

Subject: INFORMATION: Guidance for Certifying Headrests
on Aft Facing Seats

From: Manager, Transport Airplane Directorate, ANM-100

To: See Distribution

Date:

Reply to: Ross Landes
Attn. of: ANM-113-02-036

Regulatory: §§ 25.562,
Reference: 25.785(b),(d)

The purpose of this policy memorandum is to provide guidance on the certification of headrests on aft facing seats on transport category airplane projects. The FAA received a proposal for policy on the certification of headrests on aft facing seats from the General Aviation Manufacturers Association (GAMA) on August 29, 2002. The FAA has internally reviewed and evaluated this proposal (sent in the form of an Acceptable Practices Document) and finds it acceptable for use as a means of showing compliance to §§ 25.562 and 25.785(b),(d) for headrests on aft facing seats considering a range of occupants sizes.

This policy memorandum provides information and guidance regarding acceptable, but not the only, means of showing compliance with §§ 25.562 and 25.785(b),(d) for certifying headrests on aft facing seats. The policy memorandum provides a discussion of the applicable regulations and pass/fail criteria that may be used to evaluate the acceptability of headrest performance during dynamic seat tests. Terms used in this policy memorandum and attachment, such as “shall” and “must” are used only in the sense of clearly defining a particular method of compliance and apply when the acceptable method of compliance described herein is used. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the pertinent Federal Aviation Regulations (FAR). This policy memorandum does not change, create any additional, authorize changes in, or permit deviations from, regulatory requirements.

This policy memorandum also provides guidance to clarify appropriate use of SAE Aerospace Standard 8049A (AS 8049A) for showing compliance to the pertinent FARs and FAA Technical Standard Order (TSO) C127a. AS 8049A includes specific criteria for aft facing seats and aft facing seats with fixed headrests. The applicable guidance contained in this policy memorandum and attachment is an equivalent procedure for aft facing seats with fixed and adjustable headrests in showing that AS8049, subsection 3.2.10 has been met. This policy memorandum and attachment is also an equivalent procedure for meeting TSO-C39b, NAS 809, subsection 4.1.1.2. The use of this procedure for TSO compliance must be established by the applicant and accepted in advance by the Manager of the Aircraft Certification Office having geographic purview of the applicant’s facility.

Disagreements between the applicant and the Aircraft Certification Office over the application of the methods of compliance for §§ 25.562 and 25.785(b),(d) contained in this policy memorandum and its attachment, will be resolved by the Transport Standards Staff via the issue paper process or other appropriate documentation to assure standardization. All matters concerning TSO-C39b and TSO-C127a will be coordinated by the ACO with AIR-100. AIR-100 will take the appropriate action and coordinate the resolution with the ACO and the Transport Standards Staff.

If you have any questions regarding the application of this policy please contact Mr. Michael Thompson (425) 227-1157 [FAR 25 technical questions], Mr. Hal Jensen (202) 267-8807 [TSO technical questions] or Mr. Ross Landes (425) 227-1071 [procedural questions].

Manager, Transport Airplane Directorate, ANM-100

Manager, Aircraft Engineering Division, AIR-100 Concurrence

Attachment

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GAMA Business Aircraft Interiors Committee

Seat Subcommittee

**Acceptable Practices Document for Certification of
Headrests on Aft-Facing Seats**

Record of Revisions

Date Revision	Description of change
29-Aug-02 New	Initial Issue

Acceptable Practices Document for Certification of Headrests on Aft-Facing Seats

This acceptable practices document has been developed by a General Aviation Manufacturers Association (GAMA) sponsored industry committee.

1. Purpose

This document contains an acceptable means of certifying adjustable headrests on aft-facing passenger seats to meet the requirements of Title 14 Code of Federal Regulations (CFR) §§ 25.562 at Amendment 25-64 and 25.785(b) and (d) at Amendment 25-88. It is intended to streamline the seat certification process and promote standardization of compliance with airworthiness regulations.

2. Applicability

This document contains an acceptable means (but not necessarily the only means) for certifying adjustable headrests on aft-facing seats to meet the requirements of §§ 25.562 and 25.785(b) and (d) on Transport Category Aircraft.

3. Regulatory Material

The following documents contain the applicable requirements concerning the certification of seats:

14 CFR Sections 25.562 and 25.785

4. Guidance Material

The following documents contain guidance and information concerning the certification of seats:

4.1. Advisory Circulars

4.1.1. Advisory Circular 25.562-1A, "Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes," Jan. 19, 1996

4.1.2. Advisory Circular 25-17, "Transport Airplane Cabin Interiors Crashworthiness Handbook," July 15, 1991

4.2. FAA Advisory Memoranda

None known

4.3. Industry Standards

4.3.1. SAE Aerospace Standard 8049, Rev A, "Performance Standard for Seats in Civil Rotorcraft and Transport Airplanes," September 1997

4.3.2. SAE J211, "Instrumentation for Impact Tests," October 1988

4.4. Other Material

4.4.1. NAS 809, "Specification, Aircraft Seats and Berths"

4.4.2. TSO-C39b, "Aircraft Seats and Berths"

4.4.3. TSO-C127a, "Rotorcraft, Transport Airplane, Normal and Utility Airplane Seating Systems"

4.4.4. 49 CFR part 572 - Anthropomorphic Test Dummies (ATD's)

5. Background

5.1. Regulatory Protection Requirements

Headrests on aft-facing seats installed on transport category airplanes must be demonstrated to be compliant with §§ 25.562 and 25.785(b) and (d). Section 25.562 requires that seats be designed to dynamic landing conditions. Section 25.785(b) requires that seats be designed to prevent a person who is making proper use of the seat from suffering serious injury under the emergency landing conditions of §§ 25.561 and 25.562. Section 25.785(d) requires that each occupant of an aft-facing seat be protected from head injury by one or more of the following:

5.1.1. A shoulder harness that will prevent the head from contacting any injurious object.

5.1.2. The elimination of any injurious object within striking radius of the head.

5.1.3. An energy absorbing rest that will support the arms, shoulders, head, and spine.

5.2. Technical Standard Order (TSO) C127a Requirements

Technical Standard Order (TSO) C127a prescribes minimum performance standards for seating systems to be installed in transport category airplanes. The design requirements contained in TSO C127a require that:

5.2.1. An aft-facing seat must be designed with a back height sufficient to provide 930mm (36.5 in.) of support for the occupant as measured from the seat reference point (SRP) to the top of the seat back. (See AS8049A for the definition of SRP.)

5.2.2. If a separate fixed headrest is provided it must be separated by no more than 100mm (4 in.) from the backrest.

5.2.3. Measurements must be taken along the seat back tangent line in accordance with SAE Aerospace Standard 8049 Revision A (AS8049A), section 3.2.10.

5.2.4. Seating systems must provide impact protection for the occupant at seat adjustment positions, orientations, and locations allowed to be occupied during takeoff and landing (AS8049A, section 3.2.1).

6. Acceptable Means of Compliance

6.1. Seat Back Design on Aft-Facing Seats

6.1.1. Seat Back Height Requirement

The design requirements contained in TSO C127a (by reference to AS8049) require that aft-facing seats be designed with a back height sufficient to provide 930mm (36.5 in.) of support for the occupant as measured from the seat reference point (SRP) to the top of the seat back. A headrest can be used to obtain the 930mm (36.5 in.) of support.

6.1.2. Backrest/Headrest Separation Requirements

6.1.2.1. Fixed Headrest

Specifically for aft-facing seats with a fixed headrest, AS8049A specifies that the headrest is not to be separated by more than 100mm (4 in.) from the backrest, and that the height of the headrest must be sufficient to provide head support for the intended range of occupant sizes. AS8049A does not specify a maximum backrest/headrest separation distance for an adjustable headrest.

6.1.2.2. Adjustable Headrest

For an adjustable headrest, the headrest may be separated by 100mm (4 in.) from the backrest. A gap greater than 100mm (4 in.) between a backrest and an adjustable headrest may also be considered acceptable provided that it can be demonstrated that 930mm (36.5 in.) of support is provided with the proposed larger gap and the criteria in section 6 is met. The scope of this document does not include addressing a method of compliance for demonstrating that gaps larger than 100mm (4 in.) are acceptable.

6.1.2.3. Measurement of Backrest/Headrest Separation

The measurement for determining the amount of separation between the bottom of the headrest and the top of the backrest must be taken between seat structural members and not between the foam buildup attached to these members. Some seat designs have a headrest that translates vertically out of the backrest. This creates a void or recess in the seat back when the headrest is extended. A void or recess must not create a significant loss of upper torso support. Therefore, excessively flexible structure in this area, such as fairings or upholstery closeouts, must not be considered as structure for the purposes of

this measurement. As indicated in section 5.2.3, this measurement must be taken along the seat back tangent line.

6.1.3 Headrest Adjustment Instructions

A headrest that must be adjusted to provide proper support must be placarded as such so that the occupant is aware of the need to perform this action. The following wording is acceptable for this placard:

“For taxi, takeoff, and landing, the headrest must be extended to support the head.”

6.2. Pass/Fail Criteria and Test Conditions

6.2.1. Headrest Performance Criteria

The dynamic test requirements of § 25.562 and TSO-C127a are intended to evaluate occupant protection under more realistic conditions than can be provided by the application of static loads to the seat and restraint. Under these dynamic test conditions, the occupant should not suffer "serious injury," as required by § 25.785, and the seat should provide occupant protection. This includes support of the head and spine by the seat back. The following criteria should be used for the evaluation of the headrest performance:

6.2.1.1. The headrest must support the head when contact is made.

It must continue to support the head until the Anthropomorphic Test Dummy's (ATD's) head begins to rebound after the test impact. The head must not slip off the headrest. Further discussion on what constitutes support of the head is provided in section 6.2.2.

6.2.1.2. Where contact with the headrest or other structure can occur, protection must be provided so that the head impact does not exceed a Head Injury Criterion (HIC) measurement of 1,000 as defined in § 25.562(c)(5).

6.2.1.3. The headrest must withstand the loads imparted during the structural dynamic test and when the head makes contact, although the structure may yield.

6.2.1.4. The headrest must not yield to the extent that it would impede rapid evacuation of the airplane occupants (Ref. 25.562(c)(8)). Note that the permanent deformation measurement should be documented so that this determination can be made.

6.2.2. Head Support Criteria

In regard to criteria for support of the ATD's head, a headrest that extends to a height of 930mm (36.5 in.) but does not support the head does not comply with § 25.785, since an occupant would likely suffer serious injury under the conditions of § 25.562 if the head lacked support. Three phenomena have been observed in this regard.

6.2.2.1. The ATD translates up the seat back, and its head moves partially off the headrest, but is still supported (i.e., the head center of gravity is still on the headrest). In this case, the headrest is still performing its function, and the only issue would be whether the increased head trajectory could cause contact with an interior surface.

6.2.2.2. The ATD's head center of gravity translates off the headrest, either vertically or laterally, so that it is no longer supported. In this case, the headrest would be unacceptable.

6.2.2.3. The headrest structure is too flexible or the headrest is offset longitudinally too far aft of the seatback. A headrest must not be excessively flexible, either in bending or in

torsion, relative to the backrest, so that it is not providing support. Such an unacceptable design can still permit the head to remain in contact, even though it is not providing support. Additionally, a headrest must not be offset longitudinally with respect to the seatback to an extent that would prevent the head from adequately contacting it and obtaining support. These unacceptable conditions are usually indicated by gross bending in the ATD's neck.

6.2.3. Adjustable Headrest Test Conditions

If an adjustable headrest is fitted to the seat, it must be tested in the position appropriate for a 50th percentile male ATD. This position is below the point of maximum headrest extension, which allows the headrest to be used by occupants of greater size. An adjustable headrest may move out of its detent position during testing provided the post-test measurement of the separation between the headrest and backrest, as explained in section 6.1.2.3, is not more than 4 inches.

6.2.4. Floor Deformation Test Conditions

Pre-test floor deformation is not required when assessing headrest performance, but the seat must be yawed in accordance with § 25.562(b). An applicant may elect to conduct a structural test with floor deformation to evaluate the performance of the headrest. However, it is possible that pre-test floor deformation can artificially influence occupant motion and be the sole cause of a test failure. In this case, when it is determined that a failure occurs predominantly due to floor deformation, a retest without pre-floor deformation is acceptable. (Note that a retest without floor deformation is only acceptable if this determination can be made.) Movement of the ATD's head away from the centerline of the headrest before test impact can be used to determine whether the pre-test floor deformation has contributed to the failure, as the floor deformation has affected the starting position of the ATD. It is possible that comparison with another headrest that has performed satisfactorily could be used to substantiate whether the pre-test distortion was a factor and a second test without floor deformation may be conducted.

7. Headrest Design Guidelines

The following guidelines are considered to be effective for demonstrating compliance to §§ 25.562 and 25.785(b),(d) and the standards of TSO-C127a for the design of headrests on aft facing seats. These guidelines are not required. Compliance is demonstrated by meeting the criteria in section 6. Additionally, meeting the guidelines in section 7 does not exclude a headrest from testing and needing to meet the criteria in section 6.

7.1 Headrest Size

Headrest panels should be at least 8.5 inches wide by 6.5 inches high.

7.2 Headrest Stiffness

Headrest should be designed to not permanently deform or experience an angular displacement of more than 25 degrees with respect to the backrest when a 200 pound static load is applied to the center of gravity of the headrest for three seconds. This load should be applied to the headrest in its fully extended position. The load may be applied to the headrest as part of a complete seat or to the headrest with the seatback rigidly mounted to a fixture.