Plane 2" is defined as the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis.

(5) Move the passenger seat to the full rearward seating position.

(6) Place the dummy in the front passenger seat such that:

(A) Point A is located in Plane 2.

(B) A vertical plane through the shoulder joints of the dummy is at 90° to the longitudinal axis of the vehicle.

(C) The lower legs are positioned 90° (right angle) from horizontal.

(D) The dummy is positioned forward in the seat such that the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 0 degrees ±2 degrees forward (toward front of vehicle) of the vertical position.

(7) Rotate dummy's torso by applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints. Continue applying force until head C.G. is in Plane 1, or spine angle at the upper spine plate is 75 degrees ±2 degrees, whichever produces the greatest rotation.

(8) Move seat forward until contact with the forward structure of the vehicle, or seat is full forward, whichever occurs first.

(9) To keep dummy in-position, a thread with a maximum breaking strength of 311 N (70 pounds) that does not interfere with the suppression device may be used to hold dummy.

S22.2.2.3 Close all vehicle doors.

S22.2.2.4 Monitor the telltale light to check whether the air bag is deactivated, i.e., the light must be illuminated.

S22.3 *Rough road tests of automatic suppression feature, during which the passenger air bag must be deactivated.*

S22.3.1 Following completion of any of the tests specified in S22.2, and without changing the position of the vehicle seat or the dummy, drive or move the vehicle at any speed up to 40 km/h (25 mph) for any distance over any of the types of road surfaces specified in S20.4.4. (The vehicle may be moved by any external source to protect the driver from a dummy that could fall over.)

S22.3.2 Monitor the telltale light during the test to check whether the air bag remains deactivated throughout the test, i.e., the light must remain illuminated.

S22.4 *Low risk deployment test (Hybrid III 3-year-old child dummy).*

S22.4.1 Position the dummy according to any of the following positions: Position 1 (S22.4.2) or Position 2 (S22.4.3).

S22.4.2 *Position 1.*

S22.4.2.1 Locate and mark the center point of the dummy's rib cage or sternum plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S22.4.2.2 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This is referred to as ''Point B.''

S22.4.2.3 Locate the horizontal plane that passes through Point B. This will be referred to as ''Plane 1.''

S22.4.2.4 Locate the vertical plane parallel to the vehicle longitudinal axis and passing through Point B. This will be referred to as ''Plane 2.''

S22.4.2.5 Move the passenger seat to the full rearward track seating position. Place the seat back in the nominal upright position as specified by the vehicle manufacturer.

S22.4.2.6 Place the dummy in the front passenger seat such that:

S22.4.2.6.1 Point A is located in Plane 2.

S22.4.2.6.2 A vertical plane through the dummy shoulder joints is at 90 degrees to the longitudinal axis of the vehicle.

S22.4.2.6.3 The lower legs are positioned 90 degrees to the upper legs.

S22.4.2.6.4 The dummy is positioned forward in the seat such that the dummy's upper spine plate is 0 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position, and the lower legs rest against the front of the seat.

S22.4.2.7 Move the dummy forward until the upper torso or head of the dummy makes contact with the forward structure of the vehicle.

S22.4.2.8 Once contact is made, as outlined in paragraph S22.4.2.7, the dummy is then raised vertically until Point A lies within Plane 1 (the vertical height to the center of the air bag) or until a minimum clearance of 6 mm (0.25 inches) between the dummy head and the windshield is attained.

S22.4.2.9 Position the upper arm parallel to the spine and rotate the lower arm forward (at the elbow joint) sufficiently to prevent contact with or support from the seat.

S22.4.2.10 Position the lower limbs of the dummy so that the feet rest flat on the floorboard (or the feet are positioned parallel to the floorboard) of the vehicle.

S22.4.2.11 Support the dummy so that there is minimum interference with the full rotational and translational freedom for the upper torso of the dummy.

S22.4.2.11.1 The stature of the 3 year old child dummy is such that an upright standing posture is often possible. If additional height is required, the dummy is raised with the use of spacers (foam blocks, etc.) placed on the floor of the vehicle.

S22.4.2.11.2 If necessary, the upper torso is tethered with a thread with a maximum breaking strength of 311 N (70 pounds). Care should be taken that any such tether is not situated in the air bag deployment envelope.

S22.4.2.12 In calculation of the injury criteria as specified in paragraph S21.5, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S22.4.3 *Position 2.*

S22.4.3.1 Locate and mark the center point of the dummy's chest/rib plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S22.4.3.2 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as ''Point B.'' Locate the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis. This will be referred to as ''Plane 2.''

S22.4.3.3 Move the passenger seat to the full rearward seating position.

S22.4.3.4 Place the dummy in the front passenger seat such that:

S22.4.3.4.1 Point A is located in Plane 2.

S22.4.3.4.2 A vertical plane through the shoulder joints of the dummy is at 90 degrees to the longitudinal axis of the vehicle.

S22.4.3.4.3 The lower legs are positioned 90 degrees (right angle) from horizontal.

S22.4.3.4.4 The dummy is positioned forward in the seat such that the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 0 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position. Note: For some seats, it may not be possible to fully seat the dummy with the lower legs in the prescribed position. In this situation, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy's upper spine plate is 0 degrees ± 2 degrees forward (toward the front of vehicle) of the vertical position.

S22.4.3.5 Move the seat forward, while maintaining the upper spine plate orientation until some portion of the dummy contacts the forward structure of the vehicle.

S22.4.3.5.1 If contact has not been made with the forward structure of the vehicle at the full forward seating position of the seat, slide the dummy forward on the seat until contact is made. Maintain the upper spine plate orientation.

S22.4.3.5.2 Once contact is made, rotate the dummy forward until the head and/or upper torso are in contact with the instrument panel of the vehicle. Rotation is achieved by applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints.

S22.4.3.5.3 The upper legs are rotated downward and the lower legs and feet are rotated rearward (toward the rear of vehicle) so as not to impede the rotation of the head/torso into the forward structures of the vehicle.

S22.4.3.5.4 The legs are repositioned so that the feet rest flat on (or parallel to) the floorboard with the ankle joint positioned as nearly as possible to the midsaggital plane of the dummy.

S22.4.3.5.5 If necessary, the upper torso is tethered with a thread with a maximum breaking strength of 311 N (70 pounds) and/or wedge under the dummy's pelvis. Care should be taken that any such tether is not situated anywhere within the deployment envelope of the air bag. Note: If contact with the dash cannot be made by sliding the dummy forward in the seat, then place the dummy in the forward-most position on the seat which will allow the head/upper torso to rest against the instrument panel of the vehicle.

S22.4.3.6 Position the upper arms parallel to the upper spine plate and rotate the lower arm forward sufficiently to prevent contact with or support from the seat.

S22.4.3.7 In calculation of the injury criteria as specified in paragraph S21.5, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S22.4.4 Deploy the right front passenger air bag system. If the air bag contains a multistage inflator, any stage is fired that may deploy in crashes below 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], under the test procedure specified in S22.5.

S22.4.5 Determine whether the injury criteria specified in S21.5 of this standard are met.

S22.5 *Test procedure for determining stages of air bags subject to low risk deployment test requirement.* In the case of an air bag with a multistage inflator, any stage(s) that fire in any of the following tests are subject to the low risk deployment test requirement.

S22.5.1 *Rigid barrier test.* Impact the vehicle traveling longitudinally forward at any speed, up to and including 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], into a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees from the perpendicular to the line of travel of the vehicle under the applicable conditions of S8 of this standard.

S22.5.2 *Offset frontal deformable barrier test.* Impact the vehicle traveling longitudinally forward at any speed, up to and including 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], into a fixed offset deformable barrier under the conditions specified in S18.2 of this standard.

S22.5.3 *Pole test.* Impact the vehicle traveling longitudinally forward at any speed, up to and including 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], into a fixed cylindrical pole with a diameter of 255 ± 15 mm (10 ± 0.6 inches), under the applicable conditions of S8 of this standard. The vehicle impact point is at any point on the front of the vehicle that is within the middle 80 percent of the width of the vehicle.

S23 *Requirements using 6 year old child dummies.*

S23.1 Each vehicle shall, at the option of the manufacturer, meet the requirements specified in S23.2, S23.3, or S23.4, under the test procedures specified in S24, except that, at the option of the manufacturer, the vehicle may instead meet the requirements specified in S27 or S29.

S23.2 *Option 1—Automatic suppression feature that always suppresses the air bag when a child is present.* Each vehicle shall meet the requirements specified in S23.2.1 through S23.2.2.

S23.2.1 The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag as part of each of the static tests specified in S24.2, activation of the air bag after each of the static tests (using a 5th percentile adult female dummy) specified in S20.3, deactivation of the air bag throughout the rough road tests (using a 6-year-old child dummy) specified in S24.3, and activation of the air bag throughout the rough road tests (using a 5th percentile adult female dummy) specified in S20.5.

S23.2.2 The vehicle shall be equipped with a telltale light on the instrument panel meeting the requirements specified in S19.2.2.

S23.3 *Option 2—Automatic suppression feature that suppresses the air bag when an occupant is out of position.*

S23.3.1 The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which meets the requirements specified in S27.

S23.3.2 The vehicle shall be equipped with a telltale light on the instrument panel meeting the requirements specified in S19.2.2.

S23.4 *Option 3—Low risk deployment.* Each vehicle shall meet the injury criteria specified in S23.5 of this standard when the passenger air bag is statically deployed in accordance with the procedures specified in S24 of this standard.

S23.5 *Injury criteria (Hybrid III 6-year old child dummy).*

S23.5.1 All portions of the test dummy shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test.

S23.5.2 The resultant acceleration at the center of gravity of the head shall be such that the expression:

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

shall not exceed 1,000 where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2 are any two points in time during the crash of the vehicle which are separated by not more than a 36 millisecond time interval.

[Proposed Alternative One—Chest includes requirements for chest acceleration (proposed S23.5.3), chest deflection (proposed S23.5.4) and Combined Thoracic Index (proposed S23.5.5; Proposed Alternative Two—Chest includes requirements for chest acceleration and chest deflection]

S23.5.3 The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S23.5.4 Compression deflection of the sternum relative to the spine, as determined by instrumentation [a drawing incorporated by reference in Part 572 would be identified in the final rule] shall not exceed 47 mm (1.9 inches).

S23.5.5 Combined Thoracic Index (CTI) shall not exceed 1.0. The equation for calculating the CTI criterion is given by

$CTI=(A_{max}/A_{int}) + (D_{max}/D_{int})$

where A_{int} and D_{int} are intercept values defined as A_{int} = 85 g's for spine acceleration intercept, and D_{int} = 63 mm (2.5 in.) for sternal deflection intercept.

Calculation of CTI requires measurement of upper spine triaxial acceleration filtered at SAE class 180 and sternal deflection filtered at SAE class 600. From the measured data, a 3-msec clip maximum value of the resultant spine acceleration (A_{max}) and the maximum chest deflection (D_{max}) shall be determined.

S23.5.6

[Proposed Alternative One—Neck]

The biomechanical neck injury predictor, Nij, shall not exceed a value of [the agency is considering values of 1.4 and 1.0] at any point in time. The following procedure shall be used to compute Nij. The axial force (Fz) and flexion/extension moment about the occipital condyles (My) shall be used to calculate four combined injury predictors, collectively referred to as Nij. These four combined values represent the probability of sustaining each of four primary types of cervical injuries; namely tension-extension (N_{TE}), tension-flexion (N_{TF}), compression-extension (N_{CE}), and compression-flexion (N_{CF}) injuries. Axial force shall be filtered at SAE class 1000 and flexion/extension moment (My) shall be filtered at SAE class 600. Shear force, which shall be filtered at SAE class 600, is used only in conjunction with the measured moment to calculate the effective moment at the location of the occipital condyles. The equation for calculating the Nij criteria is given by

Nij=(Fz/Fzc) + (My/Myc)

where Fzc and Myc are critical values corresponding to:

Fzc=2900 N (652 lbf) for tension
Fzc=2900 N (652 lbf) for compression
Myc=125 Nm (92 lbf-ft) for flexion about occipital condyles
Myc=40 Nm (30 lbf-ft) for extension about occipital condyles

Each of the four Nij values shall be calculated at each point in time, and all four values shall not exceed [the agency is considering values of 1.4 and 1.0] at any point in time. When calculating N_{TE} and N_{TF}, all compressive loads shall be set to zero. Similarly, when calculating N_{CE} and N_{CF}, all tensile loads shall be set to zero. In a similar fashion, when calculating N_{TE} and N_{CE}, all flexion moments shall be set to zero. Likewise, when calculating N_{TF} and N_{CF}, all extension moments shall be set to zero.

[Proposed Alternative Two—Neck]

Neck injury criteria. Using the six axis upper neck load cell [a drawing incorporated by reference in Part 572 would be identified in the final rule] that is mounted between the bottom of the skull and the top of the neck as shown in drawing [a drawing incorporated by reference in Part 572 would be identified in the final rule], the peak forces and moments measured at the occipital condyles shall not exceed:

Axial Tension = 1490 N (335 lbf)
Axial Compression = 1800 N (405 lbf)
Fore-and-Aft Shear = 1400 N (315 lbf)
Flexion Bending Moment = 57 Nm (42 lbf-ft)
Extension Bending Moment = 17 Nm (13 lbf-ft)

SAE Class 1000 shall be used to filter the axial tension, axial compression, and fore-and-aft shear. SAE Class 600 shall be used to filter the measured moment and fore-and-aft shear used to compute the flexion bending moment and extension bending moment at the occipital condyles.

S24 *Test procedure for S23.*

S24.2 *Static tests of automatic suppression feature which must result in deactivation of the passenger air bag.*

S24.2.1 Except as provided in S24.2.2, all tests specified in S22 using the 3-year-old Hybrid III child dummy are conducted using the 6-year old Hybrid III child dummy. However, for tests specifying the use of a forward-facing child seat or booster seat any such seat recommended for a child weighing 52 pounds is used instead of a seat recommended for a child weighing 34 pounds.

S24.2.2 *Exceptions.*

S24.2.2.1 The tests specified in the following paragraphs of S22 are not conducted using the 6-year-old Hybrid III child dummy: S22.2.2.2(f), (g), (h), (i), (j), (k), (l) and (m).

S24.2.2.2 The test specified in S22.2.2.2(o) is conducted using the 6-year-old Hybrid III child dummy. However, in positioning the 6-year-old child dummy, the following procedures are used in place of those specified in S22.2.2.2(o)(7) and (8):

(1) Center the dummy laterally so that Point A is coincident with Plane 2 and the upper spine plate is 6 degrees ± 2 degrees forward of the vertical position.

(2) With the use of spacers (wooden blocks, etc.) position the dummy in a seated position with the H-point located 230 mm (9 inches) ± 15 mm (0.6 inches) above the floor of the vehicle. Maintain the upper spine plate orientation.

S24.3 *Road tests of automatic suppression feature, during which the passenger air bag must be deactivated.* All tests specified in S22 using the 3-year-old Hybrid III child dummy are conducted using the 6-year old Hybrid III child dummy.

S24.4 *Low risk deployment test (Hybrid III 6-year old child dummy).*

S24.4.1 Position the dummy according to any of the following positions: Position 1 (S24.4.2) or Position 2 (S24.4.3).

S24.4.2 *Position 1.*

S24.4.2.1 Locate and mark the center point of the dummy's rib cage or sternum plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S24.4.2.2 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as ''Point B.''

S24.4.2.3 Locate the horizontal plane that passes through Point B. This will be referred to as ''Plane 1.''

S24.4.2.4 Locate the vertical plane parallel to the vehicle longitudinal axis and passing through Point B. This will be referred to as ''Plane 2.''

S24.4.2.5 Move the passenger seat to the full rearward track seating position. Place the seat back in the nominal upright position as specified by the vehicle manufacturer.

S24.4.2.6 Place the dummy in the front passenger seat such that:

S24.4.2.6.1 Point A is located in Plane 2.

S24.4.2.6.2 A vertical plane through the dummy shoulder joints is at 90 degrees to the longitudinal axis of the vehicle.

S24.4.2.6.3 The lower legs are positioned 90 degrees ± 2 degrees to the upper legs.

S24.4.2.6.4 The dummy is positioned forward in the seat such that the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position, and the lower legs rest against the front of the seat or the feet are resting flat on the floorboard of the vehicle.

S24.4.2.6.5 Mark this position, and remove the legs at the pelvic interface.

S24.4.2.7 Move the dummy forward until the upper torso or head of the dummy makes contact with the forward structure of the vehicle.

S24.4.2.8 Once contact is made, as outlined in paragraph S24.4.2.7, the dummy is then raised vertically until Point A lies within Plane 1 (the vertical height to the center of the air bag) or until a minimum clearance of 6 mm (0.25 inches) between the dummy head and windshield is attained.

S24.4.2.9 Position the upper arms parallel to the spine and rotate the lower arm forward (at the elbow joint) sufficiently to prevent contact with or support from the seat.

S24.4.2.10 Support the dummy so that there is minimum interference with the full rotational and translational freedom for the upper torso of the dummy.

S24.4.2.10.1 If necessary, the upper torso is tethered with a thread with a maximum breaking strength of 311 N (70 pounds). Care should be taken that any such tether is not situated in air bag deployment envelope.

S24.4.2.11 In calculation of the injury criteria as specified in paragraph S23.5, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S24.4.3 *Position 2.*

S24.4.3.1 Locate and mark the center point of the dummy's chest/rib plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S24.4.3.2 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as ''Point B.'' Locate the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis. This will be referred to as ''Plane 2.''

S24.4.3.3 Move the passenger seat to the full rearward seating position.

S24.4.3.4 Place the dummy in the front passenger seat such that:

S24.4.3.4.1 Point A is located in Plane 2.

S24.4.3.4.2 A vertical plane through the shoulder joints of the dummy is at 90 degrees to the longitudinal axis of the vehicle.

S24.4.3.4.3 The lower legs are positioned 90 degrees (right angle) from horizontal.

S24.4.3.4.4 The dummy is positioned forward in the seat such that the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position. Note: For some seats, it may not be possible to fully seat the dummy with the lower legs in the prescribed position. In this situation, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position.

S24.4.3.5 Move the seat forward, while maintaining the upper spine plate orientation until some portion of the dummy contacts the forward structure of the vehicle.

S24.4.3.5.1 If contact has not been made with the forward structure of the vehicle at the full forward seating position of the seat, slide the dummy forward on the seat until contact is made. Maintain the upper spine plate orientation.

S24.4.3.5.2 Once contact is made, rotate the dummy forward until the head and/or upper torso are in contact with the dashboard of the vehicle. Rotation is achieved by applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints.

S24.4.3.5.3 The lower legs and feet are rotated rearward (toward rear of vehicle) so as not to impede the rotation of the head/torso into the forward structures of the vehicle.

S24.4.3.5.4 The legs are repositioned so that the feet rest flat on (or parallel to) the floorboard with the ankle joint positioned as nearly as possible to the midsaggital plane of the dummy.

S24.4.3.5.5 If necessary, the upper torso is tethered with a thread with a maximum breaking strength of 311 N (70 pounds) and/or wedge under the dummy's pelvis. Care should be taken that any such tether is not situated anywhere within the deployment envelope of the air bag. Note: If contact with the dash cannot be made by sliding the dummy forward in the seat, then place the dummy in the forward-most position on the seat which will allow the head/upper torso to rest against the dashboard of the vehicle.

S24.4.3.6 Position the upper arms parallel to the torso and rotate the lower arm forward sufficiently to prevent contact with or support from the seat.

S24.4.3.7 In calculation of the injury criteria as specified in paragraph S23.5 of this standard, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S24.4.4 Deploy the right front passenger air bag system. If the air bag contains a multistage inflator, any stage is fired that may deploy in crashes below 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], under the test procedure specified in S22.5 of this standard.

S24.4.5 Determine whether the injury criteria specified in S23.5 of this standard are met.

S25 *Requirements using an out-of-position 5th percentile adult female dummy at the driver position.*

S25.1 Each vehicle shall, at the option of the manufacturer, meet the requirements specified in S25.2 or S25.3 of this standard, under the test procedures specified in S26 of this standard, except that, at the option of the manufacturer, the vehicle may instead meet the requirements specified in S29 of this standard.

S25.2 *Option 1—Automatic suppression feature.* Each vehicle shall meet the requirements specified in S25.2.1 through S25.2.3.

S25.2.1 The vehicle shall be equipped with an automatic suppression feature for the driver air bag which results in deactivation of the air bag after each of the static tests (using a 5th percentile adult female dummy) specified in S26.2 and activation of the air bag after each of the static tests specified in S26.3 of this standard.

S25.2.2 The vehicle shall be equipped with an automatic suppression feature for the driver air bag which meets the requirements specified in S27 of this standard.

S25.2.3 The vehicle shall be equipped with a telltale light on the instrument panel which is illuminated whenever the driver air bag is deactivated and not illuminated whenever the driver air bag is activated. The telltale:

(a) Shall be clearly visible from all front seating positions;

(b) Shall be yellow;

(c) Shall have the identifying words ''DRIVER AIR BAG OFF'' on the telltale or within 25 mm (1 inch) of the telltale; and

(d) Shall not be combined with the readiness indicator required by S4.5.2 of this standard.

S25.3 *Option 2—Low risk deployment.* Each vehicle shall meet the injury criteria specified in S15.3 of this standard when the passenger air bag is statically deployed in accordance with the procedures specified in S26 of this standard.

S26 *Test procedure for S25 of this standard.*

S26.1 *General provisions.* Tests are conducted with the engine operating.

S26.2 *Static tests of automatic suppression feature which must result in deactivation of the driver air bag.*

S26.2.1 Place the 5th percentile adult female dummy in the driver seating position. Position the dummy, the seat, and the steering wheel according to any of the following specifications:

(a) The specifications set forth in S26.4 for Driver Position 1;

(b) The specifications set forth in S26.4 for Driver Position 2.

S26.2.2 Close all vehicle doors.

S26.2.3 Monitor telltale light to check whether the air bag is deactivated, i.e., the light must be illuminated.

S26.3 *Static tests of automatic suppression feature which must result in activation of the driver air bag.*

S26.3.1 *Test one—5th percentile adult female dummy.*

S26.3.1.1 Place the driver seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S26.3.1.2 Place a Part 572 5th percentile adult female test dummy at the driver seating position of a vehicle in any of the following positions (if the dummy's hands cannot reach the steering wheel for a particular seat location, the arms and hands are positioned alongside the side of dummy):

(a) In accordance with procedures specified in S16.3 of this standard, to the extent possible with the seat position that has been selected;

(b) In the same position as specified in S26.3.1.2(a) of this standard, except that the right arm is gripped to the steering wheel at any position;

(c) In the same position as specified in S26.3.1.2(a) of this standard, except that the left arm is gripped to the steering wheel at any position;

(d) In the same position as specified in S26.3.1.2(a) of this standard, except that the right and left arms are gripped to the steering wheel at any position.

S26.3.1.3 Close all vehicle doors.

S26.3.1.4 Monitor the telltale light to check whether the air bag is activated, i.e., the light must be off.

S26.3.2 *Test two—50th percentile adult male dummy.*

S26.3.2.1 Place the driver seat in any position, i.e., any seat track location, any seat height, any seat back angle.

S26.3.2.2 Place a Part 572 Hybrid III 50th percentile adult male test dummy at the driver seating position of a vehicle in any of the following positions (if the dummy's hands cannot reach the steering wheel for a particular seat location, the arms and hands are positioned alongside the side of dummy):

(a) In accordance with procedures specified in S10 of this standard, to the extent possible with the seat position that has been selected;

(b) In the same position as specified in S26.3.2.2(a) of this standard, except that the right arm is gripped to the steering wheel at any position;

(c) In the same position as specified in S26.3.2.2(a) of this standard, except that the left arm is gripped to the steering wheel at any position;

(d) In the same position as specified in S26.3.2.2(a) of this standard, except that the right and left arms are gripped to the steering wheel at any position.

S26.3.2.3 Close all vehicle doors.

S26.3.2.4 Monitor the telltale light to check whether the air bag is activated, i.e., the light must be off.

S26.4 *Low risk deployment test.*

S26.4.1 Position the dummy according to any of the following positions: Driver position 1 (S26.4.2) or Driver position 2 (S26.4.3).

S26.4.2 *Driver position 1.*

26.4.2.1 Adjust steering controls so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If there is no setting at the geometric center, position it one setting lower than the geometric center.

S26.4.2.2 Locate the point on the air bag module cover that is the geometric center of the steering wheel. This will be referred to as ''Point B.''

S26.4.2.3 Locate and mark the center point of the dummy's rib cage or sternum plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S26.4.2.4 Locate the horizontal plane that passes through Point B. This will be referred to as ''Plane 1.''

S26.4.2.5 Locate the vertical plane perpendicular to Plane 1 and parallel to the vehicle longitudinal axis which passes through Point B. This will be referred to as ''Plane 2.''

S26.4.2.6 Place the dummy in the front driver seat so that:

(a) Point A is located in Plane 2.

(b) Seat position is adjusted during placement to obtain the correct dummy orientation.

S26.4.2.7 The dummy is rotated forward until the dummy's upper spine plate angle is 6 degrees ± 2 degrees forward (toward the front of the vehicle) of the steering wheel angle.

S26.4.2.8 The height of the dummy is then adjusted so that the bottom of the chin is in the same horizontal plane as the top of the module cover (dummy height can be adjusted using the seat position and/or spacer blocks). If seat height prevents the bottom of chin from being in the same horizontal plane as the module cover, the dummy height is adjusted as close to the prescribed position as possible.

S26.4.2.9 Move dummy forward maintaining upper spine plate angle and dummy height until head or torso contact the steering wheel.

S26.4.2.10 If necessary, a thread with a maximum breaking strength of 311 N (70 pounds) is used to hold the dummy against the steering wheel. The thread is positioned so as to eliminate or minimize any contact with the deploying air bag.

S26.4.2.11 In calculation of the injury criteria as specified in paragraph S15.3, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S26.4.3 *Driver Position 2.*

S26.4.3.1 The driver's seat track is not specified and may be positioned to best facilitate the positioning of the dummy.

S26.4.3.2 Locate the point on the air bag module cover that is the geometric center of the steering wheel. This will be referred to as ''Point B.''

S26.4.3.3 Locate and mark the center point of the dummy's rib cage or sternum plate (the vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A.''

S26.4.3.4 Locate the horizontal plane that passes through Point B. This will be referred to as ''Plane 1.''

S26.4.3.5 Locate the vertical plane perpendicular to Plane 1 which passes through Point B. This will be referred to as ''Plane 2.''

S26.4.3.6 Place the dummy in the front driver seat so that:

(a) Point A is located in Plane 2.

(b) Seat position is adjusted during placement to obtain the correct dummy orientation.

S26.4.3.7 The dummy is rotated forward until the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward the front of the vehicle) of the steering wheel angle.

S26.4.3.8 The dummy is positioned so that the center of the chin is in contact with the uppermost portion of the rim of the steering wheel. The chin is not hooked over the top of the rim of the steering wheel. It is positioned to rest on the upper edge of the rim, without loading the neck. If the dummy head interferes with the vehicle upper interior before the prescribed position can be obtained, the dummy height is adjusted as close to the prescribed position as possible, while maintaining a 10 ± 2 mm clearance with the vehicle upper interior.

S26.4.3.9 To raise the height of the dummy to attain the required positioning, spacer blocks (foam, etc.) are placed on the driver's seat beneath the dummy. If necessary, a thread with a maximum breaking strength of 311 N (70 pounds) is used to hold the dummy against the steering wheel. The thread is positioned so as to eliminate or minimize any contact with the deploying air bag.

S26.4.3.10 In calculation of the injury criteria as specified in paragraph S15.3 of this standard, data are truncated prior to dummy interaction with vehicle components after the dummy's head is clear of the air bag.

S26.4.4 Deploy the driver air bag. If the air bag contains a multistage inflator, any stage is fired that may deploy in crashes below 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value], under the test procedure specified in S22.5 of this standard.

S26.4.5 Determine whether the injury criteria specified in S15.3 of this standard are met.

S27 *Option for automatic suppression feature that suppresses the air bag when an occupant is out-of-position.*

S27.1 Each vehicle shall, at each front outboard designated seating position, when tested under the conditions of S28 of this standard, comply with the requirements specified in S27.2.1(a) and S27.2.2(a) of this standard at the target locations specified in S28.3 of this standard when tested using the out of position occupant simulator described in S28.2 of this standard at any speed up to and including 11 km/h (7 mph). Each vehicle shall, in addition, meet the requirements specified in S27.1.1(b) and S27.2.2(b) of this standard using the specified test dummies. If a manufacturer selects this option, it shall select the passenger side automatic suppression plane (S28.7.1 of this standard) and the driver side automatic suppression plane (S28.7.2 of this standard) by the time of certification of the vehicle and may not thereafter select different planes.

S27.2 *Performance Criterion.*

S27.2.1 *Passenger Side.*

(a) The air bag disabling device shall deactivate the passenger side air bag and illuminate a telltale within 10 ms after any portion of the out of position occupant simulator passes through the vertical plane specified in S28.7.1 of this standard.

(b) The injury criteria specified in S21.5 of this standard shall be met when the passenger side air bag is deployed toward the Hybrid III 3-year-old child dummy when that test device is located in any position where all portions of the head, neck and torso of the dummy are tangent to or behind the air bag suppression plane. If the air bag contains a multistage inflator, any stage is fired.

S27.2.2 *Driver Side.*

(a) The air bag disabling device shall deactivate the driver side air bag and illuminate a telltale within 10 ms after any portion of the out of position occupant simulator passes through the plane specified in S28.7.2 of this standard.

(b) The injury criteria specified in S15.3 of this standard shall be met when the driver side air bag is deployed toward the Hybrid III 5th percentile adult female dummy when that test device is located in any position where all portions of the head, neck and torso of the dummy are tangent to or behind the air bag suppression plane. If the air bag contains a multistage inflator, any stage is fired.

S28 *Test procedure for S27 of this standard.*

S28.1 *Target location and test conditions.* The vehicle shall be tested and the target areas specified in S28.3 of this standard located under the following conditions.

S28.1.1 *Vehicle test attitude.*

(a) The vehicle is supported off its suspension at an attitude determined in accordance with S28.1.1(b).

(b) Directly above each wheel opening, determine the vertical distance between a level surface and a standard reference point on the test vehicle's body under the conditions of S28.1.1(b)(1) through S28.1.1(b)(2).

(1) The vehicle is loaded to its unloaded vehicle weight.

(2) All tires are inflated to the manufacturer's specifications listed on the vehicle's tire placard.

S28.1.2 *Windows and Sunroofs.*

(a) Movable vehicle windows, including sunroofs, are placed in the fully open position.

(b) Any window rearward of the B-pillar and any window on the opposite side of the longitudinal centerline of the vehicle from the target area may be removed.

S28.1.3 *Convertible tops.* The top, if any, of convertibles and open-body type vehicles is in the closed passenger compartment configuration.

S28.1.4 *Doors.*

(a) The front side door on the same side of the longitudinal centerline of the vehicle as the target area is fully closed and latched but not locked.

(b) The front side door on the opposite side of the longitudinal centerline of the vehicle from the target area, and any door rearward of the B-pillar, including rear hatchbacks or tailgates, may be open or removed.

S28.1.5 *Steering wheel and seats.*

(a) The steering wheel may be placed in any position intended for use while the vehicle is in motion.

(b) The seats may be removed from the vehicle unless removal will impair operation of the air bag disabling system.

S28.2 *Out-of-Position Occupant Simulator.* The out of position occupant simulator used for testing is a hemisphere, with a diameter of 165 mm (6.5 inches) ± 5 mm (0.2 inch).

S28.3 *Occupant Simulator Aiming Zone.* The occupant simulator aiming zone is determined according to the following procedure. (See Figures 8 and 9.)

S28.3.1 *Passenger Side.*

(a) Locate the geometric center of the passenger side air bag cover. Identify this point as Point P.

(b) Locate the line that connects Point P and CG–F (for the front outboard passenger position) as described in S28.4(a). Identify this line as Line P.

(c) Locate a circle with a diameter of 500 mm ± 5 mm (20 inches ± 0.2 inch) centered on Line P on the plane described in S28.7.1 of this standard. Identify this circle as Circle T.

(d) Locate a transverse horizontal plane (Plane 1) 100 mm ± 5 mm (4 inches ± 0.2 inch) below the transverse horizontal plane tangent to the lower edge of the air bag cover.

(e) The area of the vehicle to be targeted by the out of position occupant simulator is that area of Circle T within the vehicle above the intersection of Plane 1 and the plane described in S28.7.1 of this standard.

S28.3.2 *Driver Side.*

(a) Locate the geometric center of the driver side air bag cover. Identify this point as Point D.

(b) Locate the line that connects Point D and CG–F (for the driver position) as described in S28.4(a) of this standard. Identify this line as Line D.

(c) Locate a circle with a diameter of 500 mm ± 5 mm (20 inches ± 0.2 inch) centered on Line D on the plane described in S28.7.2 of this standard. Identify this circle as Circle U.

(d) Locate a transverse horizontal plane (Plane 2) tangent to the lower edge of the air bag cover.

(e) The area of the vehicle to be targeted by the out of position occupant simulator is that area of Circle U within the vehicle above the intersection of Plane 2 and the plane described in S28.7.2 of this standard.

S28.4 *Location of head center of gravity for front outboard designated seating positions (CG–F).* For determination of head center of gravity, all directions are in reference to the seat orientation.

(a) *Location of CG–F.* For front outboard designated seating positions, the head center of gravity with the seat in its rearmost adjustment position (CG–F2) is located 160 mm ± 5 mm (6.3 inches ± 0.2 inch) rearward and 660 mm ± 15 mm (26 inches ± 0.6 inch) upward from the seating reference point.

S28.5 *Test configuration.*

(a) *Passenger Side.* The out of position occupant simulator is guided along a velocity vector originating at any point within the vehicle to any point within the target area specified in S28.3.1(e) of this standard, and passing through the plane described in S28.7.1 of this standard.

(b) *Driver Side.* The out of position occupant simulator is guided along a velocity vector originating at any point within the vehicle to any point within the target area specified in S28.3.2(e) of this standard, and passing through the plane described in S28.7.2 of this standard.

S28.6 *Multiple tests.*

A vehicle being tested may be tested multiple times.

S28.7 *Automatic suppression plane.*

S28.7.1 *Passenger Side.* The automatic suppression plane of a vehicle is the transverse vertical plane passing through the rearmost point at which the Hybrid III three year old child dummy test device may approach the passenger side air bag when it deploys while meeting the injury criteria specified in S21.5 of this standard. If the air bag contains a multistage inflator, any stage is fired.

S28.7.2 *Driver Side.* The automatic suppression plane of a vehicle is located as follows:

(a) Locate the plane A tangent to the rear face of the steering wheel rim.

(b) Locate the plane B parallel to plane A and passing through the geometric center of the air bag cover.

(c) The automatic suppression plane is a plane parallel to plane B and passing through the point nearest to plane B where any portion of a 5th percentile adult female dummy may be located in the event of air bag deployment and meet the injury criteria specified in S15.3 of this standard. If the air bag contains a multistage inflator, any stage is fired.

S29 *Dynamic out-of-position test option.* At the option of the vehicle manufacturer, a pre-impact deceleration test as specified in S30, may be used in place of the tests specified in S21, S23, and S25 of this section. Each vehicle shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3, S21.5, and S23.5, and the vehicle integrity criteria specified in S14.3, in accordance with the test procedures specified in S30 of this standard.

S30 *Test procedure for pre-crash deceleration impact test.*

S30.1 *General Provisions.* The vehicle is impacted into a rigid barrier, perpendicular to the barrier face as follows. Place a Part 572 5th percentile adult female test dummy at the driver seating position and any of the following test dummies at the right front designated seating position: a Hybrid III 3-year-old child dummy or a Hybrid III 6-year old child dummy. The manual safety belts are not to be fastened in any position. Accelerate the vehicle to a velocity of 32 km/h (20 mph) [the agency is also considering a range of speeds above and below this value] and then decelerate the vehicle such that the vehicle achieves a barrier impact speed of 24 km ± 2 km (15 mph ± 1 mph) [the agency is also considering a range of speeds above and below this value] at impact. The deceleration is initiated 2.1 meters ± 200 mm (7 ft ± 0.66 ft) from the impact barrier.

S30.2 Test Conditions.

S30.2.1 *Pre-crash Deceleration Impact Conditions.* Impact a vehicle traveling longitudinally and decelerating to a speed of 24 km/h ± 2 km/h (15 mph ± 1 mph) [the agency is also considering a range of values above and below this value], into a fixed collision barrier that is perpendicular to the line of travel of the vehicle.

S30.2.2 *Loading.* The vehicle, including the test devices and instrumentation, is loaded as specified in S16.2 of this standard.

S30.2.3 *Dummy Seating and positioning.* The 5th percentile adult female dummy is seated and positioned as specified in S16.3 of this standard, except that prior to seating the dummy, two pieces of low friction material, i.e., a silk or acetate cloth material having a 75 denier warp and a 150 denier filling, and a 225 count with a 68 pick, having linear dimensions no less than 60 cm (23.6 inches) by 60 cm (23.6 inches), are placed on the seat. If the Hybrid III 3-year-old child dummy is used at the right front designated seating position, it is seated and positioned as specified in S30.2.3.1 of this standard. If the Hybrid III 6-year-old child dummy is used at the right front designated seating position, it is seated and positioned as specified in S30.2.3.2 of this standard.

S30.2.3.1 *Seating procedure for Hybrid III 3-year-old child dummy.*

S30.2.3.1.1 The passenger side automatic suppression plane of a vehicle is that specified in S28.7.1.

S30.2.3.1.2 Place two pieces of low friction material, i.e., a silk or acetate cloth material having a 75 denier warp and a 150 denier filling, and a 225 count with a 68 pick, having linear dimensions no less than 60 cm (23.6 inches) by 60 cm (23.6 inches), on the seat.

S30.2.3.1.3 Locate and mark the center point of the dummy's chest/rib plate. (The vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A''.

S30.2.3.1.4 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as ''Point B''. Locate the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis. This will be referred to as ''Plane 2''.

S30.2.3.1.5 Move the passenger seat to the full rearward seating position.

S30.2.3.1.6 Place the Hybrid III 3-year-old child dummy in the front passenger seat, on the low friction fabric sheets, such that:

(a) Point A is to be located in Plane 2.

(b) A vertical plane through the shoulder joints of the dummy shall be at 90 degrees to the longitudinal axis of the vehicle.

(c) The lower legs are positioned 90 degrees ± 2 degrees (right angle) from horizontal.

(d) The dummy is positioned forward in the seat such the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 0 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position. Note: For some seats, it may not be possible to fully seat the dummy with the lower legs in the prescribed position. In this situation, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy's upper spine plate is 0 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position.

S30.2.3.1.7 Move the seat forward, while maintaining the upper spine plate orientation until the seat is in the full forward seating position or any part of the head or torso of the dummy intersects a plane parallel to the Automatic Suppression Plane, located 300 mm ± 15 mm (12 inches ± 0.6 inch) rearward of the Automatic Suppression Plane, whichever occurs first.

S30.2.3.1.8 The legs should be repositioned so that the feet rest flat on (or parallel to) the floorboard with the ankle joint positioned as nearly as possible to the medial plane of the dummy.

S30.2.3.1.9 If necessary, the upper torso can be tethered with a thread with a maximum breaking strength of 311 N (70 pounds) and/or wedge under dummy's pelvis. Care should be taken that any such tether is not situated anywhere within the deployment envelope of the air bag.

S30.2.3.1.10 Position the upper arms parallel to the upper spine plate and rotate the lower arm forward sufficiently to prevent contact with or support from the seat.

S30.2.3.1.11 Sufficient slack should be maintained in the instrumentation wiring harness so that the dummy motion is not restricted by the harness.

S30.2.3.2 *Seating procedure for Hybrid III 6-year-old child dummy.*

S30.2.3.2.1 The passenger side automatic suppression plane of a vehicle is that specified in S28.7.1.

S30.2.3.2.2 Place two pieces of low friction material, i.e., a silk or acetate cloth material having a 75 denier warp and a 150 denier filling, and a 225 count with a 68 pick, having linear dimensions no less than 60 cm (23.6 inches) by 60 cm (23.6 inches), on the seat.

S30.2.3.2.3 Locate and mark the center point of the dummy's chest/rib plate. (The vertical mid-point on the mid-sagittal plane of the frontal chest plate of the dummy). This will be referred to as ''Point A''.

S30.2.3.2.4 Locate the point on the air bag module cover that is the geometric center of the air bag module cover. This will be referred to as ''Point

B''. Locate the vertical plane which passes through Point B and is parallel to the vehicle longitudinal axis. This will be referred to as ''Plane 2''.

S30.2.3.2.5 Move the passenger seat to the full rearward seating position.

S30.2.3.2.6 Place the dummy in the front passenger seat, on the low friction fabric sheets, such that:

(a) Point A is to be located in Plane 2.

(b) A vertical plane through the shoulder joints of the dummy shall be at 90 degrees ± 2 degrees to the longitudinal axis of the vehicle.

(c) The lower legs are positioned 90 degrees ± 2 degrees (right angle) from horizontal.

(d) The dummy is positioned forward in the seat such the lower legs rest against the front of the seat and such that the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position. Note: For some seats, it may not be possible to fully seat the dummy with the lower legs in the prescribed position. In this situation, rotate the lower legs forward until the dummy is resting on the seat with the feet positioned flat on the floorboard and the dummy's upper spine plate is 6 degrees ± 2 degrees forward (toward front of vehicle) of the vertical position.

S30.2.3.2.7 Move the seat forward, while maintaining the upper spine plate orientation until the seat is in the full forward seating position or any part of the head or torso of the dummy intersects a plane parallel to the Automatic Suppression Plane, located 300 mm ± 15 mm (12 inches ± 0.6 inch) rearward of the Automatic Suppression Plane, whichever occurs first.

S30.2.3.2.8 The legs should be repositioned so that the feet rest flat on (or parallel to) the floorboard with the ankle joint positioned as nearly as possible to the midsagittal plane of the dummy.

S30.2.3.2.9 If necessary, the upper torso can be tethered with a thread with a maximum breaking strength of 311 N (70 pounds) and/or wedge under dummy's pelvis. Care should be taken that any such tether is not situated anywhere within the deployment envelope of the air bag.

S30.2.3.2.10 Position the upper arms parallel to the upper spine plate and rotate the lower arm forward sufficiently to prevent contact with or support from the seat.

S30.2.3.2.11 Sufficient slack should be maintained in the instrumentation wiring harness so that the dummy motion is not restricted by the harness.

S30.2.4 *Impact configuration.* The vehicle is accelerated to a speed of 32 km/h ± 2 km/h (20 mph ± 1.3 mph) [the agency is also considering a range of values above and below this value]. Pre-crash deceleration is initiated such that the vehicle impacts the barrier perpendicular to the barrier face at a velocity of 24 km/h ± 2 km/h (15 mph, ± 1 mph) [the agency is also considering a range of values above and below this value]. The deceleration is initiated 2.1 meters ± 200 mm (7 ft ± 0.66 ft) [the agency is also considering a range of values above and below this value] from the impact barrier. Vehicle deceleration is 0.8 ± 0.3 g's [the agency is also considering a range of values above and below this value] prior to barrier contact.

3. Figures 8 and 9 would be added immediately following Figure 7 to read as follows:

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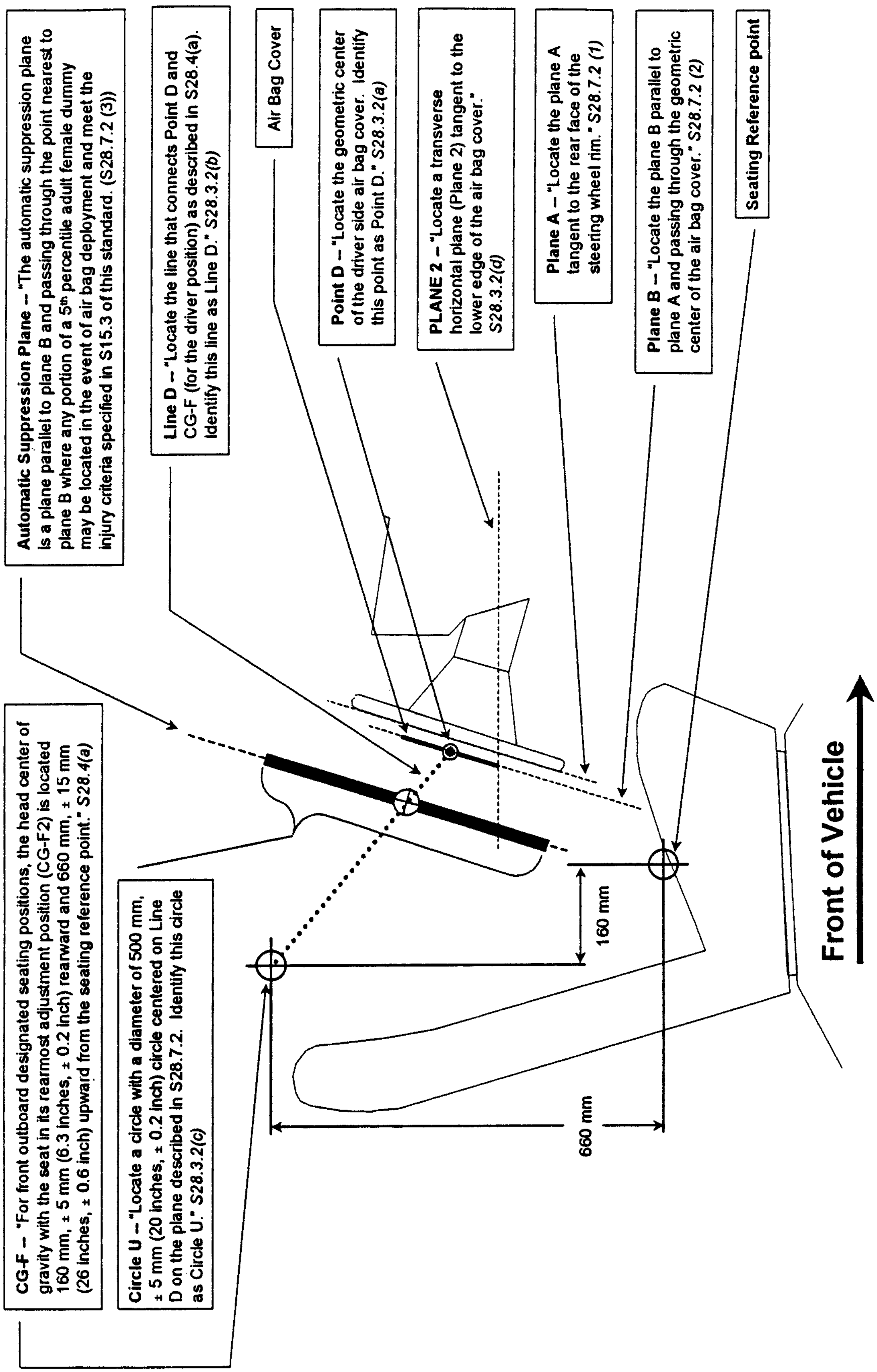

Figure 8, Driver Side OOP Occupant Simulator Aiming Zone (S28.3)
(right side view of vehicle)

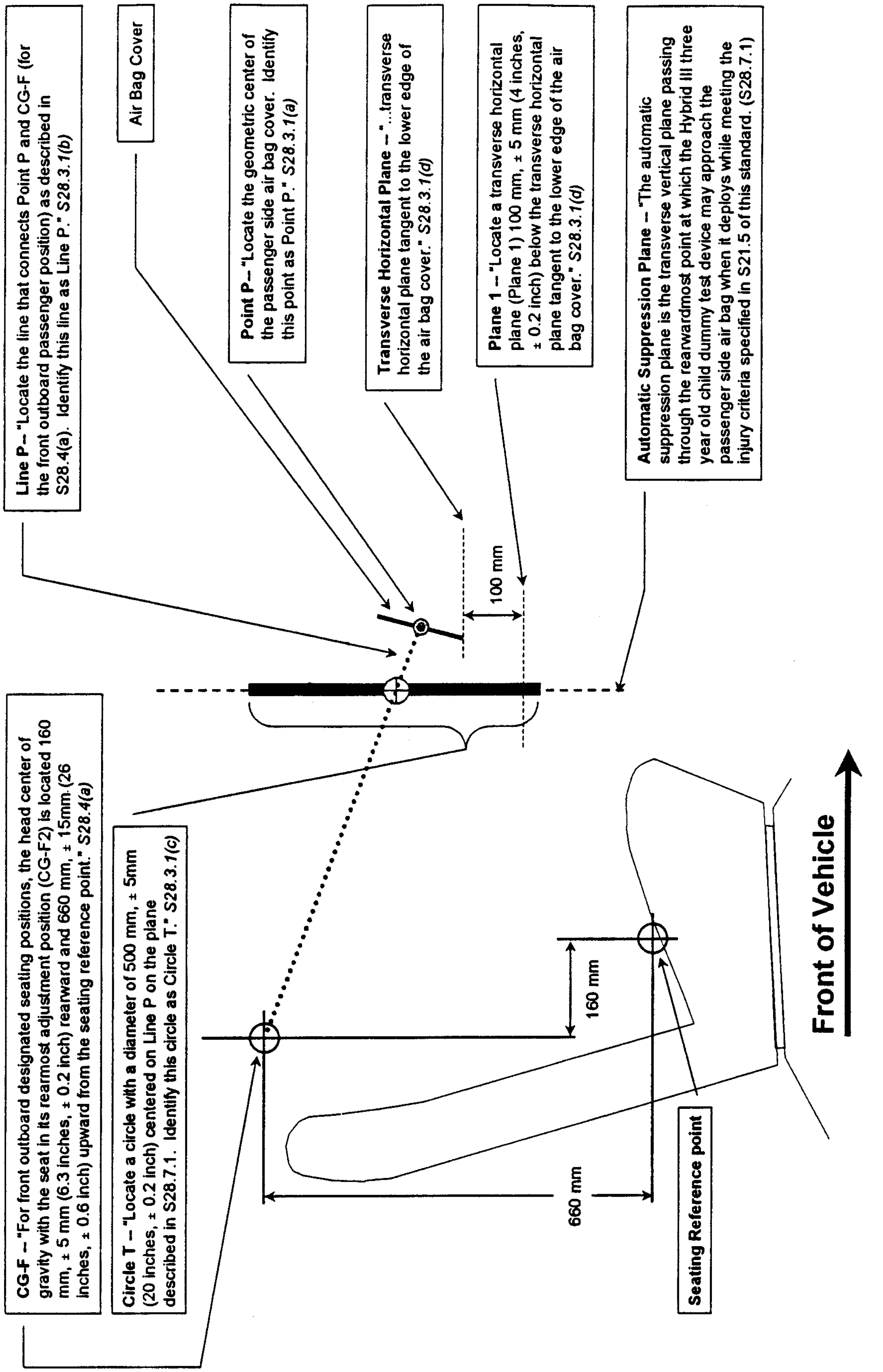

Figure 9, Passenger Side OOP Occupant Simulator Aiming Zone (S28.3)
(right side view of vehicle)

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4. Part 585 would be revised to read as follows:

PART 585—ADVANCED AIR BAG PHASE-IN REPORTING REQUIREMENTS

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

§ 585.1 Scope.

This part establishes requirements for manufacturers of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less to submit a report, and maintain records related to the report, concerning the number of such vehicles that meet the advanced air bag requirements of Standard No. 208, Occupant crash protection (49 CFR 571.208).

§ 585.2 Purpose.

This purpose of these reporting requirements is to aid the National Highway Traffic Safety Administration in determining whether a manufacturer of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less has complied with the advanced air bag requirements of Standard No. 208.

§ 585.3 Applicability.

This part applies to manufacturers of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less. However, this part does not apply to any manufacturers whose production consists exclusively of walk-in vans, vehicles designed to be sold exclusively to the U.S. Postal Service, vehicles manufactured in two or more stages, and vehicles that are altered after previously having been certified in accordance with part 567 of this chapter.

§ 585.4 Definitions.

(a) All terms defined in 49 U.S.C. 30102 are used in their statutory meaning.

(b) Bus, gross vehicle weight rating or GVWR, multipurpose passenger vehicle, passenger car, and truck are used as defined in section 571.3 of this chapter.

(c) Production year means the 12-month period between September 1 of one year and August 31 of the following year, inclusive.

§ 585.5 Response to inquiries.

During the production years ending August 31, 2003, August 31, 2004, and August 31, 2005, each manufacturer shall, upon request from the Office of Vehicle Safety Compliance, provide information regarding which vehicle make/models are certified as complying with the requirements of S14 of Standard No. 208.

§ 585.6 Reporting requirements.

(a) Phase-in selection reporting requirement. Within 60 days after the end of the production year ending August 31, 2003, each manufacturer choosing to comply with one of the phase-in schedules permitted by S14.1 of 49 CFR § 571.208 shall submit a report to the National Highway Traffic Safety Administration stating which phase-in schedule it will comply with until September 1, 2005. Each report shall—

(1) Identify the manufacturer;

(2) State the full name, title, and address of the official responsible for preparing the report;

(3) Identify the paragraph for the phase-in schedule selected;

(4) Be written in the English language; and

(5) Be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590.

(b) General reporting requirements. Within 60 days after the end of the production years ending August 31, 2003, August 31, 2004, and August 31, 2005, each manufacturer shall submit a report to the National Highway Traffic Safety Administration concerning its compliance with the advanced air bag requirements of Standard No. 208 for its passenger cars, trucks, buses and multipurpose passenger vehicles produced in that year. Each report shall—

(1) Identify the manufacturer;

(2) State the full name, title, and address of the official responsible for preparing the report;

(3) Identify the production year being reported on;

(4) Contain a statement regarding whether or not the manufacturer complied with the advanced air bag requirements of Standard No. 208 for the period covered by the report and the basis for that statement;

(5) Provide the information specified in Sec. 585.6(c);

(6) Be written in the English language; and

(7) Be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590.

(c) Report content—(1) Basis for phase-in production goals. Each manufacturer shall provide the number of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less manufactured for sale in the United States for each of the three previous production years, or, at the manufacturer's option, for the current production year. A new manufacturer that has not previously manufactured passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less for sale in the United States must report the number of such vehicles manufactured during the current production year. However, manufacturers are not required to report any information with respect to those vehicles that are walk-in vans, vehicles designed to be sold exclusively to the U.S. Postal Service, vehicles manufactured in two or more stages, and vehicles that are altered after previously having been certified in accordance with part 567 of this chapter.

(2) Production. Each manufacturer shall report for the production year for which the report is filed the number of passenger cars and trucks, buses, and multipurpose passenger vehicles with a GVWR of 3,855 kg (8500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5500 pounds) or less that meet the advanced air bag requirements of Standard No. 208.

(3) Vehicles produced by more than one manufacturer. Each manufacturer whose reporting of information is affected by one or more of the express written contracts permitted by S14.1.3.2 of Standard No. 208 shall:

(i) Report the existence of each contract, including the names of all parties to the contract, and explain how the contract affects the report being submitted.

(ii) Report the actual number of vehicles covered by each contract.

§ 585.7 Records.

Each manufacturer shall maintain records of the Vehicle Identification Number for each passenger car, multipurpose passenger vehicle, truck and bus for which information is reported under § 585.6(c)(2) until December 31, 2006.

§ 585.8 Petitions to extend period to file report.

A petition for extension of the time to submit a report must be received not later than 15 days before expiration of the time stated in § 585.6(b). The petition must be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, DC 20590. The filing of a petition does not automatically extend the time for filing a report. A petition will be granted only if the petitioner shows good cause for the extension, and if the extension is consistent with the public interest.

PART 587—DEFORMABLE BARRIERS

5. The authority citation for part 587 would be revised to read as follows:

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

6. The heading of part 587 would be revised to read as set forth above.

7. The heading ''Subpart A—General'' would be inserted immediately before section 587.1.

8. Section 587.1 would be revised to read as follows:

§ 587.1 Scope.

This part describes deformable impact barriers that are to be used for testing compliance of motor vehicles with motor vehicle safety standards.

9. Section 587.3 would be revised to read as follows:

§ 587.3 Application.

This part does not in itself impose duties or liabilities on any person. It is a description of tools that measure the performance of occupant protection systems required by the safety standards that incorporated it. It is designed to be referenced by, and become part of, the test procedures specified in motor vehicle safety standards such as Standard No. 208, Occupant Crash Protection, and Standard No. 214, Side Impact Protection.

Subpart B—[Amended]

10. The heading ''Subpart B—Side Impact Moving Deformable Barrier'' would be inserted immediately after the end of section 587.3.

§§ 587.7 through 587.10 [Reserved]

11. Sections 587.7 through 587.10 would be reserved.

Subpart C—[Amended]

12. The heading ''Subpart C—Offset Deformable Barrier'' would be inserted immediately after the end of section 587.10.

§ 587.11 [Reserved]

13. Section 587.11 would be reserved.

14. Sections 587.12 through 587.17 would be added to read as follows:

§ 587.12 General description.

The fixed offset deformable barrier is comprised of two elements: A fixed collision barrier and a deformable face (Figure 1). The base unit is a fixed barrier and must be adequate to not deflect or displace during the vehicle impact. The deformable face is 200 mm (7.8 inches) ± 15 mm (0.6 inch) off the ground, and consists of two separate layers of aluminum honeycomb and an aluminum covering.

§ 587.13 Component And Material Specifications.

The dimensions of the barrier are illustrated in Figure 1 of this part. The dimensions of the individual components of the barrier are listed separately below. All dimensions allow a tolerance of ± 2.5 mm (0.1 inch) unless otherwise specified.

(a) Main honeycomb block.

(1) *Dimensions.* The main section of the deformable face of the fixed barrier has the following dimensions. The height is 650 mm (25.6 inches) (in direction of honeycomb ribbon axis), the width is 1,000 mm (39.4 inches), and the depth is 450 mm (17.7 inches) (in direction of honeycomb cell axes).

(2) *Material.* The main section of the deformable face of the fixed barrier is constructed of the following material. The honeycomb is manufactured out of aluminum, 3003 (ISO 209, part 1), with a foil thickness of 0.076 mm (0.003 inches) ± 1 mm (0.040 inch) ± 0.004 mm (0.002 inch), an aluminum honeycomb cell size of 19.14 mm (0.75 inches), a density of 28.6 kg/m^3 (1.78 lb/ft^3) ± 2kg/m^3 (0.25 $1b/ft^3$) and a crush strength of 0.342 MPa (49.6 psi) + 0%–10%, in accordance with the certification procedure described in section 587.14.

(b) Bumper element.

(1) *Dimensions.* The bumper element of the deformable face of the fixed barrier has the following dimensions. The height is 330 mm (13 inches)(in direction of honeycomb ribbon axis), the width is 1,000 mm (39.4 inches), and the depth is 90 mm (3.5 inches)(in direction of honeycomb cell axes).

(2) *Material.* The bumper element of the deformable face of the fixed barrier is constructed of the following material. The honeycomb is manufactured out of aluminum 3003 (ISO 209, part 1), foil thickness of 0.076 mm(0.003 inch) ± 0.004 mm (0.0002 inch), cell size of 6.4 mm (0.25 inch) ± 1 mm (0.040 inch), density of 82.6 kg/m^3 (5.15 lb/ft^3) ± 3 kg/m^3 (0.19 lb/ft^3), and crush strength of 1.711 MPa (248 psi) + 0%–10%, in accordance with the certification procedure described in section 587.14.

(c) Backing sheet.

(1) *Dimensions.* The deformable barrier backing sheet has the following dimensions. The height is 800 mm (31.5 inches), the width is 1,000 mm (39.4 inches) inch), and the thickness is 2.0 mm (0.078 inch) ± 0.1 mm (0.004 inch).

(2) *Material.* The deformable barrier backing sheet is manufactured out of Aluminum 5251/5052.

(d) Cladding sheet.

(1) *Dimensions.* The cladding sheet of the main section of the deformable face of the fixed barrier has the following dimensions. The length is 1,700 mm (66.9 inches), the width is 1,000 mm (39.4 inches), and the thickness is 0.81 mm (0.03 inch) ± 0.07 mm (0.003 inch).

(2) *Material.* The cladding sheet of the main section of the deformable face of the fixed barrier is manufactured out of Aluminum 5251/5052.

(e) Bumper facing sheet.

(1) *Dimensions.* The bumper facing sheet has the following dimensions. The height is 330 mm(13 inches), the width is 1,000 mm(39.4 inches), and the thickness is 0.81 mm (0.03 inch) ± 0.07 mm (0.003 inch)

(2) *Material.* The bumper facing sheet is manufactured out of aluminum 5251/5052.

(f) Adhesive. The adhesive to be used throughout should be a two-part polyurethane.

§ 587.14 Aluminum honeycomb certification.

The following procedure is applied to materials for the frontal impact barrier, these materials having a crush strength of 0.342 MPa (49.6 psi) and 1.711 MPa (248 psi). (See Figure 1.)

(a) Sample locations. To ensure uniformity of crush strength across the whole of the barrier face, 8 samples are taken from 4 locations evenly spaced across the honeycomb block. For a block to pass certification, 7 of these 8 samples must meet the crush strength requirements of the following sections. Any part of the block may then be used for a barrier. The location of the samples depends on the size of the honeycomb block. First, four samples, each measuring 300 mm (11.8 inches) × 300 mm (11.8 inches) × 50 mm (1.97 inches)thick are cut from the block of barrier face material. (See Figure 2 for how to locate these samples on a typical honeycomb block.) Each of these larger samples are cut into samples for certification testing (150 mm (5.9 inches) × 150 mm (5.9 inches) × 50 mm (1.97 inches)). Certification is based on the testing of two samples from each of the four locations.

(b) Sample size. Samples of the following size are used for testing. The length is 150 mm(5.9 inches) ± 6 mm (0.24 inch), the width is 150 mm (5.9 inches) ± 6 mm (0.24 inch), and the thickness is 50 mm (1.97 inches) ± 2 mm (0.078 inch). The walls of incomplete cells around the edge of the sample are trimmed as follows (See Figure 3). In the width ''W'' direction, the fringes must be no greater than 1.8 mm (0.07 inch); in the length (''L'') direction, half the length of one bonded cell wall (in the ribbon direction) must be left at either end of the specimen.

(c) Area measurement. The length of the sample is measured in three locations, 12.7 mm (0.5 inch) from each end and in the middle, and recorded as L1, L2, and L3 (Figure 3). In the same manner, the width is measured and recorded as W1, W2 and W3 (Figure 3). These measurements are taken on the centerline of the thickness. The crush area is then calculated as:

$$A = \frac{(L1 + L2 + L3)}{3} \times \frac{(W1 + W2 + W3)}{3}$$

(d) Crush rate and distance. The sample is crushed at a rate of not less than 5.1 mm/min (0.2 in/min) and not more than 7.6 mm/min (0.29 in/min). The minimum crush distance is 16.5 mm(0.65 inch). Force versus deflection data are to be collected in either analogue or digital form for each sample tested. If analogue data are collected then a means of converting this to digital must be available. All digital data must be collected at a rate consistent with SAE J211, 1995.

(e) Crush strength determination. Ignore all data prior to 6.4 mm (0.25 inch) of crush and after 16.5 mm (0.65 inch) of crush. Divide the remaining data into three sections or displacement intervals (n = 1,2,3) (see Figure 4) as follows. Interval one should be at 6.4–9.7 mm (0.25–0.38 inch) deflection, inclusive. Interval two should be at 9.7–13.2 mm (0.38–0.52 inch) deflection, exclusive. Interval three is 13.2–16.5 mm (0.52–0.65 inch) deflection, inclusive. Find the average for each section as follows: where m represents the number of data points measured in each of the three intervals. Calculate the crush strength of each section as follows:

$$F(n) = \frac{[F(n)1 + F(n)2 + F(n)m]}{m}; m = 1,2,3$$

where m represents the number of data points measured in each of the three intervals. Calculate the crush strength of each section as follows:

$$S(n) = \frac{F(n)}{A}; n = 1,2,3$$

(f) Sample crush strength specification. For a honeycomb sample to pass this certification, the following condition must be met. For the 0.342 MPa (49.6 psi) material, the strength be equal or greater than 0.308 MPa (45 psi) but less than or equal to 0.342 MPa (49.6 psi) for all three compression intervals. For the 1.711 MPa (248 psi) material the strength must be equal to or greater than 1.540 MPa (223 psi) but less than or equal to 1.711 MPa (248 psi) for each of the compression intervals.

(g) Block crush strength specification. Eight samples are to be tested, from four locations, evenly spaced across the block. For a block to pass certification, 7 of the 8 samples must meet the crush strength specification of the previous section. Any part of the block may then be used for a barrier.

(h)(1) The testing hardware must have a capacity of applying 13.3 kN (3,000 lb) over a stroke of at least 16.5 mm (0.65 inches), at a constant and known rate. The crush plates must be parallel (within 0.127 mm (0.005 inch)), be at least 165 mm × 165 mm (6.5 inch × 6.5 inch) in size, have a surface roughness approximately equivalent to 60 grit sandpaper, and be marked to ensure centering of the applied load on the sample.

(2) The hardware used for certifying aluminum honeycomb must be capable of applying sufficient load (13.3 kN (3,000 lb)), over at least a 16.5 mm (0.65 inch) stroke. The crush rate must be constant and known. To ensure that the load is applied to the entire sample, the top and bottom crush plates must be no smaller than 165 mm by 165 mm (6.5 inch × 6.5 inch). The engaging surfaces of the crush plates must also have a roughness approximately equivalent to 60 grit sandpaper. The bottom crush plate should be marked to ensure that the applied load is centered on the sample.

(3) The crush plate assemblies must have an average angular rigidity (about axes normal to the direction of crush) of at least 1017 Nm/deg (750 ft-lb/deg), over the range of 0 to 203 N m (0 to 150 ft-lb) applied torque.

§ 587.15 Adhesive Bonding Procedure.

Immediately before bonding, aluminum sheet surfaces to be bonded must be thoroughly cleaned using a suitable solvent, such as 1-1-1 Trichloroethane. This is to be carried out at least twice or as required to eliminate grease or dirt deposits. The cleaned surfaces must then be abraded using 120 grit abrasive paper. Metallic/silicon carbide abrasive paper is not to be used. The surfaces must be thoroughly abraded and the abrasive paper changed regularly during the process to avoid clogging, which may lead to a polishing effect. Following abrading, the surfaces must be thoroughly cleaned again, as above. In total, the surfaces must be solvent cleaned at least four times. All dust and deposits left as a result of the abrading process must be removed, as these will adversely affect bonding. The adhesive should be applied to one surface only, using a ribbed rubber roller. In cases where honeycomb is to be bonded to aluminum sheet, the adhesive should be applied to the aluminum sheet only. A maximum of 0.5 kg/m² (11.9 lb/ft²) be applied evenly over the surface, giving a maximum film thickness of 0.5 mm (0.02 inch).

§ 587.16 Construction.

(a) The main honeycomb block is bonded to the backing sheet with adhesive such that the cell axes are perpendicular to the sheet. The cladding is bonded to the front surface of the honeycomb block. The top and bottom surfaces of the cladding sheet must not be bonded to the main honeycomb block but should be positioned closely to it. The cladding sheet must be adhesively bonded to the backing sheet at the mounting flanges. The bumper element must be adhesively bonded to the front of the cladding sheet such that the cell axes are perpendicular to the sheet. The bottom of the bumper element must be flush with the bottom surface of the cladding sheet. The bumper facing sheet must be adhesively bonded to the front of the bumper element.

(b) The bumper element must then be divided into three equal sections by means of two horizontal slots. These slots must be cut through the entire depth of the bumper section and extend the whole width of the bumper. The slots must be cut using a saw; their width must be the width of the blade used and must not exceed 4.0 mm (0.16 inch).

(c) Clearance holes for mounting the barrier are to be drilled in the mounting flanges (shown in Figure 2.) The holes must be 20 mm (0.79 inch) in diameter. Five holes must be drilled in the top flange at a distance of 40 mm (1.57 inches) from the top edge of the flange and five holes in the bottom flange, 40 mm (1.6 inches) from the bottom edge of that flange. The holes must be spaced 100 mm, 300 mm (11.8 inches), 500 mm (19.7 inches), 700 mm (27.5 inches), 900 mm (35.4 inches) horizontally, from either edge of the barrier. All holes must be drilled to ± 1 mm (0.04 inch) of the nominal distances.

§ 587.17 Mounting.

(a) The deformable barrier must be rigidly fixed to the edge of a mass of not less than 7×10^4 kg (154,324 lbs) or to some structure attached thereto. The attachment of the barrier face must be such that the vehicle must not contact any part of the structure more than 75 mm (2.9 inches) from the top surface of the barrier (excluding the upper flange) during any stage of the impact. (A mass, the end of which is between 925 mm (36.4 inches) and 1000 mm (39.4 inches) high and at least 1000 mm (39.4 inches) deep, is considered to satisfy this requirement.) The front face of the surface to which the deformable barrier is attached must be flat and continuous over the height and width of the face and must be vertical ± 1 degree and perpendicular ± 1 degree to the axis of the run-up track. The attachment surface must not be displaced more than 10 mm (0.4 inch) during the test. If necessary, additional anchorage or arresting devices must be used to prevent displacement of the barrier. The edge of the deformable barrier must be aligned with the edge of the ridged barrier appropriate for the side of the vehicle to be tested.

(b) The deformable barrier must be fixed to the fixed barrier by means of ten bolts, five in the top mounting flange and five in the bottom. These bolts must be at least 8 mm (0.3 inch) in diameter. Steel clamping strips must be used for both the top and bottom mounting flanges (figures 1 and 2). These strips must be 60 mm (2.4 inches) high and 1000 mm (39.4 inches) wide and have thickness of at least 3 mm (0.12 inch). Five clearance holes of 20 mm (0.8 inch) diameter must be drilled in both strips to correspond with those in the mounting flange on the barrier (see section 587.16(c)). None of the fixtures must fail in the impact test.

15. Figures 1 through 5 would be added to Part 587.

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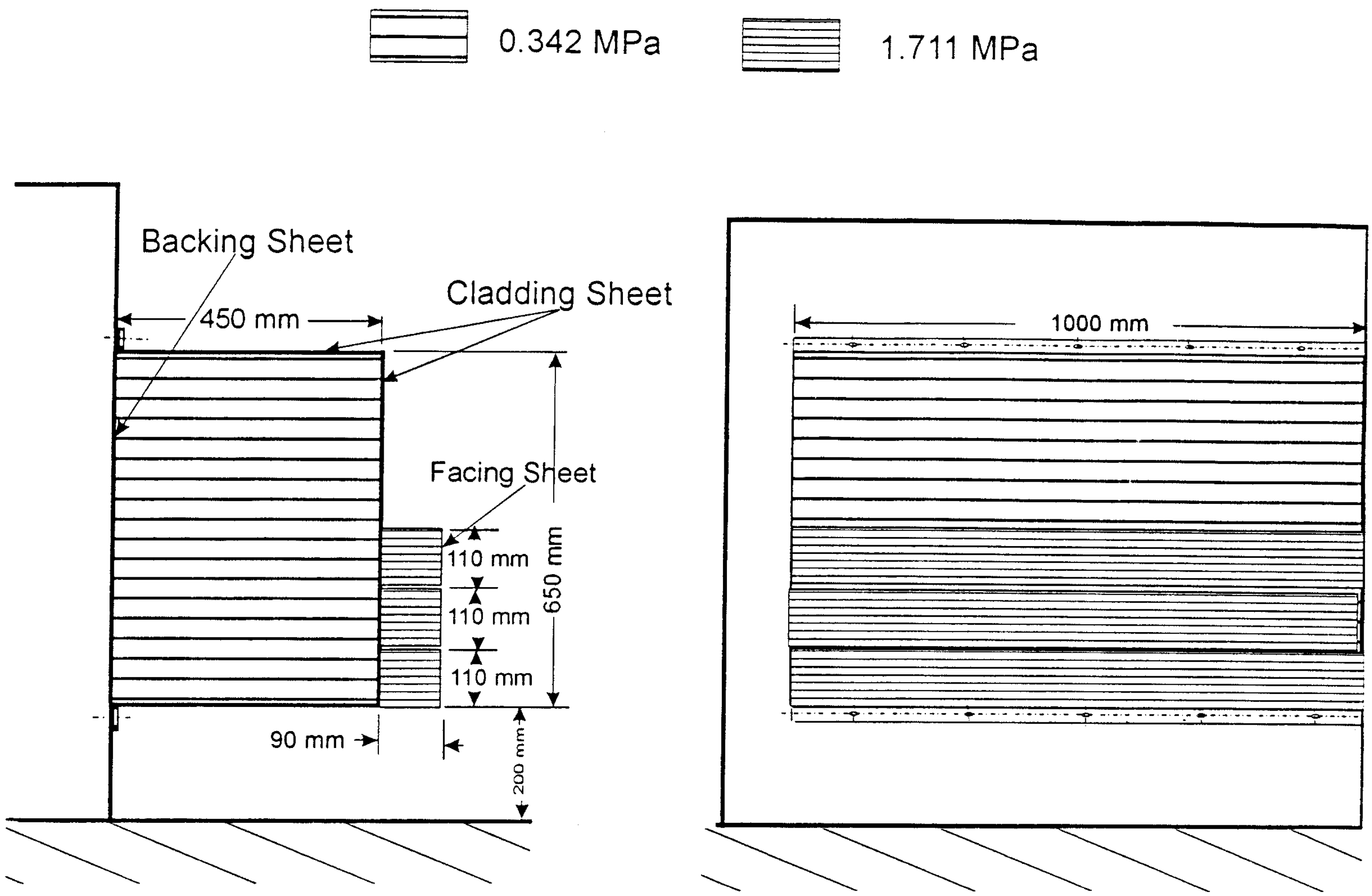
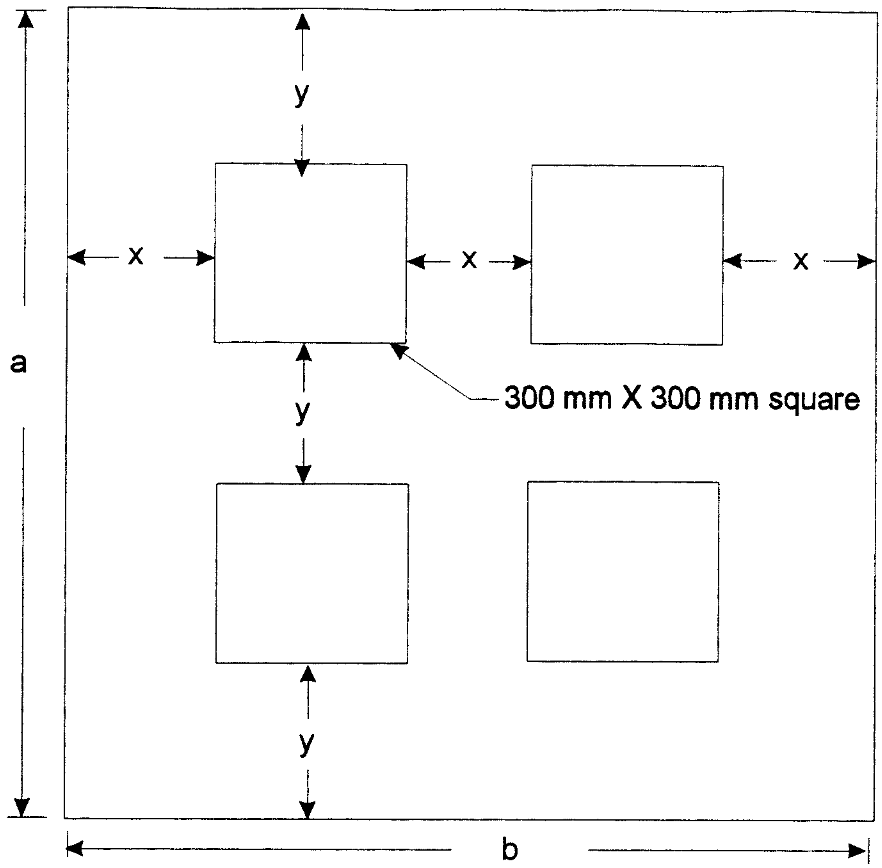
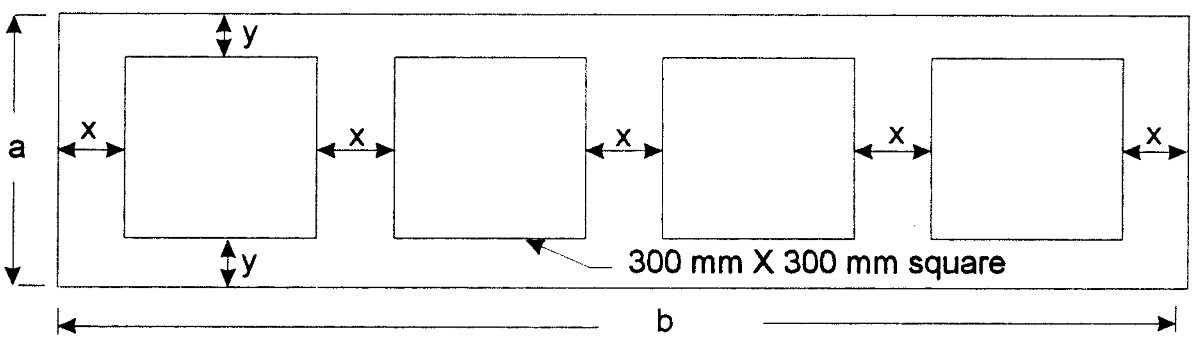


Figure 1 Offset Barrier



If a ≥ 900 mm: x = 1/3(b-600)mm and y = 1/3(a-600)mm (for a<b)



If a < 900 mm: x = 1/5 (b - 1200) mm and y = 1/2 (a - 300) mm (for a≤ b)

Figure 2

Location of Samples for Certification

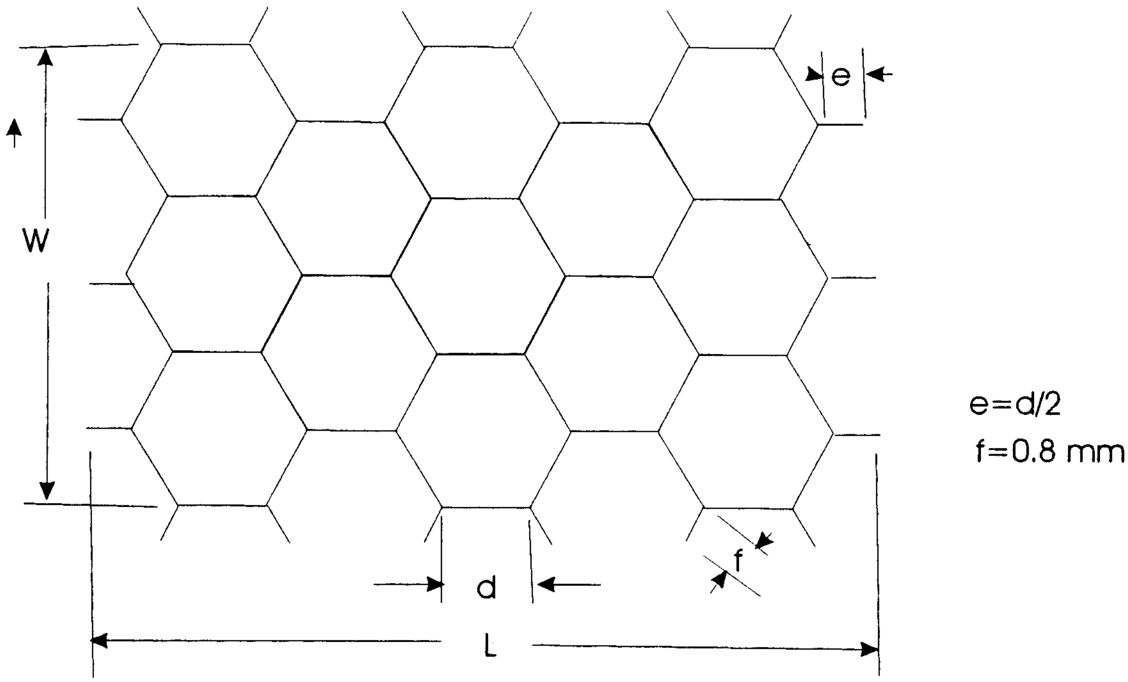


Figure 3 - Honeycomb Axes and Measured Dimensions

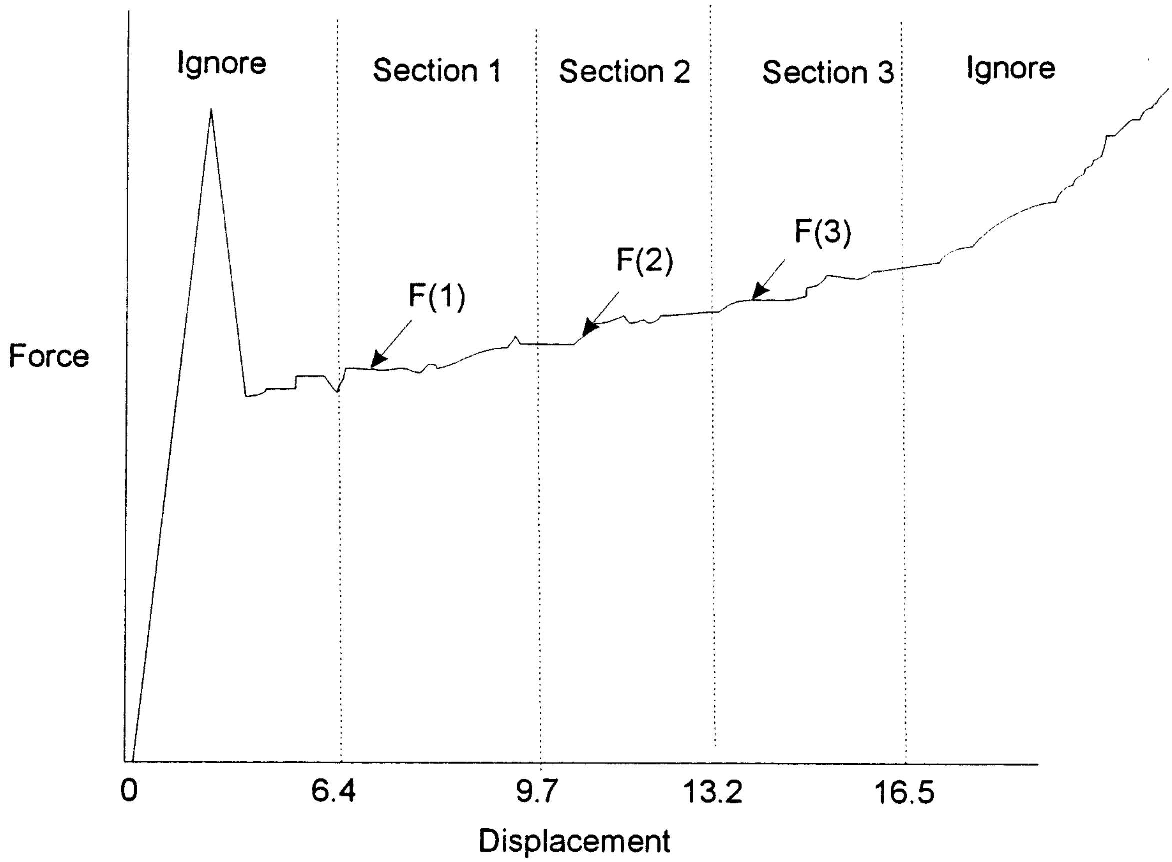


Figure 4
Crush Force and Displacement

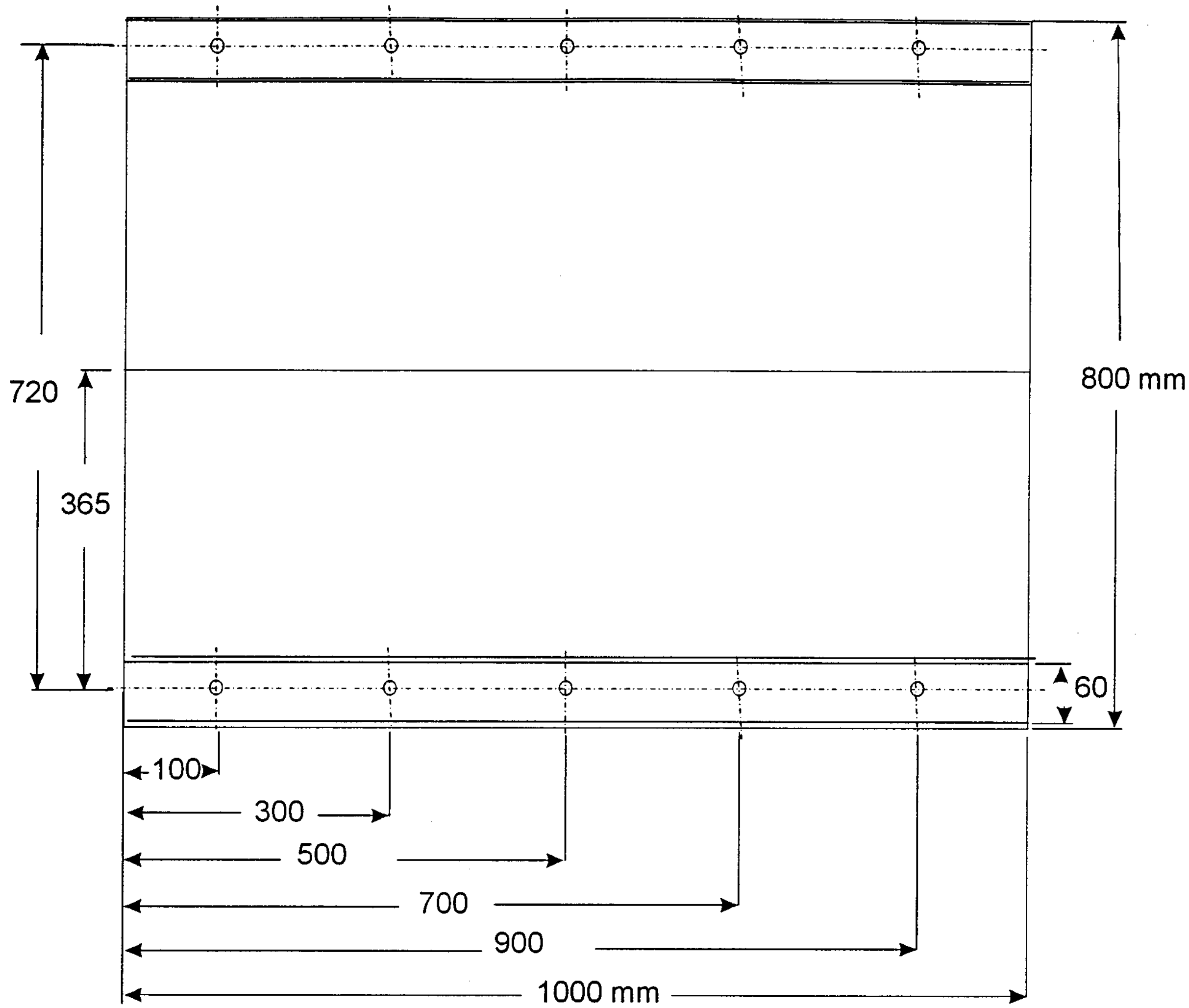


Figure 5
Positions of Holes for Barrier Mounting

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PART 595—RETROFIT ON-OFF SWITCHES FOR AIR BAGS

16. The authority citation for part 595 would continue to read as follows:

Authority: 49 U.S.C. 322, 30111, 30115, 30117, 30122 and 30166; delegation of authority at 49 CFR 1.50.

17. Section 595.5 would be amended by revising paragraph (a) and adding paragraph (b)(6) to read as follows:

§ 595.5 Requirements.

(a) Beginning January 19, 1998, a dealer or motor vehicle repair business may modify a motor vehicle manufactured before September 1, 2005 by installing an on-off switch that allows an occupant of the vehicle to turn off an air bag in that vehicle, subject to the conditions in paragraphs (b)(1) through (6) of this section:

(b) * * *

(6) The vehicle was not certified to meet the advanced air bag requirements of Federal Motor Vehicle Safety Standard No. 208, i.e., the requirements specified in S15, S17, S19, S21, S23, and S25 of 49 CFR 571.208.

Issued: September 1, 1998.

L. Robert Shelton,

Associate Administrator for Safety Performance Standards.

Appendix—Response to Petitions

Note: The following appendix will not appear in the Code of Federal Regulations.

NHTSA has received a number of petitions and recommendations which address air bag performance requirements. These include petitions for rulemaking concerning the adverse effects of air bags, recommendations from NTSB, and petitions for reconsideration of several regulatory actions addressing this problem on an interim basis.

In this appendix, NHTSA discusses and responds to those outstanding petitions and recommendations which address air bag performance requirements. In some cases, the agency presents its initial response to a petition; in other cases, the agency discusses how today's proposal for advanced air bags provides a further response to petitions for rulemaking which have already been granted. NHTSA notes that it will respond in other notices to any outstanding petitions addressing other types of air bag-related issues, e.g., consumer information requirements and retrofit on-off switches.

A. Petitions Requesting That New Test Requirements Be Added to Standard No. 208

1. August 1996 Petition From AAMA

As part of AAMA's August 1996 petition requesting that an unbelted sled test be allowed as an alternative to the existing unbelted barrier crash test to facilitate quick depowering of air bags, that organization also petitioned the agency to propose driver and passenger out-of-position occupant test requirements, based on the latest ISO test practices, as a way of testing the injury potential of air bags for those occupants. AAMA recommended that the agency use the Hybrid III 5th percentile adult female dummy at the driver position and an appropriate child dummy at the passenger position. AAMA stated that additional work was needed to more fully develop the ISO protocol to a level appropriate for an amendment to Standard No. 208.

Today's proposal for advanced air bags includes out-of-position occupant requirements based on the ISO test procedures, using the Hybrid III 5th percentile adult female dummy and several child dummies. This notice is therefore in further response to AAMA's petition.

2. September 1996 Petition From Anita Glass Lindsey

On September 1, 1996, Anita Glass Lindsey submitted a petition to amend Standard No. 208 to specify use of a 5th percentile adult female test dummy in testing vehicles for compliance with the standard's air bag requirements. NHTSA granted the petition in the preamble its NPRM concerning depowering. 62 FR 807, 827; January 6, 1997. The agency stated that it contemplated initiating a new rulemaking proceeding to propose the adoption of a 5th percentile adult female dummy and to specify injury criteria and limits, including neck injury criteria and limits, suitable for that dummy.

Today's proposal for advanced air bags proposes the adoption of the Hybrid III 5th percentile adult female dummy and related test requirements and injury criteria. The notice is therefore in further response to Ms. Lindsey's petition.

3. September 1996 NTSB Safety Recommendations

On September 17, 1996, the National Transportation Safety Board (NTSB) issued a number of safety recommendations to NHTSA for reducing the problem of child fatalities caused by air bags. These recommendations are as follows:

1. Immediately evaluate passenger air bags based on all available sources, including NHTSA's recent crash testing, and then publicize the findings and modify performance and testing requirements, as appropriate, based on the findings of the evaluation.
2. Immediately revise Federal Motor Vehicle Safety Standard 208, *Occupant Crash Protection,* to establish performance requirements for passenger air bags based on testing procedures that reflect actual accident environments, including pre-impact braking, out-of-position child occupants (belted and unbelted), properly positioned belted child occupants, and with the seat track in the forward-most position.
3. Evaluate the effect of higher deployment thresholds for passenger air bags in combination with the recommended changes in air bag performance certification testing, and then modify the deployment thresholds based on the findings of the evaluation.
4. Establish a timetable to implement intelligent air bag technology that will moderate or prevent the air bag from deployment if full deployment would pose an injury hazard to a belted or unbelted occupant in the right front seating position, such as a child who is seated too close to the instrument panel, a child who moves forward because of pre-impact braking, or a child who is restrained in a rear-facing child restraint system.
5. Determine the feasibility of applying technical solutions to vehicles not covered by NHTSA's proposed rulemaking of August 1, 1996, to prevent air bag-induced injuries to children in the passenger position.

Today's proposal for advanced air bags is responsive to these recommendations.

4. November 1996 Petitions From Public Citizen and the Center for Auto Safety

On November 8, 1996, the Center for Auto Safety (CFAS) petitioned the agency to amend Standard No. 208 to specify that a vehicle's air bags must not deploy in a crash if the vehicle's change of velocity is less than 12 mph. CFAS noted that many of the crashes resulting in air bag fatalities, especially those of children, involved very low changes in vehicle velocity.

On November 20, 1996, CFAS and Public Citizen petitioned the agency to begin rulemaking to require dual inflation air bags. In low-speed crashes, these bags would inflate more slowly, and thus less aggressively, than then-current air bags. In higher-speed crashes, they would inflate at the same rate as then-current air bags. The petitioners asserted that their proposal is the best solution in the near future and is superior to depowering, since depowering involves ''some trade-off in safety protection and will not add significant protection for unrestrained children.''

NHTSA considered and discussed these petitions during its depowering rulemaking. The agency believes that higher deployment thresholds and dual or multiple level inflators are among the available alternatives for reducing adverse effects of air bags. However, NHTSA is not proposing to require either alternative because it believes such a requirement would be unnecessarily design-restrictive, given the other available alternatives.

Moreover, the agency believes that neither a requirement for higher deployment thresholds alone nor a requirement for dual or multiple level inflators would be a sufficient longer term approach for the agency to adopt. NHTSA is concerned that a requirement for higher deployment thresholds would discourage the use of multiple level inflators, which the agency believes offer greater potential benefits. A requirement for multiple level inflators would be inadequate because it would not measure injury risk, e.g., the possibility that even the lower inflation level might cause fatalities to out-of-position occupants.

5. February 1997 Petition From Parents for Safer Air Bags

On February 28, 1997, Parents for Safer Air Bags petitioned NHTSA to (1) investigate the effect of temperature on air bag inflation and (2) incorporate performance requirements in Standard No. 208 that require compliance with the standard at $-40°$ C ($-40°$ F) and at 82° C (180° F).

That organization stated that it had been advised by engineering experts that temperature can materially affect air bag pressure. It supplied a graph showing how inflator performance typically varies by temperature in a tank test. It expressed concern that an occupant in Minnesota in the winter may ''bottom out'' as a result of excessive depowering while an occupant in Arizona in the summer may be struck with excessive bag punch even with depowering.

The Parents' Coalition stated that it had been advised that the most effective test protocol to insure proper air bag performance in variant climatic conditions is a static deployment with pendulum loading that simulates occupant acceleration and tests for bottom out and rebound. The petitioner stated that the air bag inflator and module should be cooled to −40° F. (and heated to 180° F.) and then tested at those temperatures.

NHTSA agrees that temperature will have an effect on any gas. Since air bag inflation is dependent on gas, temperature may have an effect on inflation characteristics. Therefore, the agency agrees that the vehicle manufacturers need to take account of temperature issues as they design their air bags. The agency notes, however, that few if any people would operate their vehicles at the extreme temperatures cited by the petitioner. Moreover, to the extent that an inflator was at an extreme temperature at the beginning of a trip, the temperature would likely move close to the occupant compartment's operating temperature after a few minutes.

The agency believes that the relevant issues to consider in responding to the Parents' Coalition petition are whether this is an issue which needs to be addressed by Federal regulation and, if so, what type of regulation. NHTSA has tentatively concluded that there is not a demonstrated need to include temperature requirements in Standard No. 208, but it is requesting comments on this issue.

NHTSA notes that, in issuing today's proposal for advanced air bags, the agency has tentatively concluded that a substantial number of additional performance requirements need to be added to Standard No. 208 to ensure that the vehicle manufacturers design their air bags to provide appropriate protection under a wider variety of circumstances. However, in the context of a statutory scheme requiring the agency to issue performance requirements (as opposed to one requiring design requirements or government approval), it is neither appropriate nor possible for the agency to address every real world variable that can affect safety. Ultimately, the vehicle manufacturers must be expected to design their vehicles not only so they meet the performance requirements specified by the Federal motor vehicle safety standards, but also in light of the full range of real world conditions their vehicles will experience.

Based on an examination of available data, NHTSA is not aware of a need to add temperature requirements to Standard No. 208. The agency has evaluated its Special Crash Investigations of air bag fatalities and serious injuries, and has been unable to find any relationship between temperature and air-bag-induced injuries.

NHTSA also believes that it would be relatively difficult to develop temperature requirements that would be appropriate for Standard No. 208. The agency does not believe that a pendulum test, by itself, would be desirable because it would not measure injury criteria.

However, the agency believes that manufacturers can, and should, consider temperature performance as they design their air bags. They are in a position to know how significant temperature variation is to the performance of a particular air bag design, and can conduct the kinds of testing that are suited to each such design.

As indicated above, while the agency has tentatively concluded that there is not a need to include temperature requirements in Standard No. 208, it is requesting comments on this issue. The agency is particularly interested in receiving comments from air bag manufacturers and vehicle manufacturers concerning what testing and other steps they have taken to ensure that air bag performance is appropriate under varying temperature conditions, the steps they have taken in the context of depowering their air bags (e.g., how they may have addressed the possibility that depowered air bags might be more likely to ''bottom out'' in cold temperatures), and how they plan to address the issue in the context of advanced air bag designs.

6. April 1998 Petition From CFAS, Consumer Federation of America, Parents for Safer Air Bags, and Public Citizen

On April 20, 1998, CFAS, Consumer Federation of America, Parents for Safer Air Bags, and Public Citizen submitted a joint petition requesting that the agency upgrade Standard No. 208 to include testing of the ''family of dummies'' in (1) barrier tests up to and including 30 mph (belted and unbelted), (2) moderate speed off-set deformable barrier tests (belted and unbelted), and (3) static tests with out-of-position dummies. The petitioners stated that this comprehensive set of tests would ensure that air bag systems are safe and effective in ''real world'' crash conditions, not just in the ''single crash scenario'' in the present standard.

The petitioners argued that the present requirements in Standard No. 208 are under-inclusive, since they require testing only of the properly positioned, average-sized adult male dummy in a 30 mph collision. They stated that the standard omits testing of child sized dummies, small women dummies, out-of-position dummies, and dummies of any size and position in low-speed collisions. The petitioners also stated that the standard omits off-set crashes into a deformable barrier—tests that reveal the ability of the crash sensor to promptly detect the crash event and deploy the bag before the occupant has had time to move dangerously close to the air bag.

According to the petitioners, these gaps in Standard No. 208 have allowed air bag systems to enter the market that have caused severe and fatal injuries to child passengers and small women drivers in minor collisions. The petitioners believe that the solution is the upgrading of Standard No. 208's air bag performance requirements, as summarized earlier in this section.

The petitioners also emphasized that they believe the unbelted 30 mph barrier test should be reinstated. Noting that some automobile manufacturers are urging permanent elimination of that test in favor of the current sled test option, the petitioners stated that the agency should reject this recommendation due to the serious inadequacies of the sled test. Among other things, the petitioners stated that the sled test (1) uses a ''fictitious'' 125 millisecond crash pulse that fails to account for the fact that some vehicles have a much faster crash pulse; (2) does not allow observation of how the vehicle crushes; (3) does not allow observation of the occupant's interaction with the vehicle structure in an actual crash (the so-called occupant ''kinematics''); and (4) fails to test the effectiveness of the vehicle's crash sensors.

NHTSA notes that it received this petition as it was nearing completion of its proposal for advanced air bags. Nonetheless, the agency has carefully analyzed the petition. The agency believes that while not identical, today's proposal is essentially consistent with the approach recommended by the petitioners. Accordingly, the agency has decided to grant the petition and views today's proposal as responsive to the petition.

NHTSA notes that it agrees with the petitioners that the current requirements of Standard No. 208 are under-inclusive and need to be upgraded. However, the agency believes it is incorrect to characterize the standard's longstanding barrier test requirements as ''a single crash scenario.'' Given that the current standard specifies that vehicles must be able to comply with the barrier test at different speeds, different angles, and with both belted and unbelted dummies,[23] the standard simulates a wide variety of real world crash scenarios. However, the agency agrees that the standard needs to be upgraded so that it directly addresses a number of crash scenarios not simulated by the barrier test, such as ones involving out-of-position occupants.

B. Petition Requesting Extension of the Provision Allowing On-Off Switches for Vehicles Without Rear Seats or With Small Rear Seats

On January 6, 1997, NHTSA published a final rule in the **Federal Register** (62 FR 798) extending until September 1, 2000 the time period during which vehicle manufacturers are permitted to offer manual on-off switches for the passenger-side air bag for vehicles without rear seats or with rear seats that are too small to accommodate rear facing infant seats. The agency extended the option from an earlier date so that manufacturers would have more time to implement better, automatic solutions.

GM requested the agency to reconsider its position regarding this ''sunset'' date. That company essentially argued that there is still

[23] As discussed elsewhere in this notice, the standard currently includes an unbelted sled test option that may be selected as an alternative to the unbelted barrier test.

considerable uncertainty as to whether such automatic solutions will be available by September 1, 2000.

NHTSA has decided to grant GM's petition. In today's proposal for advanced air bags, the agency is proposing, among other things, to require automatic means for ensuring that passenger air bags do not pose a risk to children in rear facing infant seats. In developing this proposal, the agency has considered the lead time needed to implement these solutions. The agency has therefore tentatively concluded that it should extend the date for this ''sunset'' so that the temporary amendment would expire as the upgraded performance requirements are phased in.

During the proposed phase-in, manual on-off switches would not be available for any vehicles certified to the upgraded requirements, but would be available for other vehicles if those vehicles do not have rear seats or have rear seats that are too small to accommodate rear facing infant seats.

C. Petitions Requesting a Permanent Option of Using Unbelted Sled Test Instead of Unbelted Barrier Test

As discussed earlier in this notice, NHTSA is proposing to amend Standard No. 208 to improve occupant protection for occupants of different sizes, belted and unbelted, while minimizing the risk to infants, children, and other occupants from injuries and deaths caused by current air bag designs. The current standard provides vehicle manufacturers with the flexibility necessary to introduce advanced air bags, but does not require them to do so.

Partially because Standard No. 208 has always provided the flexibility to address the problem of out-of-position occupants, the agency specified in its depowering rulemaking that the alternative sled test was a temporary measure, instead of a permanent one. NHTSA explained that there is no need to permanently reduce Standard No. 208's performance requirements to enable manufacturers to choose alternatives to the current single inflation level air bags and thus avoid the adverse effects of those air bags. Those requirements permit manufacturers to install air bags that adapt deployment based on one or more factors such as crash severity, belt use, and occupant size, weight or position, or that inflate in a manner that is not seriously harmful to out-of-position occupants.

NHTSA decided to make the alternative sled test available until advanced air bags could be introduced. It specified that the alternative sled test would ''sunset'' on September 1, 2001, based on its judgment in the Spring of 1997 that vehicle manufacturers could install some types of advanced air bags in their fleets by that date. The agency recognized, however, that there was uncertainty as to how quickly advanced air bags could be incorporated into the entire fleet. Accordingly, the agency indicated that it would revisit the sunset date, to the extent appropriate, in its future rulemaking on advanced air bags. See 62 FR 12968, March 19, 1997.

NHTSA received four petitions requesting that the agency eliminate the sunset date for the alternative unbelted sled test. The petitions were submitted by AAMA, AIAM, Ford, and IIHS.

The agency notes that the sunset date (September 1, 2001) specified in the standard has been superseded by the NHTSA Reauthorization Act of 1998. The Act ensures that the sled test option will remain in place at least until the vehicle manufacturers introduce advanced air bags. As discussed earlier in this notice, the Act provides that the unbelted sled test option ''shall remain in effect unless and until changed by [the final rule for advanced air bags].'' The Conference Report states that the current sled test certification option remains in effect ''unless and until phased out according to the schedule in the final rule.''

Since the Act overrides the provision in Standard No. 208 sunsetting the sled test alternative, the Act effectively moots the petitions for reconsideration concerning that provision. Accordingly, there is no need to set out the arguments made in those petitions. Further, those arguments and their underlying premises have themselves been superseded in some respects by the Act, having been submitted long before the air bag provisions of the Act were formulated and enacted. For example, many of those arguments were premised on the continued use of the current, single inflation level air bags, instead of the advanced air bags mandated by Congress in the Act.

Nevertheless, those arguments were generally considered by the agency before deciding to propose terminating the sled test alternative. The following discussion supplements the discussion in the preamble of the reasons for issuing that proposal.

Adoption in 1997 of the Temporary Sled Test Option. AAMA first petitioned the agency to provide a sled test alternative to the unbelted barrier test requirements in August 1996. By the time that organization submitted its petition, it had become clear that while the single inflation level air bag designs then being installed by the industry were highly effective in reducing teenager and adult fatalities from frontal crashes, they also sometimes caused fatalities to out-of-position occupants, especially children, in low speed crashes. NHTSA and the industry were then seeking solutions that could be implemented quickly to reduce the adverse effects of air bags, while also maintaining, to the extent possible, the benefits of air bags.

In analyzing AAMA's rulemaking petition, the agency recognized that there were downsides to the approach recommended by that organization. Unlike a full scale vehicle crash test, a sled test does not, and cannot, measure the actual protection that an occupant will receive in a crash. The test can measure limited performance attributes of the air bag, but not the performance provided by the full air bag system, much less the combination of the vehicle and its occupant crash protection system. It is that combination that determines the amount of protection actually received by occupants in a real world crash.

NHTSA was faced with a difficult decision in evaluating AAMA's rulemaking petition to permit use of the sled test. The agency wanted the industry to quickly mitigate the adverse effects of its then-current air bag designs, which the auto industry said it would do if the agency adopted the sled test, but the agency did not want to reduce the protection being ensured by Standard No. 208.

Faced with this dilemma, NHTSA carefully analyzed whether a reduction in stringency of the Standard was necessary in the short term to address adverse effects of air bags to out-of-position occupants. A review of the record showed that a wide range of technological solutions were, and had been, available to prevent adverse effects of air bags, and still enable vehicles to meet Standard No. 208's barrier crash test requirements.[24] However, these technologies generally could not be implemented as quickly as depowering.

In light of the rulemaking record before it, NHTSA decided to adopt the sled test alternative requested by the auto industry[25] and supported by others to be absolutely sure that, given the air bag designs then being used by the industry, the vehicle manufacturers had the necessary flexibility to address the problem of adverse effects of air bags in the shortest time possible. The agency recognized that there were longer term technological solutions that did not require a reduction in the safety protection afforded by Standard No. 208. It further recognized that many or most vehicles could have their air bags substantially depowered and still meet the standard's longstanding barrier test requirements. Nevertheless, NHTSA wanted to make sure that the standard did not prevent quick action by the manufacturers that would reduce air bag risks while still providing a measure of protection.

The agency took this action because the sled test offered advantages that, in the short

[24] In its 1984 decision, the Department had expressly recognized that the vehicle manufacturers had raised concerns about potential adverse effects of air bags to out-of-position occupants. In response to those concerns, the Department had identified a variety of available technological means for addressing those risks. The July 11, 1984 Final Regulatory Impact Analysis (FRIA) listed a variety of potential technological means for addressing the problem of injuries associated with air bag deployments (FRIA, pp. III–8 to 10) including dual level inflation systems and other technological measures such as bag shape and size, instrument panel contour, aspiration, and inflation technique. It also noted that a variety of different sensors could be used to trigger dual level inflation systems, e.g., a sensor that measures impact speed, a sensor that measures occupant size or weight and senses whether an occupant is out of position; and an electronic proximity sensor. However, the auto manufacturers generally did not adopt any of these technologies.

[25] The sled test alternative adopted by NHTSA, with a 125 msec pulse, had a more stringent pulse than the one first advocated by AAMA. That organization first recommended a 143 msec pulse. However, testing by NHTSA showed that a vehicle could pass Standard No. 208's requirements without an air bag with the 143 msec pulse. The more stringent pulse was recommended by AAMA in a later submission. Further testing by the agency showed that some vehicles could pass Standard No. 208's requirements without an air bag even with the 125 msec pulse. Given this testing, NHTSA added new neck injury criteria to the sled test alternative, to help ensure that the vehicle manufacturers did not depower their air bags to a point where they would provide little benefit.

run, outweighed the fundamental shortcomings of that test as a representation of potentially fatal real world crashes and thus as a reliable predictor of real world performance. Much of the sled test's short run value lay in the fact that it was simpler and less costly to conduct than a barrier crash test and that, by simplifying compliance testing through removal of some of the key elements related to real world performance, it made compliance much easier to achieve, and to demonstrate.

At the same time, the agency made it clear that it viewed the reduction in the standard's safety requirements as a short-term interim measure, while the vehicle manufacturers develop and implement better solutions. 62 FR 12968. The agency considered the sled test to be a short term means of ensuring that the vehicle manufacturers could quickly depower all of their air bags, but not an effective long-term means for measuring a vehicle's occupant protection.

Proposal to Sunset the Sled Test Option. NHTSA has proposed to sunset the unbelted sled test option in part because the agency believes that ensuring continued protection of unbelted occupants is vital to motor vehicle safety. About half of the occupants in potentially fatal crashes are still unbelted. Moreover, youth are overrepresented among unbelted victims in fatal crashes. Young people of both sexes, but particularly males, are disproportionately represented among the unbelted. It is well known that the young are more prone to risky behavior. As drivers grow older, they mature and adopt safer driving and riding habits.[26] By continuing to provide effective air bag protection for the unbelted, the agency and the vehicle manufacturers can help give young drivers and passengers a better chance of safely passing through their risk-prone years. Providing effective air bag protection for the unbelted will also help other disproportionately represented groups, such as rural residents and members of minorities.

The auto industry suggests that unbelted occupants would continue to be provided a level of protection even in the absence of an unbelted barrier test requirement. However, they have not provided any specific information concerning what level of protection would be provided. The agency tentatively concludes that such protection can best be measured, and ensured, in full scale vehicle crash tests.

In order to determine the amount of life-saving and injury-reducing protection that is provided by the combination of a vehicle and its air bags to unbelted occupants, it is necessary to test a vehicle in situations in which an unbelted occupant would, in the absence of an effective air bag, typically face a significant risk of serious injury or death. This need is met by the unbelted 48 km/h (30 mph) barrier test requirement, which is representative of a significant percentage of such real world crashes. A NHTSA paper titled ''Review of Potential Test Procedures for FMVSS No. 208,'' notes that data from the National Automotive Sampling System (NASS) indicate that the barrier crash pulse (full and oblique) represents about three-quarters of real world collisions. A copy of this paper is being placed in the public docket.

NHTSA believes that Standard No. 208 should continue to address the protection of the nearly 50 percent of all occupants in potentially fatal crashes who are still unbelted. Apart from the substantial numbers of lives at stake, the experience with current single inflation level air bags suggests that the agency should amend Standard No. 208 to ensure occupant protection in a wider variety of real world crash scenarios, rather than narrowing its scope.

Nevertheless, some petitioners have argued that NHTSA should drop the unbelted barrier requirement based on an expectation that seat belt use will substantially increase in the future. The agency recognizes that as seat belt use increases, the percentage of real world crashes that is directly represented by the unbelted barrier test decreases. However, there are several reasons why the agency tentatively concludes that dropping that test requirement would not be appropriate, particularly at this time.

First, future projections of increases in seat belt use are uncertain, and seat belt use in potentially fatal crashes is currently little over 50 percent. The agency tentatively concludes that it should not reduce safety performance requirements for nearly one-half the occupants involved in potentially fatal crashes, particularly on the basis of uncertain projections about future seat belt use.

Second, even as seat belt use increases, the persons not using seat belts will tend to be over-involved in potentially fatal crashes. Teenagers are among the persons least likely to use seat belts. They are also much more likely than other groups to be involved in potentially fatal crashes. Moreover, even in countries where seat belt use is 90 percent, unbelted occupants still represent about 33 percent of all fatalities.

The arguments made by the petitioners regarding the effect of the barrier test on air bag performance were typically premised on the continued use of the current, one-size-fits-all, air bag designs. They did not address the range of advanced air bag technologies that may be employed to meet the barrier test requirements. The issue about the compliance tests that should be used in the future should be determined in the context of the air bag technology to be used in the future, and not in the context of the older air bag designs currently in use. When the full range of advanced air bag technologies is considered, the agency believes that it is apparent that the vehicle manufacturers can address the adverse effects of air bags to out-of-position occupants, and provide excellent protection to both belted and unbelted occupants.

The agency believes the appropriate solution to the current air bag problems is to preserve and enhance the life-saving and injury-reducing benefits that air bags are providing to all occupants, belted and unbelted, while dramatically reducing or eliminating fatalities and serious injuries caused by air bags. In the longer run, the agency believes its plan to adopt requirements for advanced air bags and maintain an effective unbelted vehicle test requirement will achieve this goal.

The agency believes that justifying the elimination of the unbelted barrier test based on the shortcomings of current (or pre-depowered) air bag designs has parallels to the rationale for the agency's decision in the early 1980's to rescind the automatic restraint requirements. The agency rescinded those requirements for the stated reason that many vehicle manufacturers had initially chosen to comply with them by detachable automatic seat belts, instead of either nondetachable automatic seat belts or air bags, and that those detachable belts might not significantly improve vehicle safety. The U.S. Supreme Court unanimously concluded that the appropriate regulatory response to ineffective or undesirable design choices by the vehicle manufacturers regarding automatic restraints was not simply to rescind the requirements for those restraints, but first to consider the alternative of amending the requirements to ensure better technological choices in the future. *Motor Vehicle Mfrs. Ass'n* v. *State Farm Mut. Auto. Ins. Co.,* 403 U.S. 29 (1983). The reasoning underlying that decision suggests that the fact that the air bag designs chosen to date do not meet all safety considerations is not a sufficient reason, by itself, to undercut or negate the broad, longstanding performance requirements for air bags, given that there are other, superior alternative designs from which to choose. Instead, the appropriate long-term solution is to amend the requirements to ensure that the manufacturers select and install better air bag designs in the future.

In arguing for permanent retention of the sled test, the petitioners made a number of arguments about the potential benefits of depowered air bags. However, NHTSA does not believe that it is necessary to retain the sled test to obtain the benefits of depowered air bags. Ultimately, the issue is not whether some vehicles with depowered, single inflation level air bags do not today meet the 48 km/h (30 mph) barrier test requirement. As noted above, the issue about future compliance tests should be determined in the context of future air bag technology, and not in the context of today's less sophisticated air bag designs. Various advanced air bag technologies can be used that will provide full protection in compliance with such substantial test crashes, while not injuring out-of-position occupants.

As discussed above, the primary reason NHTSA decided to adopt the temporary sled test alternative in its depowering rulemaking was because of its desire to ensure that the vehicle manufacturers could depower all of their single inflation level air bags quickly. The certification testing that vehicle manufacturers would have needed to conduct to ensure that their depowered air bags continued to meet the 48 km/h (30 mph) barrier test would have prevented the quick depowering of all air bags. However, the agency did not determine that multi-inflation

[26] The National Occupant Protection Use Survey (NOPUS) reported in August 1997 that young adults (16–24 years old) were observed with the lowest belt use rate (less than 50%) of any of the reported observed categories. The NOPUS data report findings of trained observers at controlled intersections. A copy of the NOPUS report is available at the NHTSA web site under the category ''Reports and Research Notes''.

level or even single inflation level depowered air bags could not, given sufficient time, be produced that would also meet the 48 km/h (30 mph) barrier test.[27]

In this connection, the agency notes that, based on very limited data, it appears that many, perhaps most, vehicles with depowered air bags continue to meet Standard No. 208's unbelted barrier test requirements by wide margins. NHTSA has tested five vehicles with depowered driver air bags in unbelted 48 km/h (30 mph) rigid barrier tests, and all passed Standard No. 208's injury criteria by significant margins.[28] The agency has tested six vehicles with depowered passenger air bags in unbelted 48 km/h (30 mph) rigid barrier tests, and all but one passed the standard's injury criteria performance limits by significant margins.[29]

NHTSA notes that the petitioners suggested that it should evaluate the real world safety impacts of depowering before deciding whether to restore the barrier test. This suggestion does not take into account the limitations of the sled test alternative for measuring the occupant protection provided in a potentially fatal crash, especially as compared to an actual crash test. Further, there is some question whether determining the level of protection provided by the current depowered air bags would enable the agency to assess the level of safety ensured by the sled test. The sled test gives vehicle manufacturers broad flexibility to design and install air bags that are significantly more depowered than the current depowered air bags. In comparing regulatory alternatives, the question for the agency to answer is the level of safety protection actually required by different alternatives instead of the safety protection that is currently provided, or may in the future be provided, voluntarily by the manufacturers.

These concerns are particularly relevant in considering any kind of permanent change to a safety standard. Since the agency analyzed the sled test amendment as a relatively short-term, interim means of ensuring that manufacturers could quickly depower their vehicles' existing air bags, it primarily analyzed the safety impacts of the changes the vehicle manufacturers said they would make. The agency did not analyze the safety implications of replacing the barrier test with a sled test on a long-term basis.

NHTSA does not know what kind of occupant protection the vehicle manufacturers would chose to provide if the sled test alternative were made permanent. As indicated above, based on very limited data, it appears that many vehicles with depowered air bags continue to meet Standard No. 208's unbelted barrier test requirements by wide margins. If the manufacturers continued to voluntarily meet the barrier test requirements for nearly all of their vehicles, the safety impacts of the sled test alternative would obviously be minimal.

However, the agency has no assurance that the vehicle manufacturers would continue to voluntarily meet the barrier test requirements if the sled test alternative were made permanent. The vehicles with depowered air bags being produced in model year 1998 were not primarily designed to meet the sled test. Instead, the vehicles were designed several years ago to meet the barrier test requirements but now have depowered air bags. There is no way of reliably predicting how the vehicle manufacturers would design their vehicles in the context of a permanent sled test alternative.

As to concerns about international harmonization, NHTSA supports international harmonization, when it is consistent with the adoption of best safety practices. For the reasons discussed above, the agency tentatively concludes that permanent retention of the sled test alternative would not be consistent with best safety practices.

Questions for commenters concerning the proposed sunsetting. While the information currently available to the agency on balance supports the proposal to sunset the sled test, the agency wishes to have as much information as possible to aid it in making a sound final decision regarding this proposal. To the end, the agency invites public comment on:

1. *Criteria for assessing tests.* What objective criteria should be used to evaluate and compare the available alternative types of compliance test procedures, e.g., the rigid barrier crash test and the sled test. Such criteria might include, but not be limited to:

A. Impact of a procedure on design flexibility;

B. Extent to which a procedure ensures that good real world performance is provided;

C. Extent to which a procedure creates the potential for degradation of real world performance;

D. Extent to which a procedure is representative of the varied real world crashes in which serious and fatal injuries occur; and

E. Administrative considerations, such as repeatability and costs of test conducted pursuant to a procedure.

2. *Comparison and ranking of tests.* How do the alternative test procedures rank when compared to each other based on the criteria listed above and any other appropriate objective criteria, *and* based on advanced air bag technology? The agency emphasizes that any comparisons submitted to the agency should be forward-looking ones in terms of technology. Some past comparisons of the barrier crash test and sled test have been of limited utility and relevance because they have been premised on the continued use of old air bag technology.

D. Petition Objecting to NHTSA's Final Rule on Depowering

Donald Friedman petitioned the agency to reconsider its decision to allow the sled test alternative even on a temporary basis. He argued that the problem of fatalities in low-speed air bag deployment crashes arose because some motor vehicle manufacturers failed to fully meet their legal responsibilities, that NHTSA responded belatedly and inappropriately with an amendment that will not prevent some of the low speed crash deployment fatalities, that the sled test amendment compromises the safety purpose of Standard No. 208 so that the standard no longer meets the need for motor vehicle safety, and that the agency had not formally considered all reasonable, available alternatives.

Mr. Friedman asked that the rulemaking be reopened with a broader spectrum of proposed options. He stated that NHTSA should not take at face value the industry's claim that the only way it can respond to the current situation is to depower air bags. The petitioner stated that, at a minimum, the options should include (1) making no change in the standard while encouraging manufacturers to raise the minimum crash speed at which air bags deploy, (2) recommending under any depowering option that manufacturers use more effective belt-use inducements in their new vehicles, and (3) recommending that manufacturers offer pedal extension attachments for short people who request them.

The petitioner also requested that the agency consider alternatives for the period after the next several years, including that NHTSA recommend that manufacturers use available voluntary consensus standards organizations or professional societies to draft recommended practices for air bag safety within the requirements of the original Standard No. 208. The petitioner stated that he opposes rulemaking to add major requirements to reduce the potential of harm from air bag deployment. Mr. Friedman stated that it took 20 years to get the automatic crash protection standard in place, and it is unlikely that the agency could make a major revision of this standard effective in less than a decade.

After carefully considering Mr. Friedman's petition, the agency has decided to deny it. NHTSA believes that it considered a reasonable range of interim approaches for addressing the problem of adverse effects from air bags, and that the temporary depowering amendment was a reasonable part of the interim approach selected by the agency.

The agency notes that it addressed a range of alternatives in both the NPRM and the final rule for depowering. Contrary to the allegation of the petitioner, NHTSA did not take at face value the industry's claim that the only way it can respond to the current situation is to depower air bags. In the final rule on depowering, NHTSA explained its position on this subject as follows:

NHTSA notes that, in its January 1997 proposal, it discussed a variety of alternative approaches for addressing the adverse effects of air bags, including higher deployment thresholds, dual level inflators, smart air

[27] Depowering has a very short leadtime because it can be accomplished simply by reducing the amount of propellant in existing air bag designs. If longer leadtime is assumed, however, manufacturers can make air bags less aggressive by means such as changing folding patterns and deployment paths, with a smaller chance of creating difficulties with respect to the barrier test requirements.

[28] These vehicles included the Taurus, Explorer, Neon, Camry and Accord.

[29] The vehicles which passed the standard's injury criteria by significant margins included the Taurus, Explorer, Caravan, Camry and Accord. The exception was the Neon.

bags, and various other changes to air bags. In issuing its proposal, the agency recognized that, for many vehicles, depowering has a shorter lead time than any of the other alternatives. The agency also explained that a change in Standard No. 208 is not needed to permit manufacturers to implement these other alternatives. The agency explained further:

The agency expects to ultimately require smart air bags through rulemaking. In the meantime, the agency is not endorsing depowering over other solutions. Instead, the agency is proposing a regulatory change to add depowering to the alternatives available to the vehicle manufacturers to address this problem on a short-term basis. To the extent that manufacturers can implement superior alternatives for some vehicles, the agency would encourage them to do so.

NHTSA shares the concern of the Parent's Coalition that depowering will not likely save all children and will likely result in trade-offs for adults. That is why the agency is limiting the duration of its depowering amendments and plans to conduct rulemaking to require smart air bags. In the meantime, however, NHTSA wants to be sure that the vehicle manufacturers have the necessary tools to address immediately the problem of adverse effects of air bags. Standard No. 208's existing performance requirements do restrict the use of depowering, since substantially depowering the air bags of many vehicles would make those vehicles incapable of complying with the standard's injury criteria in a 30 mph barrier crash test. Accordingly, to permit use of this alternative, it is necessary to amend Standard No. 208.

The issuance of any rule narrowing the discretion that vehicle manufacturers have had since the 1984 decision, whether by requiring depowering, higher thresholds, other changes to air bags, or smart air bags, would involve considerably more complex issues than a rulemaking simply adding greater flexibility. The agency would need to assess safety effects, practicability, and leadtime for the entire vehicle fleet. NHTSA will assess those types of issues in its rulemaking for smart air bags. The agency notes that there may not be any reason to have higher deployment thresholds with some types of smart air bags, since a low-power inflation may be automatically selected for low severity crashes.

Until the agency conducts its rulemaking regarding smart air bags, it believes it is best to focus on ensuring that manufacturers have appropriate flexibility to address the problem of adverse effects of air bags. This will enable the manufacturers to select the solutions which can be accomplished most quickly for their individual models. NHTSA encourages the vehicle manufacturers to use the best available alternative solutions that can be quickly implemented for their vehicles, whether depowering, higher thresholds, other changes to air bags, smart air bags, or a combination of the above. The agency notes again that the vehicle manufacturers need not wait for further rulemaking to begin installing smart air bags, and encourages them to move in that direction expeditiously.

NHTSA notes that Mr. Friedman did not address or challenge the specific rationales provided by the agency for the temporary depowering amendment. Moreover, he did not address the agency's overall comprehensive plan of rulemaking and other actions addressing the adverse effects of air bags, or explain why his various recommendations constitute a better approach. (This comprehensive plan was discussed in the depowering final rule at 62 FR 12961–62). Accordingly, the agency has concluded that the petitioner has not provided a basis for reopening the depowering rulemaking.

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