

# Memorandum

U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Subject: **INFORMATION:** Policy Statement on Side-Facing Seats  
on Transport Category Airplanes

Date: May 6, 2005

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

Reply to  
Attn. of: ANM-03-115-30

To: See Distribution

Regulatory §§ 25.562 and  
Reference: 25.785(a) at  
Amendment 25-64;  
Policy Memorandum  
dated November 19,  
1997

## Summary

The purpose of this memorandum is to update existing Federal Aviation Administration (FAA) certification policy on § 25.785(a) at Amendment 25-64 and § 25.562 for side-facing seats.

## Current Regulatory and Advisory Material

Section 25.562(a), Amendment 25-64, requires that the seat and restraint system be designed to protect each occupant when (1) proper use is made of the seats, safety belts, and shoulder harnesses and (2) the occupant is exposed to loads resulting from the conditions prescribed in § 25.562(b).

Section 25.785(a), Amendment 25-64, requires general occupant protection for occupants of seats that are occupied during takeoff and landing. This paragraph is currently codified as § 25.785(b).

The FAA policy memorandum, "Side-Facing Seats on Transport Category Airplanes," dated November 19, 1997, describes dynamic test procedures and pass/fail criteria that are considered to provide an appropriate level of safety for occupants of both multiple place side-facing seats certified by exemptions and single place side-facing seats certified by special conditions on transport category airplanes.

## Relevant Past Practice

The performance measures of § 25.562(c) only address forward and aft facing seats. Side-facing seats are considered a novel design for transport category airplanes that include Amendment 25-64 in the certification basis, and were not considered when those airworthiness standards were promulgated. The existing regulations do not provide adequate or appropriate safety standards for occupants of side-facing seats because they do not consider the differences in the dynamic forces that would apply to a side-facing occupant. The FAA determined that a level of safety that is equivalent to that afforded to occupants of forward and aft-facing seating could be achieved by additional airworthiness standards, in the form of special conditions, for single occupant side-facing seats. However, for reasons discussed below, the best criteria currently available for evaluating multiple occupant side-facing seats (divans) do not ensure a level of safety that is equivalent to that afforded to occupants of forward and aft-facing seating. Therefore, the only certification method available for multiple occupant side-facing seats, for airplanes that include Amendment 25-64 in their certification basis, is through an exemption from the general injury requirements of § 25.785(a), Amendment 25-64, and § 25.562(a).

The FAA policy memorandum, “Side-Facing Seats on Transport Category Airplanes,” dated November 19, 1997, describes dynamic test procedures and pass/fail criteria which have been found acceptable as a method of certifying single and multiple occupant side-facing seats on transport category airplanes. Attached to that memorandum is guidance material in the form of draft issue papers that is used to develop project specific issue papers. These issue papers are used to establish the minimum acceptable testing and human injury criteria of special conditions for single occupant side-facing seats and exemptions for multiple occupant side-facing seats.

## **Policy**

We have reviewed the guidance in the November 19, 1997, memorandum, “Side-Facing Seats on Transport Category Airplanes” and its attachments, and provide revisions to the guidance below. Except as noted below, the 1997 memorandum still describes current FAA policy. Note that the FAA has ongoing research to further refine the compliance criteria for multiple occupancy seating with the goal of establishing an equivalent level of safety. In particular, we are researching the potential effects of multiple occupant side-facing seats on the potential for neck injuries. Without this information, we cannot find that the level of safety provided by these seats is equivalent to that required by the regulations. In contrast, we do not consider neck injury to be a significant issue for single occupant side-facing seats as long as such seats are located immediately behind structure, such as an interior wall or furnishing that would support the pelvis, upper arm, chest, and head of an occupant seated behind the structure. In the event refined criteria for multiple occupant side-facing seats are established, this policy will be updated accordingly.

### Criteria for Multiple Occupant Side-Facing Seats

The 1997 memorandum contains criteria that are considered to provide one acceptable method of justifying an adequate level of safety for exemptions for multiple occupant side-facing seats. One criterion regards prevention of “body-to-body” contact. It does not

allow incidental contact of a leg, foot, arm or hand that would result in incapacitation of an occupant. Incidental contact of a leg, foot, arm or hand has not indicated a potential for injury during tests occurring since the 1997 memorandum was issued. We find that this criterion is no longer warranted and paragraph 1(b) of the (DRAFT) ISSUE PAPER, Attachment 1, is revised to delete it as a limitation. Note that contact between the head, pelvis, or shoulder area of adjacent Anthropomorphic Test Dummies (ATD) is still considered unacceptable.

If a multiple occupant side-facing seat is installed aft of a structure such as an interior wall or furnishing, the 1997 memorandum stated that two inches of padding should be provided on the surface of this structure where an occupant could contact it when subjected to the dynamic loads of § 25.562(b). Seat testing should also meet Thoracic Trauma Index (TTI), Head Injury Criterion (HIC) and lateral pelvic acceleration criteria for impacts against such structure. We have determined that if an adequate level of safety is provided when these injury parameters are met, padding is not necessary. Paragraph 1(e) of the (DRAFT) ISSUE PAPER, Attachment 1, is revised to state that padding is recommended, but not required. Dynamic tests, or rational analysis based on previous tests, should demonstrate that TTI, HIC and lateral pelvic acceleration criteria are met.

The 1997 memorandum provides a guideline that all multiple occupant side-facing seats have end closures. End closures are used to prevent an occupant from translating off of the seat. We consider that use of the restraint system for this purpose is another acceptable means to achieve this objective. Therefore, all multiple occupant side-facing seats should have end closures or other means to prevent the ATD's pelvis from translating beyond the end of the seat. Paragraph 1(g) of the (DRAFT) ISSUE PAPER, Attachment 1, is updated to reflect this position.

Note that unless it is demonstrated that the seat and seat belts alone are sufficient in restraining the occupant under the dynamic loads, items such as end closures, walls or furnishings, whether attached to a seat frame or not, that aid in restraining seated occupants must be designed to meet the dynamic load conditions of § 25.562. These items are an integral part of the seat restraint system and therefore must comply with § 25.562(a) which states the following:

*“(a) The seat and restraint system [emphasis added] in the airplane must be designed as prescribed in this section to protect each occupant during an emergency landing condition when... (2) The occupant is exposed to loads resulting from the conditions prescribed in this section.”*

Pre-test floor deformation for these items that are not attached to the seat is not necessary, but can be included in the test if the resultant geometric relationship of the seat and the additional item would otherwise reduce the effectiveness of the item.

The exemption limitations in the 1997 memorandum state that one longitudinal test should be conducted in accordance with § 25.562(b)(2) using a Side Impact Dummy (SID) in the center seat place. The exemptions granted for multiple occupant side-facing seats have not required a test with a SID in this location. The initial intent of a test with a

SID in this location was to determine that an acceptable level of thorax protection exists from a collision with an armrest or other barrier installed just forward of the center seat place. However, tests have demonstrated that these armrests are not structural barriers that contribute significantly to thorax injury. We have determined that the existing injury criteria are sufficient to justify an exemption without a test using a SID in the center seat place to obtain TTI. Paragraph 2(b) of the (DRAFT) ISSUE PAPER, Attachment 1, is revised to reflect this change. A Hybrid II ATD or equivalent may be used in this location instead.

Note that the pelvic lateral acceleration injury criterion still should be met at this seat location if pelvic contact with an armrest/structural barrier occurs. This criterion may be met by dynamic test or rational analysis based on previous test(s). A Hybrid II ATD or equivalent can be used to obtain pelvic lateral acceleration data. If in the future, rigid structure is placed between seat places (such as between the center and forward seat places) that would warrant assessment of TTI, a test with a SID in the appropriate seat place (such as the center seat place) would be needed.

As discussed previously, we have found that an acceptable level of safety can be provided to justify an exemption without a test with a SID in the center seat place. We have also found that it is permissible to obtain occupant injury data with floor deformation and with the seat yawed 10 degrees because the differences in test results would not be substantial considering the level of safety determined to be adequate for this exemption. Based on this determination, the longitudinal tests specified in the 1997 memorandum have been modified to only include a minimum of one test. Paragraph 2(b) of the (DRAFT) ISSUE PAPER, Attachment 1, has been revised to reflect this policy. If a seat is installed aft of structure (e.g., an interior wall or furnishing) that does not have a homogeneous surface, more than one test may be necessary to demonstrate that the injury criteria are met for the area which an occupant could contact. For example, different yaw angles could result in different injury considerations and may necessitate separate tests to evaluate.

#### Criteria for Single Occupant Side-Facing Seats

Paragraph 1(b) of the (DRAFT) ISSUE PAPER, Attachment 2, has been revised to clarify that padding of contact surfaces is recommended, but not required.

#### **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 specified 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, or actions relating to maintenance, alterations, and repairs. Also, as with all advisory material, this policy statement identifies one means, but not the only means, of compliance.

Questions regarding this memorandum should be directed to Mike Thompson of the Airframe & Cabin Safety Branch, ANM-115. Mr. Thompson's telephone number is (425) 227-1157 and his e-mail address is michael.t.thompson@faa.gov.

### **Implementation**

The compliance method 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 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/

Ali Bahrami

Attachments

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# Attachment 1

## **(DRAFT)** **ISSUE PAPER**

**PROJECT:** **ITEM:** CI-1  
**STAGE:** 2

**REG. REF.:** §§ 11.25, 25.562, 25.785 **DATE:** March 31, 2003

**NATIONAL POLICY REF.:** **ISSUE STATUS:** OPEN

**SUBJECT:** Dynamic Test Requirements **BRANCH ACTION:** ANM-115,  
for Side-Facing Divans AAM-630, ANM-102N  
(Sofas)

**COMPLIANCE TARGET:** Pre-TC

### *PETITION FOR EXEMPTION*

**STATEMENT OF ISSUE:** Side-facing seats are considered a novel design for transport category airplanes that include Amendment 25-64 in the certification basis, and were not considered when those airworthiness standards were promulgated. The FAA has determined that the existing regulations do not provide adequate or appropriate safety standards for occupants of side-facing multiple occupant seats (divans). Additionally, the best criteria currently available for evaluation of this type of seating do not ensure a level of safety that is equivalent to that afforded to occupants of forward and aft facing seating. Therefore, the only certification method available for this type of seating, for aircraft that include Amendment 25-64 in their certification basis, is through an exemption from the general injury requirements of § 25.785(b) and § 25.562(a).

This issue paper will be used to establish the minimum acceptable testing and human injury criteria that will be applied to side-facing divan certifications. This information will complement the exemption process as defined in § 11.25 and in no way is intended to circumvent the need to provide an acceptable public interest argument as required per § 11.81(d).

**BACKGROUND:** Part 25 was amended June 16, 1988, by Amendment 25-64, to revise the emergency landing conditions that must be

considered in the design of the airplane. Amendment 25-64 revised the static load conditions in § 25.561, and added a new § 25.562 that required dynamic testing for all seats approved for occupancy during takeoff and landing. The intent of Amendment 25-64 is to provide an improved level of safety for occupants on transport category airplanes. Because most seating is forward-facing on transport category airplanes, the pass/fail criteria developed in Amendment 25-64 focused primarily on these seats.

For multiple occupant side-facing seating, the best criteria currently available cannot be said to provide an equivalent level of safety for those occupants. Therefore, the only vehicle available for accepting these installations will be through an exemption from the general injury requirements of § 25.785(b) and § 25.562(a). The criteria contained in this issue paper may be included in a petition for exemption from the noted requirements if an applicant so chooses. Any petition for exemption must also address why a grant of the petition would be in the public interest, in accordance with § 11.81(d), and it should be emphasized that this public interest requirement must be satisfied regardless of the criteria that the divan is tested to.

**FAA POSITION:** The following proposed injury criteria and installation/testing guidelines represent the minimum acceptable standard for incorporation in a petition for exemption from the general occupant injury criteria of §§ 25.785(b) and 25.562(a). Note that this issue paper addresses an exemption from the general occupant injury criteria of §§ 25.785(b) and 25.562(a) only. Compliance with the structural requirements must be demonstrated for side-facing seats using the same conditions for the test and pass/fail criteria as for fore- and aft-facing seats.

## 1. The Proposed Injury Criteria

- (a) Existing Criteria: All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupants of side facing seating. Head Injury Criterion (HIC) assessments are only required for head contact with the seat and/or adjacent structures.
- (b) Body-to-Body Contact: Contact between the head, pelvis, torso or shoulder area of one Anthropomorphic Test Dummy (ATD) with the adjacent seated ATD's head, pelvis, torso or shoulder area is not allowed during the tests conducted in accordance with § 25.562(b)(1) and (b)(2). Contact during rebound is allowed.
- (c) Thoracic Trauma: If the torso of an ATD at the forward most seat place impacts seat and/or adjacent structure during testing, compliance with Thoracic Trauma Index (TTI) injury criterion must be substantiated by dynamic test or by rational

analysis based on previous test(s) of a similar seat installation. TTI data must be acquired with a Side Impact Dummy (SID), as defined by 49 CFR Part 572, Subpart F, or an equivalent ATD or a more appropriate ATD and must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) Part 571.214, section S6.13.5. TTI must be less than 85, as defined in 49 CFR Part 572, Subpart F. Torso contact during rebound is acceptable and need not be measured.

- (d) Pelvis: If the pelvis of an ATD at any seat place impacts seat and/or adjacent structure during testing, pelvic lateral acceleration injury criteria must be substantiated by dynamic test or by rational analysis based on previous test(s) of a similar seat installation. Pelvic lateral acceleration must not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS Part 571.214, section S6.13.5.
- (e) Body-to-Wall/Furnishing Contact: If the seat is installed aft of a structure such as an interior wall or furnishing that may contact the pelvis, upper arm, chest, or head of an occupant seated next to the structure, the structure or a conservative representation of the structure and its stiffness must be included in the tests. It is recommended, but not required, that the contact surface of the actual structure be covered with at least two inches of energy absorbing protective padding (foam or equivalent) such as Ensolite.
- (f) Shoulder Strap Loads: Where upper torso straps (shoulder straps) are used for sofa occupants, the tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.
- (g) Occupant Retention: All side-facing seats require end closures or other means to prevent the ATD's pelvis from translating beyond the end of the seat at any time during testing.

## **2. General Guidelines**

- (a) All seat positions need to be occupied by ATDs for the longitudinal tests.
- (b) A minimum of one longitudinal test, conducted in accordance with the conditions specified in § 25.562(b)(2), is required to assess the injury criteria as follows. Note that if a seat is installed aft of structure (e.g., an interior wall or furnishing) that does not have a homogeneous surface, an additional test(s) may be required to demonstrate that the injury criteria are met for the area which an occupant could contact. For example, different yaw angles could result in

different injury considerations and may require separate tests to evaluate.

- For configurations without structure (e.g., wall, bulkhead) installed directly forward of the forward seat place, Hybrid II ATDs or equivalent must be in all seat places.
- For configurations with structure (e.g., wall, bulkhead) installed directly forward of the forward seat place, an SID or equivalent ATD or more appropriate ATD must be in the forward seat place and a Hybrid II ATD or equivalent must be in all other seat places.
- The test may be conducted with or without deformed floor.
- The test must be conducted with either no yaw or 10 degrees yaw for evaluating occupant injury. Deviating away from the no yaw condition must not result in the critical area of contact not being evaluated. Allowing the test to be conducted at 10 degrees yaw will permit many occupant injury tests to be considered the structural test as well and is considered acceptable since an exemption is sought in lieu of compliance with part 25. Note that this condition does not provide relief from the requirement that torso restraint straps, where installed, must remain on the occupant's shoulder during the impact condition of § 25.562(b)(2).

(c) For the vertical test, conducted in accordance with the conditions specified in § 25.562(b)(1), Hybrid II ATDs or equivalent must be used in all seat positions.

**FCAA POSITION:**

Open.

**APPLICANT'S POSITION:**

Open.

**CONCLUSION:**

Open.

## Attachment 2

# ( *DRAFT* ) *ISSUE PAPER*

**PROJECT:**

**ITEM:** CI-X

**STAGE:** 2

**REG. REF.:** §§ 21.16, 25.562, 25.785

**DATE:** March 31, 2003

**NATIONAL  
POLICY REF.:**

**ISSUE STATUS:** OPEN

**SUBJECT:** Dynamic Test Requirements  
for Single Place Side-Facing  
Seats

**BRANCH ACTION:** ANM-115,  
AAM-630, ANM-102N

**COMPLIANCE**

**TARGET:** Pre-TC

## *PROPOSED SPECIAL CONDITION*

**STATEMENT OF ISSUE:** Side-facing seats are considered a novel design for transport category airplanes that include Amendment 25-64 in the certification basis, and were not considered when those airworthiness standards were promulgated. The FAA has determined that the existing regulations do not provide adequate or appropriate safety standards for occupants of single-place side-facing seats. In order to provide a level of safety that is equivalent to that afforded to occupants of forward and aft facing seating, additional airworthiness standards, in the form of special conditions, are necessary.

This issue paper will be used to establish the minimum acceptable testing and human injury criteria that will be applied to single-place side-facing seat certifications. This information will complement the criteria given in § 25.562 and can be used in developing Special Conditions in accordance with § 21.16.

**BACKGROUND:** Part 25 was amended June 16, 1988, by Amendment 25-64, to revise the emergency landing conditions that must be considered in the design of the airplane. Amendment 25-64 revised the static load conditions in § 25.561, and added a new § 25.562 that required dynamic testing for all seats approved for occupancy during takeoff and landing. The intent of Amendment

25-64 is to provide an improved level of safety for occupants on transport category airplanes. Because most seating is forward-facing on transport category airplanes, the pass/fail criteria developed in Amendment 25-64 focused primarily on these seats.

This issue paper is intended to provide a standardized methodology to address all single-place side-facing seat installation approvals in the future. Since the regulations do not address side-facing seats, these criteria should be documented in Special Conditions.

**FAA POSITION:** In addition to the airworthiness standards in §§ 25.562 and 25.785, the following proposed special condition provides injury criteria and installation/testing guidelines that represent the minimum acceptable airworthiness standard for single-place side-facing seats:

### **1. The Proposed Injury Criteria**

- (a) Existing Criteria: All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupant of a side facing seat. Head Injury Criterion (HIC) assessments are only required for head contact with the seat and/or adjacent structures.
- (b) Body-to-Wall/Furnishing Contact: The seat must be installed aft of a structure such as an interior wall or furnishing that will support the pelvis, upper arm, chest, and head of an occupant seated next to the structure. A conservative representation of the structure and its stiffness must be included in the tests. It is recommended, but not required, that the contact surface of this structure be covered with at least two inches of energy absorbing protective padding (foam or equivalent), such as Ensolite.
- (c) Thoracic Trauma: Thoracic Trauma Index (TTI) injury criterion must be substantiated by dynamic test or by rational analysis based on previous test(s) of a similar seat installation. Testing must be conducted with a Side Impact Dummy (SID), as defined by 49 CFR Part 572, Subpart F, or its equivalent. TTI must be less than 85, as defined in 49 CFR Part 572, Subpart F. SID TTI data must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) Part 571.214, section S6.13.5.
- (d) Pelvis: Pelvic lateral acceleration must be shown by dynamic test or by rational analysis based on previous test(s) of a similar seat installation to not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS Part 571.214, section S6.13.5.

(e) Shoulder Strap Loads: Where upper torso straps (shoulder straps) are used for occupants, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

## **2. General Test Guidelines**

(a) One longitudinal test with the SID ATD or its equivalent, undeformed floor, no yaw, and with all lateral structural supports (armrests/walls).

Pass/fail injury assessments: TTI and pelvic acceleration.

(b) One longitudinal test with the Hybrid II ATD, deformed floor, with 10 degrees yaw, and with all lateral structural supports (armrests/walls).

Pass/fail injury assessments: HIC; and upper torso restraint load, restraint system retention and pelvic acceleration.

(c) Vertical (14 G's) test is to be conducted with modified Hybrid II ATDs with existing pass/fail criteria.

### **FCAA POSITION:**

Open.

### **APPLICANT'S POSITION:**

Open.

### **CONCLUSION:**

Open.