

Memorandum

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

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

Date: DRAFT

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 clarify Federal Aviation Administration (FAA) certification policy on § 25.785(a), Amendment 25-64, for side-facing seats.

Current Regulatory and Advisory Material

Section 25.785(a), Amendment 25-64, requires general occupant protection for occupants of side-facing seats that are occupied during takeoff and landing.

The FAA policy memorandum, "Side-Facing Seats on Transport Category Airplanes," dated November 19, 1997, provides dynamic test requirements and pass/fail criteria which are considered to provide an appropriate level of safety for occupants of 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

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. Hence, the existing regulations do not provide adequate or appropriate safety standards for occupants of side-facing seats. 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, 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.

The FAA policy memorandum, “Side-Facing Seats on Transport Category Airplanes,” dated November 19, 1997, provides dynamic test requirements 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

The FAA memorandum, “Side-Facing Seats on Transport Category Airplanes,” dated November 19, 1997, contains guidance used to establish the minimum acceptable testing and human injury criteria for obtaining special conditions for single occupant side-facing seats and an exemption for multiple occupant side-facing seats. The FAA has reviewed the guidance in this memorandum and provides updated guidance below.

Criteria for Multiple Occupant Side-Facing Seats

The 1997 memorandum contains criteria which are considered to provide one acceptable method of justifying an adequate level of safety for exemptions for multiple occupant side-facing seats. One criterion is in regard to prevention of “body-to-body” contact. These criteria do 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 been a concern during testing that has occurred since the 1997 policy memorandum was issued, and the FAA finds that this criterion is no longer warranted 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 exemption limitations found acceptable in the 1997 memorandum require two inches of padding on the surface of this structure where an occupant could contact it when subjected to the dynamic loads of § 25.562(b). These limitations also require that Thoracic Trauma Index (TTI), Head Injury Criterion (HIC) and lateral pelvic acceleration criteria be met for impacts against structure. The FAA has determined that an adequate level of safety is provided when these injury parameters are met without padding installed on the structure. This memorandum revises the previous limitations to not require padding since dynamic tests, or rational analysis based on previous tests, must demonstrate that TTI, HIC and lateral pelvic acceleration criteria are met. Although padding is not required by this method, the FAA still encourages the use of padding where practical.

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. The FAA considers 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 occupant from translating beyond the end of the seat.

Note that 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 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 which are not attached to the seat is not required, 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, which were found acceptable in the 1997 memorandum, require one longitudinal test 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, these armrests have not been structural barriers which contribute significantly to thorax injury. The FAA has 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. 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.

The FAA has 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 and by obtaining occupant injury data with floor deformation and with the seat yawed 10 degrees. Based on this determination, the longitudinal tests specified in the 1997 memorandum have been modified to only include a minimum of one test. If a seat is installed aft of structure (e.g., an interior wall or furnishing) which 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.

The draft issue paper of the 1997 memorandum for multiple occupancy seating has been revised to reflect this guidance and is attached. 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 the event those criteria are established, this policy will be updated accordingly.

Criteria for Single Occupant Side-Facing Seats

The draft issue paper of the 1997 memorandum for single occupant side-facing seats has been revised to address the criterion for padding of contact surfaces in a similar manner to that discussed for multiple occupant side-facing seats and is attached.

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.

Attachments

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).

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 occupancy 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). The criteria contained in this issue paper may be included in a petition for exemption from the noted requirement 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). Note that this issue paper addresses an exemption from the general occupant injury criteria of § 25.785(b) 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, 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 its equivalent 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, 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 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) which 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, a SID or equivalent 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 away from the critical contact angle (provided this 10 degrees yaw is within the yaw range specified in § 25.562(b)(2)) for evaluating occupant injury. Deviating away from the critical contact angle must not result in the critical area of contact not being evaluated. This allowance will permit many occupant injury tests to be considered the structural test as well. It 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.

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, 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.