



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: INFORMATION: Policy Statement on Acceptance of a
Component Test Method to Demonstrate Compliance with
§ 25.562(c)(2) for Replacement Seat Bottom Cushions

Date: August 9, 2005

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

Reply to ANM-115-05-005
Attn. of:

To: See Distribution

Regulatory § 25.562
Reference:

Summary

The purpose of this memorandum is to clarify Federal Aviation Administration (FAA) certification policy on a component test method for demonstrating that a seat with a replacement bottom cushion complies with § 25.562(c)(2). Specifically, this policy only addresses non-flotation monolithic (single layer) cushions. The definition of monolithic cushion, as used in this memorandum, includes cushions constructed of multiple layers of identical foam material bonded together to form a single cushion. It does not include cushions constructed of multiple layers of different foam materials bonded together to form a single cushion.

Current Regulatory Material

The applicable regulations relative to the Component Method to Demonstrate Compliance for Replacement Seat Bottom Cushions are §§ 25.562(b) and (c)(2). These lay out the regulatory basis for the installation and approval of these replacement seat bottom cushions.

Section 25.562(b) and (c)(2) states:

- (b) Each seat type design approved for crew or passenger occupancy during takeoff and landing must successfully complete dynamic tests or be demonstrated by rational analysis based on dynamic tests of a similar type seat, in accordance with each of the following emergency landing conditions. The tests must be conducted with an occupant simulated by a 170-pound anthropomorphic test dummy, as defined by 49 CFR Part 572, Subpart B, or its equivalent, sitting in the normal upright position.*
- (1) A change in downward vertical velocity (Δv) of not less than 35 feet per second, with the airplane's longitudinal axis canted downward 30 degrees with respect to the horizontal plane and with the wings level. Peak floor deceleration must occur in not more than 0.08 seconds after impact and must reach a minimum of 14g.*

- (2) *A change in forward longitudinal velocity (Δv) of not less than 44 feet per second, with the airplane's longitudinal axis horizontal and yawed 10 degrees either right or left, whichever would cause the greatest likelihood of the upper torso restraint system (where installed) moving off the occupant's shoulder, and with the wings level. Peak floor deceleration must occur in not more than 0.09 seconds after impact and must reach a minimum of 16g. Where floor rails or floor fittings are used to attach the seating devices to the test fixture, the rails or fittings must be misaligned with respect to the adjacent set of rails or fittings by at least 10 degrees vertically (i.e., out of parallel) with one rolled 10 degrees.*
- (c) *The following performance measures must not be exceeded during the dynamic tests conducted in accordance with paragraph (b) of this section:*
 * * *
- (2) *The maximum compressive load measured between the pelvis and the lumbar column of the anthropomorphic dummy must not exceed 1,500 pounds.*

Relevant Past Practice

Section 25.562(c)(2) requires that the maximum compressive load measured between the pelvis and the lumbar column (commonly referred to as the lumbar load) of the anthropomorphic test dummy (ATD) must not exceed 1,500 pounds during the dynamic tests conducted in accordance with § 25.562(b). Historically, substantiating changes to the bottom cushion of a seat certificated to § 25.562 that could effect the lumbar load typically required a full scale 14g downward dynamic test using the actual seat. To provide a simplified alternative, the FAA funded a research project to develop a component test methodology for demonstrating that a replacement bottom cushion would not produce a higher lumbar load than a certificated bottom cushion for a seat certificated to § 25.562. This research resulted in an acceptable methodology that is documented in DOT/FAA/AR-05/5, I “Development and Validation of an Aircraft Seat Cushion Component Test – Volume I,” dated March 2005. This report can be downloaded from the FAA’s website at <http://actlibrary.tc.faa.gov>. This method provides a simplified means of demonstrating compliance with § 25.562(c)(2) and will streamline the seat certification process by reducing the costs and time associated with seat certification.

Policy

Seat bottom cushion changes must be evaluated to determine that compliance with § 25.562 is maintained when considering both the 14g downward test and the 16g longitudinal test specified in the regulation. This policy addresses demonstrating compliance with the lumbar load criteria of § 25.562(c)(2) which is determined in a 14g downward test. Proposed AC 25.562-1X provides draft guidance for assessing seat cushion changes with regard to the 16g longitudinal test.

The following methodology is acceptable for demonstrating compliance with § 25.562(c)(2) for new seat bottom cushions that will replace previously approved cushions. It is based on a component test, which compresses and then decompresses a

cushion and determines the reactive load from the cushion throughout the deflection. This test is conducted on both the proposed and certificated cushions. Compliance is determined by comparing the load-deflection curves, which result from testing both cushions, against a “criterion curve” of maximum lumbar load.

Test Device and Test Specimens

- A test device that will provide the same or equivalent results as the test device used in DOT/FAA/AR-05/5,I “Development and Validation of an Aircraft Seat Cushion Component Test - Volume I,” should be used to conduct the component tests.
- The specimens should conform with DOT/FAA/AR-05/5,I section 4.1.1. Test specimens should be representative of the actual proposed and certificated cushion assemblies, including foam and fire blocking material. Dress covers do not need to be included on the test specimens except for unusual designs where the dress cover would prevent air from escaping the cushion assembly during testing.
- The test specimen for the certificated cushion should not be constructed from a cushion that has been used in service. Seat cushions degrade during service in a manner (reduced thickness, different strength characteristics) that would affect the test results.

Test Procedure

Conduct a component test for both the proposed and certificated bottom cushions in accordance with the procedures in DOT/FAA/AR-05/5,I section 4.1.5.

Acceptance Criteria

The document DOT/FAA/AR-05/5,I contains acceptance criteria for monolithic non-flotation cushions. Follow the third bullet of section 4.2 (page 4-3) and determine the acceptability of the proposed cushion from the performance requirements that begin on page 4-5. Note that performance requirement # 4 is necessary because the component test evaluates the plateau strength region, and not the initial portion, of the force-deflection curve.

The third bullet of section 4.2 (page 4-3) requires a criterion curve for the certificated cushion to be computed. The file Monolithic_Criterion_Curve.xls can be downloaded from an FAA Internet site and used to generate this criterion curve. To obtain this spreadsheet, access <http://www.airweb.faa.gov/rgl> and locate this policy memorandum. Monolithic_Criterion_Curve.xls can be downloaded from the same web page containing this memorandum. This spreadsheet computes the criterion curve for a monolithic non-flotation cushion when the thickness of the cushion in the Buttock Reference Point (BRP) region is input. The BRP region is the area 1.0 to 9.0 inches forward of the Seat Reference Point (SRP) and -7.0 to 7.0 inches laterally from the seat centerline. Refer to the Society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS) 8049A for

the definition of SRP. This SAE document can be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania, 15096.

Limitations

- All limitations presented in DOT/FAA/AR-05/5,I are applicable to this method of compliance.
- The proposed cushion should be constructed similarly to the certificated cushion as follows:
 - The thickness of the proposed and certificated bottom cushions in the BRP region should be within 0.5 inch of each other.
 - Monolithic non-flotation cushions may only be replaced by monolithic non-flotation cushions.
- This method is only applicable to cushions with load-deflection curves that can be described by the functional form presented in DOT/FAA/AR-05/5,I Figure 1-3. As such, foams should be typical non-flotation foams used in the construction of current aircraft seat bottom cushions. This methodology is not applicable to energy absorbing seat cushion designs that utilize crushable materials (e.g., honeycomb, rigid tooling foams) or highly rate sensitive materials (e.g., Confor®).
- This method is not applicable to cushion assemblies that have dress covers with integral padding. The padding in the dress cover, in addition to the foam cushion, effectively results in a multiple layer cushion. This method is only applicable to single layer cushions.

Changes to Technical Standard Order (TSO) Approved Seats

Replacement of seat cushions on seats approved under a TSO can generally be considered a minor change to the TSO in accordance with recent policy (“Classification of Design Changes to TSO-C39b, TSO-C127, and TSO-C127a Articles,” 9/8/2003). Design changes made to a seat bottom cushion on a TSO seat must be accomplished in accordance with § 21.611. For seats, Advisory Circular (AC) 21-25A lists one method for complying with § 21.611(c). The method of compliance provided in this policy memorandum is only applicable to transport airplane seats.

Effect of Policy

The general policy stated in this document does not constitute a new regulation. The FAA individual that implements policy should follow this policy when applicable to the specific project. Whenever a proposed method of compliance is outside this established policy, it must be coordinated with the policy issuing office. The individual who is

considering an alternate method should coordinate their project with the project officer and technical specialists, jointly, to determine if an issue paper is needed or if an item of record is more appropriate. Similarly, if the implementing office becomes aware of reasons that an applicant's proposal 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 statement of policy identifies one means, but not the only means, of compliance.

Implementation

The compliance methods discussed in this policy should be applied to type certificate, amended type certificate, supplemental type certificate, and amended supplemental type certification programs whose application date is on or after the date the policy is finalized. For the certification programs whose date of 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/

Ali Bahrami

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