



AEROSPACE RECOMMENDED PRACTICE

ARP5526™**REV. E**Issued 2003-01
Revised 2018-08

Superseding ARP5526D

(R) Aircraft Seat Design Guidance and Clarifications

RATIONALE

The change in this revision represents the latest agreement obtained by the SAE SEAT Committee to include the latest industry needs in regard to lifevest stowage ease of search and evaluation of surfaces within the head strike zone.

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) documents a common understanding of terms, compliance issues, and design criteria to facilitate certification of seat installations specific to Part 25 aircraft. This ARP provides general guidance for seats to be installed in Part 23 aircraft and Parts 27 and 29 rotorcraft and does not specify specific designs or design methods for such certification.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AFRL-HE-WP-TR-2002-0170 CAESAR: Summary Statistics for the Adult Population (ages 18-65) of the United States of America

AS5678 Passive RFID Tags Intended for Aircraft Use

AS8049 Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft

2.2 NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS809 Specification - Aircraft Seats and Berths

2.3 CFR Publications

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

Code of Federal Regulations Title 14 Part 23 (14 CFR Part 23) Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes

Code of Federal Regulations Title 14 Part 25 (14 CFR Part 25) Airworthiness Standards: Transport Category Airplanes

Code of Federal Regulations Title 14 Part 27 (14 CFR Part 27) Airworthiness Standards: Normal Category Rotorcraft

Code of Federal Regulations Title 14 Part 29 (14 CFR Part 29) Airworthiness Standards: Transport Category Rotorcraft

Code of Federal Regulations Title 14 Part 121 (14 CFR 121) Certification and Operations: Domestic, Flag, and Supplemental Air Carriers and Commercial Operators of Large Aircraft

2.4 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 25-17A	Transport Airplane Cabin Interiors Crashworthiness Handbook
AC 25.785-1B	Flight Attendant Seat and Torso Restraint System Installations
PS-ANM100-2003-10019	Subject: Policy Statement on Evaluating a Seat Armrest Cavity for a Potential Fire Hazard
PS-ANM-25.853-01-R2	Subject: Flammability Testing of Interior Materials
ANM-04-115-28	Subject: Policy Statement on an Unreliable Design of Seat Belt Attachment, Fittings on Passengers' Seats and Compliance with § 25.601
ANM-03-115-31	Policy Statement on Conducting Component Level Tests to Demonstrate Compliance with §§ 25.785(b) and (d)

Special Airworthiness Information Bulletin (SAIB) NM-04-37, issued December 22, 2003, recommends that a specific design of seat belt attachment fitting be replaced with an improved design fitting.

2.5 Civil Aerospace Medical Institute

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

DOT/FAA/AM-03/9	Human Factors Associated with the Certification of Airplane Passenger Seats: Life Preserver Retrieval
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2.6 NASA Publications

NASA Technical Services, NASA STI Program STI Support Services, Mail Stop 148, NASA Langley Research Center, Hampton, VA 23681-2199, 757-864-9658, Fax: 757-864-6500, <http://ntrs.nasa.gov/>.

NASA-STD-3000 Vol. I	Man Systems Integration Standards Rev. B, NASA Johnson Space Center, Houston, TX, 1995.
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2.7 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 1439	Tests for Sharpness of Edges on Equipment
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2.8 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment
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3. RECOMMENDED PRACTICES

FAR references can be considered valid across aircraft categories: 14 Code of Federal Regulations Parts 23, 25, 27, and 29.

3.1 Seat Back Handhold in Turbulence

3.1.1 Applicable Policy and Regulations

14 CFR Part 25.785 (j) Amendment 25-88

If the seat backs do not provide a firm handhold, there must be a handgrip or rail along each aisle to enable persons to steady themselves while using aisles in moderately rough air.

AC 25-17A par. 81.b (6) Crashworthiness Handbook

The seat back may serve as a firm handhold. Since many seats are capable of breaking over, the breakover load must be adequate to be considered firm. A load of 25 pounds (111 N) minimum, acting horizontally, is considered adequate when applied at the top center of the seat back.

3.1.2 Recommended Practice

A handhold is defined as a means of providing a hand hold support for a person standing upright in an aisle during flight. If an adequate supplemental rail or handgrip is not provided in the interior, seat backs may be used as the handhold so long as they are spaced sufficiently close together to be within reach for an occupant using the aisle. For that purpose, a seat pitch of 65 inches (165 cm) or less is considered adequate in a typical commercial transport aircraft configured with forward or rearward facing passenger seats positioned along an aisle. Due to the unique and customized interior arrangement of forward, sideward, or rearward facing passenger seats in business/private transport aircraft (not for hire), these configurations should be assessed individually. Divan seating and side facing seats do not normally place the seat back where it can be effectively used as a handhold.

To act as a handhold, the upper aisle-side corner of the seat back should provide either a surface to grip or push against. A seat back used as a handhold should not break over when a force of 25 pounds (111 N) in a direction perpendicular to the seat back is applied at the top center of the seat back. Seat backs with head rests that telescope more than 3 inches (7.6 cm) above the seat back may be used for a handhold if, in addition to all other requirements, no portion of the head rest, e.g., bendable ears and/or tilting head rest, can be moved more than 7 inches (17.8 cm) before a 25 pound (111 N) resistive force is met.

The seat back handhold should be at least 33 inches (84 cm) above the floor, even if the seat back is reclined.

3.2 Seat Belt Misalignment/Disengagement

3.2.1 Applicable Policy and Regulations

14 CFR Part 25.601

General.

The airplane may not have design features or details that experience has shown to be hazardous or unreliable. The suitability of each questionable design detail and part must be established by tests.

14 CFR Part 25.562 Amendment 25-64

(a) The seat and restraint system in the airplane must be designed as prescribed in this section to protect each occupant during an emergency landing condition when:

- (1) Proper use is made of seats, safety belts, and shoulder harnesses provided for in the design.
- (2) The occupant is exposed to loads resulting from the conditions prescribed in this section.

FAA Policy Memo ANM-04-115-28

Policy Statement on an Unreliable Design of Seat Belt Attachment Fittings on Passenger's Seats and Compliance with § 25.601.

NAS 809

When anchorages for safety belts are provided, they should be of a type which will permit self-aligning of the belt or fitting.

3.2.2 Recommended Practice

3.2.2.1 Restraint

The term restraint in this section refers to any strap, webbing, or similar device designed to secure a person in an aircraft with the intention of minimizing injury, including all buckles or other fasteners, and all integral hardware.

Seatbelt misalignment is a condition where the seatbelt and/or shackle is positioned to give the impression that the belt has been properly tightened, when in fact there is slack in the system or the shackle is positioned so that it will not carry the force generated in an emergency landing or turbulence condition.

The seat belt installation should provide a self-orienting (free rotation and self-alignment) line of pull for the belt, minimize the possibility of inadvertent disconnection, and be designed to minimize an incorrect installation.

The seat belt installation should not appear to the belted occupant to be properly adjusted (snug) while there is significant (1 inch [2.54 cm] or more) slack in the system which may pay out in an emergency landing situation. For example, the belt installation should not be able to be caught between seat features such that the occupant would not know there was slack in the belt which may allow the occupant to slide forward during emergency landing or turbulence.

To evaluate the installed seat belt for misalignment, the seat should be positioned in its taxi, takeoff, and landing condition. Installations on seats having bottom cushions that can be removed or incorrectly repositioned without tools should be evaluated with the cushions installed, removed, and incorrectly repositioned. The belt and shackle combination should be manipulated with one hand in an attempt to place the restraint in a non-design configuration where it could carry the seatbelt adjustment forces. Particular effort should be made to place the restraint in a position that the restraint forces would not be applied to the hook of the shackle in the same manner as they would be applied in a straight tension pull on the belt. Attempts should be made with the restraint in its normal shape, a single twist of the webbing and/or a single fold of the webbing. Typical areas around the restraint shackle that should be checked are the plastic shrouding around the armrest, the hydraulic seat recline device, the seat pan, anti-rotation brackets/stops, seat pan supports, and exposed fasteners. If a condition of potential misalignment is identified, the seatbelt and shackle, in that condition, should be loaded by a restorative force of 5 pounds (22 N) applied through the belt in the direction that it would be loaded in the emergency landing or turbulence situation. If the load is carried in the misaligned condition, the design is unacceptable. The examples in 3.2.3 illustrate various misalignment conditions that have been found to be unacceptable, as indicated. These examples are not intended to be all-inclusive.

To evaluate the belt for inadvertent disengagement, where disengagement is defined as the separation of the restraint's attachment fitting from the seat structure, the belt should be tested in all orientations with the seat in the taxi, takeoff, and landing conditions with the seat cushions installed. Interaction of belts in adjacent seats, where the belts could be inadvertently crossed and used by occupants in those adjacent seats, must be evaluated for the possibility of disengagement.

3.2.3 Examples

Examples of various causes of seat belt misalignment are illustrated in Figures 1 and 2.