

# Memorandum

U.S. Department  
of Transportation

**Federal Aviation  
Administration**

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Subject: **INFORMATION:** Policy Statement on Conducting  
Component Level Tests to Demonstrate Compliance with  
§§ 25.785(b) and (d)

Date: May 9, 2005

From: Manager, Transport Airplane Directorate, Aircraft  
Certification Service, ANM-100

Reply to  
Attn. of: ANM-03-115-31

To: See Distribution

Regulatory §§ 25.785(b) and (d)  
Reference:

The purpose of this memorandum is to provide Federal Aviation Administration (FAA) certification policy on conducting component level tests in order to demonstrate compliance with the requirements of §§ 25.785(b) and (d). The tests described herein provide a standardized approach by which each potentially injurious item located within the headstrike zone can be assessed for occupant injury potential. These test methods are the product of an Aviation Rulemaking Advisory Committee recommendation and are harmonized with the Joint Aviation Authorities (JAA) and Transport Canada.

Although this policy memorandum focuses primarily on describing component level tests for seatback mounted accessories installed within the striking radius of the head, the same test methodologies can be applied more generally to any surface or other items that may be potentially injurious and are located within the headstrike zone (e.g., escape slide bustles, and tables, etc.) that need to be addressed for compliance with §§ 25.785(b) and (d).

In addition to §§ 25.785(b) and (d) blunt trauma requirements, some aircraft certification bases include the additional (and more stringent) requirements of § 25.562(c)(5). For these airplanes, protection must also be provided so that the head impact does not exceed a head injury criterion (HIC) measurement of 1000 units. The tests described herein do not address compliance with § 25.562(c)(5) HIC requirements.

## **Current Regulatory and Advisory Material**

Section 25.785(b), Amendment 25-88, requires that each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing be designed so that a person making proper use of those facilities will not suffer serious injury in an emergency landing as a result of inertia forces specified in §§ 25.561 and 25.562.

Section 25.785(d), Amendment 25-88, requires, in pertinent part, that each occupant of a forward or aft facing seat be protected from head injury by the elimination of injurious objects within the striking radius of the head.

These same occupant injury protection requirements have existed within § 25.785 (with the exception of reference to § 25.562 which was added by Amendment 25-64) since the adoption of part 25. As such, the policy contained within this memorandum can be utilized for demonstrating compliance with § 25.785 at all amendments. This policy cannot, however, be used in lieu of HIC testing for airplanes whose certification bases specifically require compliance with the requirements of § 25.562(c)(5). Attachment 1 provides additional information for determining how certification bases considerations affect the applicability of the tests described herein.

In order to demonstrate compliance with §§ 25.785(b) and (d), two injury mechanisms must be examined. The first consideration is blunt trauma injuries experienced by the occupant resulting from the crash loads. This policy memorandum describes three impact test methods that can be used to evaluate blunt trauma injuries. The second injury mechanism is sharp or injurious edges or features. Sharp or injurious edges or features could cause additional injury and thus impede occupants from exiting the airplanes after a crash; they are therefore not acceptable. They are not allowed as design features of airplane interiors, nor are they allowed to be formed as a result of the impact tests described within this policy memo. Both injury mechanisms (i.e., blunt trauma and sharp or injurious edges or features) must be successfully addressed in order to make a determination of compliance with the requirements of §§ 25.785(b) and (d).

Advisory Circular (AC) 25-17, paragraph 81b(4), as supplemented by FAA memorandum dated July 13, 1994, provided a method for demonstrating compliance with § 25.785 blunt trauma requirements using a comparative bowling ball test. This approach allowed an applicant to compare the characteristics of a new (i.e., unapproved) feature against a previously approved configuration. If the blunt trauma characteristics (measured by bowling ball impact accelerations) associated with the new feature were less severe than the previously approved configuration, they were considered acceptable. Advisory Circular 25-17 also described an assessment of the test article for sharp or injurious edges or features post-test.

We recognized that there were shortcomings with the bowling ball test policy as it was originally published. Because of these shortcomings, we noted in the July 13, 1994, memorandum our intent to develop more comprehensive policy on this subject. As such, this policy memorandum supersedes the guidance contained in AC 25-17, paragraphs 81b(4)(i) through b(4)(iv) regarding the bowling ball test pass/fail criteria and the subsequent FAA memorandum on this same subject, dated July 13, 1994. Likewise, the impact device described in Society of Automotive Engineers (SAE) standard J921 essentially performs the same function as the bowling ball test and therefore is also no longer acceptable for demonstrating compliance with the

requirements of §§ 25.785(b) and (d). This policy memorandum does not supersede any of the other methods of compliance pertaining to §§ 25.785(b) and (d) contained within AC 25-17. The remaining allowable methods of compliance described in AC 25-17 include padding potentially injurious surfaces and relocating objects outside of the headstrike zone.

Implementation of this new policy memorandum does not nullify any previously completed compliance determinations. However, all new compliance determinations should be made in accordance with this policy memorandum, the remaining methods of compliance identified in AC 25-17, or other methods of compliance established through the issue paper process.

### **Policy**

Sections 25.785(b) and (d) require that seatbacks, components mounted on the seatbacks (such as video monitors, telephones, cup holders, etc.), and any other objects located within the striking radius of the head, be designed to prevent serious injury to an occupant whose head would impact the objects as a result of the emergency landing inertia forces.

We have determined through 16g row to row dynamic tests that seatback accessories totaling less than three pounds do not exceed the performance criteria described below when installed in seatbacks that provide at least one inch of permanent deformation. Industry data indicate that “standard” airline passenger seatback designs generally provide more than one inch of permanent deformation. As a result, data substantiating seatback deformation is not required unless the seatback design contains unusual features that significantly increase the stiffness beyond that of traditional passenger seats.

If the seatback has been stiffened such that the one-inch permanent deformation assumption is questionable, testing may be required. For example, a business class pod seat with a separate composite seatback privacy shroud would not be considered a “standard” seatback and may require further investigation. Standard seatback designs containing accessories whose combined weight is less than three pounds can be accepted without further assessment for blunt trauma injury potential. These items still require assessment for the creation of sharp or injurious edges or features resulting from occupant impact.

In order to generate compliance determinations for which the objectives may be clearly met, the test methods require, by necessity, determinate pass/fail criteria. As noted in this policy, other acceptable methods of compliance which may not meet these criteria may be proposed. The inclusion of determinate pass/fail criteria is a change from the approach that was previously accepted, which allowed approval based solely on comparative analysis. This change is necessary because the comparative bowling ball test could not adequately discriminate between injurious and non-injurious features. For example, a traditional seatback could have very effective energy absorption characteristics.

However, this very effective energy absorbing seatback could be modified to include an item such as an “XYZ brand” video monitor, which could result in *slightly* degraded energy absorption characteristics. Under these circumstances, applying the guidance provided in AC 25-17, as modified by the FAA memorandum dated July 13, 1994, would lead one to conclude that the video monitor installation was unacceptable.

The converse was also possible; an applicant could present a very rigid “standard” seatback that provided very little energy-absorbing capability. Because “standard” seatbacks have been traditionally accepted as being adequately delethalized by inspection, an applicant could then show by comparison that the addition of the same “XYZ brand” video monitor would slightly improve the energy-absorption characteristics of the seatback assembly due to the somewhat crushable nature of the video monitor screen. The applicant could then conclude that the monitor that was determined to be unacceptable in the first example would be acceptable in the second example, even though the seat in the first example would provide greater occupant injury protection. This was not the intent of the previous guidance; therefore, we have determined that changing to absolute pass/fail criteria is necessary.

#### Test Methods

In order to determine whether or not an item is “injurious” from a blunt trauma perspective, the item should be installed in a seatback and subjected to an impact test using either a 13 pound bowling ball, a Free Motion Headform as defined in 49 CFR part 572, subpart L, or a Head Component Test Device. Schematics describing each type of test and the corresponding pass/fail criteria are contained in detail in Attachments 2 through 4. If a seatback contains more than one potentially injurious item, the test should be repeated to strike each potentially injurious item using one of the test methods described in Attachments 2 through 4. Under all three test methods potentially injurious features are struck with a test device simulating a human head traveling at a minimum velocity of 34 ft./sec. The resulting peak accelerations should not exceed 200g’s, and accelerations in excess of 80g’s should not exceed a cumulative duration of 3.0 milliseconds.

In addition to the means of compliance described in Attachments 2 through 4, it remains acceptable to utilize the other means of compliance identified above.

#### Considerations for Seat Technical Standard Order (TSO) Authorization Holders

We believe that the vast majority of these types of component tests will be conducted on seats to address occupant injury considerations. When the seat manufacturer (TSO authorization holder) uses a seatback accessory manufacturer as a supplier, they assume responsibility for the integration of the accessory in the seatback (see AIR-100 memorandum, Policy and Guidance on the Approval of Electronic Components on

Aircraft Seating Systems, dated October 27, 1998). In this case these types of tests can be conducted in parallel with the seat TSO processes but cannot be approved under the TSO authorization (or Letter of Design Approval for foreign manufacturers). If the testing is done in parallel with a TSO approval, we will accept statements made by seat TSO authorization holders regarding the pass/fail criteria pertaining to the seatback mounted accessories.

The design approval for seatback accessories is not covered by the TSO authorization. Instead, the seat TSO design approval only covers the mass, location, and means of attachment of seatback accessories. Current industry practices show that most seat TSO holders do not wish to be held accountable for the design and manufacturing responsibility of accessories. In this case, design approval and installation approval of the accessories is the responsibility of the seat installer, even though the actual integration of the accessories into the seats is most likely accomplished by the seat manufacturer. Whether responsibility for the approval of the seatback accessories is assumed by the TSO holder or the seat installer, it is acceptable for seat manufacturers to conduct the tests described in Attachments 2 through 4 to determine the occupant injury characteristics. In either case, adequate test article definition is still required, but can be encompassed by the seat manufacturer's quality control system and conformity inspection processes.

A statement from the TSO authorization-holding seat manufacturer that the seatback-mounted accessories meet the pass/fail criteria described in this memorandum along with submittal of the resultant test data should be sufficient for the installer to make a determination of compliance with §§ 25.785(b) and (d). This may be a specific statement or encompassed in a more general statement, but cannot be included in the TSO applicant's statement of conformance (per § 21.605(a)(1)), nor any other documents associated with the TSO approval (e.g., installation limitations drawing/document).

An example of the latter is as follows: The seat installer (e.g., an airplane manufacturer) includes the text from § 25.785(b) and (d) in its seat interface requirements document (or equivalent) that all seat suppliers must meet, and specifically requires that all seatback mounted accessories be evaluated for occupant injury potential (i.e., blunt trauma and sharp or injurious edges) per this memorandum. The seat supplier, upon delivery of the seats, should provide the test data and a statement to the installer that all of the requirements of the interface document have been met, thereby enabling the installer to make a determination that the occupant injury concerns have been adequately addressed.

#### Sharp and Injurious Edges

As a result of the impact tests described above, sharp edges may be formed that are injurious or may impede egress. This is not acceptable. An assessment of sharp or injurious edges must therefore be completed for each seatback mounted accessory, or any other potentially injurious item located within the headstrike zone to determine compliance with the requirements of §§ 25.785(b) and (d).

We recognize that repeated tests may be necessary to develop and refine a seat/seatback accessory configuration that meets the occupant injury requirements. As such, the costs associated with utilizing production quality accessories for repetitive impact tests can become prohibitive. In order to help reduce the costs associated with these tests, we have determined that blunt trauma evaluations and evaluations of sharp and injurious edges or features can be performed independently, if so desired. The blunt trauma tests described in Attachments 2 through 4 can be conducted utilizing surrogate test articles in accordance with FAA Policy Memorandum ANM-03-115-28, dated October 2, 2003. Likewise, a component level assessment of sharp and injurious edges and features can be made of a seatback accessory by itself, if it is rigidly mounted in a test fixture and subjected to one of the test methods described in Attachments 2 through 4. If a seatback accessory does not show the propensity to create sharp or injurious edges when tested in a rigid fixture, this is sufficient to find compliance for the article as installed.

If testing with a surrogate test article yields unacceptable blunt trauma results, or an accessory develops sharp and injurious edges or features characteristics when tested while mounted in a rigid test fixture, it may be advantageous to more accurately represent the energy-absorbing characteristics of the seat and seatback accessory acting together as a system. In these cases it may be necessary to conduct the tests described in Attachments 2 through 4 on the accessory installed in the seatback assembly. If this testing approach still does not yield acceptable results, it remains acceptable to conduct testing to meet the HIC requirements of § 25.562(c)(5), and thereafter demonstrate that no sharp or injurious features were created.

#### Considerations for Airplane Manufacturers and Airplane Modifiers

An airplane manufacturer/modifier may also utilize the methods described above and in Attachments 2 through 4 to determine that features located within the striking radius of an occupant's head are non-injurious in accordance with §§ 25.785(b) and (d). In these cases, the development of an FAA-approved test plan, test article conformity, and test witnessing responsibilities must be coordinated with the aircraft certification office with oversight responsibility for the installation or modification in accordance with FAA Order 8110.4.

#### **Effect of Policy**

The general policy stated in this document does not constitute a new regulation or create what the courts refer to as a "binding norm." The office that implements policy should follow this policy when applicable to the specific project. Whenever an applicant's proposed method of compliance is outside this established policy, it must be coordinated with the policy issuing office (e.g., through the issue paper process or equivalent). Similarly, if the implementing office becomes aware of reasons that an applicant's proposal that meets this policy should not be approved, the office must coordinate its response with the policy issuing office.

Applicants should expect that the certificating officials will consider this information when making findings of compliance relevant to new certificate actions. Also, as with all advisory material, this policy statement identifies one means, but not the only means, of compliance.

### **Implementation**

The compliance method discussed in this policy should be applied to type, amended supplemental, and amended supplemental type certification programs whose application date is on or after the date the policy is finalized. For existing certification programs whose application precedes the date this policy is effective and the methods of compliance have already been coordinated with and approved by the FAA or their designee, the applicant may continue to follow the previously acceptable methods of compliance or choose to follow the guidance contained in this policy.

/s/

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Attachments