Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, DC

TSO-C127a

Effective
Date: 8/21/98

Technical Standard Order

Subject: ROTORCRAFT, TRANSPORT AIRPLANE, AND NORMAL AND UTILITY AIRPLANE SEATING SYSTEMS

1. PURPOSE. This Technical Standard Order (TSO) prescribes the minimum performance standards (MPS) that rotorcraft, transport airplane, and normal and utility airplane seating systems of the following designated types must meet in order to be identified with the applicable TSO marking:

Type A - Transport Airplane
Type B - Rotorcraft
Type C1 - Normal & Utility Airplane - Crew Seats
Type C2 - Normal & Utility Airplane - Passenger Seats

2. APPLICABILITY. This TSO is effective for new applications submitted after the effective date of this TSO. All prior revisions to this TSO are no longer effective after the effective date of this TSO. However, applications submitted against the previous version of this TSO will be accepted up to six months after the effective date of this TSO. Seating systems approved under a previous TSO authorization may continue to be manufactured under the provisions of their original approval. However, major design changes to seating systems approved under a previous version of this TSO requires a new authorization under this TSO, per 14 CFR 21.611(b) .

3. REQUIREMENTS. New models of seating systems that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the MPS, qualification requirements, and minimum documentation requirements set forth in Society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS), Document No. AS 8049A, "Performance Standards for Seats in Civil Rotorcraft and Transport Airplanes," dated September, 1997, as amended by Appendix 1 of this TSO.

a. Additional information on the dynamic testing of seating systems is contained in Advisory Circular (AC) 20-137, "Dynamic Evaluation of Seat Restraint Systems & Occupant Restraint for Rotorcraft (Normal & Transport)," AC 23.562-1, "Dynamic Testing of Part 23 Airplane Restraint/Systems and Occupant Protection," and AC 25.562-1A, "Dynamic Evaluation of Seat Restraint Systems & Occupant Protection on Transport Airplanes". Compliance with these AC's is not necessary to receive a TSO authorization under this TSO. However, the applicant for a seat installation approval should be aware that any seating system may be required to meet the criteria contained in these AC's in order to qualify for installation in an aircraft."

DISTIBUTION: ZVS-326; A-W(IR)-3; A-X(FS)-3; A-X(CD)-4; A-FFS-1,2,7,8(LTD); A-FAC-0(MAX); AFS-610(2cys)

b. Environmental Qualification. There are no environmental test procedures referenced in this TSO or SAE AS 8049A.

c. Deviations. The FAA has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation in accordance with 14 CFR 21.609.

4. MARKING. In accordance with 14 CFR 21.607 (d), articles manufactured under this TSO must be marked as follows:

a. At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR Part 21.607(d), except for the option provided for in 14 CFR 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number, and

(1) The applicable seat type: "Type A-," "Type B-," "Type C1-," or "Type C2-" followed by the appropriate seat facing direction designation: "FF"-forward; "RF"-rearward; or "SF"-sideward.

(2) The seating system, safety belt, and seat cushion part numbers.

(3) For Type A passenger seating systems, the approved seat pitch necessary to maintain clearance to assure an effective emergency evacuation, as defined in AC 25.562-1A, Appendix 2. Use appropriate statement as follows: "See installation limitations in [component maintenance manual (CMM) or drawing number (insert number)]" or "[Minimum or Allowable range (if applicable)] seat pitch (insert number/range)."

(4) Optional marking is permitted to allow the use of aircraft-specific installation limitations, such as follows: **"FOR USE ON** (insert aircraft type or serial number) **ONLY."** or **"FOR USE ON AIRCRAFT USED IN PART 91 OPERATIONS ONLY"**

b. In addition to the requirements of 14 CFR 21.607(d), each separate component that is easily removable (without hand tools, except those components identified in paragraph **4.a(2)** that are TSO articles), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable with other seating systems must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's sub-assembly part number, and the TSO number, and

c. In addition to the requirements of 14 CFR 21.607(d), for Type A and Type B transport passenger, flight attendant, and observer seating systems, each seat cushion required for qualification of the seating system must be marked with "Complies with 14 CFR 25.853(c) effective February 2, 1995, or 14 CFR 29.853(b) effective November 26, 1984, as applicable" when tested in accordance with the requirements of Section 3.4.2 of SAE AS 8049A, as revised by subparagraph 2.2.3 of Appendix 1 of this TSO.

5. DATA REQUIREMENTS.

a. Application Data. In accordance with 14 CFR 21.605(a)(2), the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having purview of the manufacturer's facilities, one copy each of the following technical data to support the FAA design and production approval:

(1) Operating instructions and equipment limitations. The limitations shall be sufficient to describe the operational capability of the seating system.

(2) Installation procedures and limitations. The limitations shall be sufficient to ensure that the article, when installed in accordance with the installation procedures, continues to meet the requirements of this TSO. The limitations shall also be sufficient to identify any unique aspects of the installation. Installation instructions and limitations shall include all pertinent restrictions or other conditions relevant to the seating system installation in an aircraft. In particular, a description shall be provided to cover any installation limitations identified in Subsection 5.3.10.3 Test Data: b, h, j, k, o, and p of SAE AS 8049A, as revised by subparagraph 2.2.9 of APPENDIX 1 of this TSO and specifically any head strike path or permanent structural deformations, as reported in subparagraph **5.a(12)(iv)** below, that may have an impact on emergency evacuation. The limitations also shall include the following.

(i) A NOTE with the following statement:

> "The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must be approved for installation. The article may be installed only if the installation is performed in accordance with 14 CFR Part 43 or the applicable airworthiness requirements."

(3) Schematic drawings as applicable to the installation procedures.

(4) Wiring diagrams as applicable to the installation procedures.

(5) List of the components, by part number, that make up the seating system complying with the standards prescribed in this TSO.

(6) Detailed periodic cleaning, maintenance, and repair instructions, in the form of a Component Maintenance Manual (CMM) for continued airworthiness, including specific guidance on the limits of wear and damage permissible to the seat cushions and safety belt webbing material which would warrant replacement, i.e., explain how and/or when these materials lose their system effectiveness and when the strength of the webbing would be expected to drop below the specified abrasion breaking strength. Include recommended inspection intervals and service life.

(7) Material and process specifications.

(8) The quality control system description required by 14 CFR 21.605(a)(3) and 21.143(a), including functional test specification to be used to test each production article to ensure compliance with this TSO.

(9) Manufacturer's TSO qualification test report.

(10) Nameplate drawing.

(11) A drawing list, enumerating all of the drawings and processes, including revision level, that are necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(12) Detailed seat cushion drawing and test results used to establish approval as follows:

(i) Configuration drawings including foam, fire blocking layer, as required, and dress cover of the seat back and seat pan cushions.

(ii) Materials specification for the seat back and seat pan cushions.

(iii) Flammability test results on representative seat cushions with dress covers conducted per Section 3.4.2 of SAE AS 8049A, as revised by subparagraph 2.2.3 of APPENDIX 1 of this TSO.

(iv) Static and dynamic qualification test results on the seating system as per Section 5 of SAE AS 8049A, with a description of any equivalent procedures provided in subparagraph 2.1.3 of Appendix 1 of this TSO.

b. Manufacturer Data. In addition to the data that are to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO having purview of the manufacturer's facilities the following technical data:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.

(2) Equipment calibration procedures.

(3) Corrective maintenance procedures within 12 months after TSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

c. Furnished Data. One copy of the data and information specified in paragraphs **5.a(1)** through **(6)** and **(12)** of this TSO and any other data or information that are necessary for the proper installation certification and use and/or for continued airworthiness of the seating system must accompany each article manufactured under this TSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Copies of SAE AS 8049A and SAE J211 may be purchased from the Society of Automotive Engineers, Inc., Department 331, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

b. Federal Aviation Regulations, 14 CFR Part 21, Subpart O, 14 CFR Part 23, 14 CFR Part 25, 14 CFR Part 29, and 49 CFR Part 572 may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325.

c. Advisory Circular 20-110, "Index of Aviation Technical Standard Orders," AC 20-137, AC 23.562-1 and AC 25.562-1A may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

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APPENDIX 1. MINIMUM PERFORMANCE STANDARD (MPS) FOR ROTORCRAFT, TRANSPORT AIRPLANE, AND NORMAL AND UTILITY AIRPLANE SEATING SYSTEMS

1. Purpose. This appendix prescribes the MPS for seating systems, as modified by the FAA for reference in this TSO.

2. Requirements. The standards applicable to this TSO are set forth in the industry standard specified in paragraph **3** of this TSO. SAE AS 8049A, "Performance Standards for Seats in Civil Rotorcraft and Transport Airplanes," dated September 1997, which is the applicable standard is modified as follows:

2.1 Exceptions.

2.1.1 The information contained in Section 1. SCOPE: and Section 2. REFERENCES: of SAE AS 8049A is duplicative and shall be disregarded.

2.1.2 Compliance with Section 3.1 Guidance: of SAE AS 8049A is not required, except for Subsections 3.1.4, 3.1.8, 3.1.11, 3.1.14 (passenger seats only), 3.1.15 and 3.1.17 through 3.1.20.

2.1.3 Compliance with the dynamic test procedures and documentation of Subsection 5.3.1 Dynamic Impact Test Parameters: through Subsection 5.3.9.2 Impact Pulse Shape: of SAE AS 8049A may be demonstrated by equivalent procedures such as those described in either AC 23.562-1 or 25.562-1A. The simplified procedures for head injury criteria (HIC) outlined in policy letter TAD-96-002 dated 2/16/96 also may be used in lieu of the selection of test conditions described in Subsection 5.3.6.2 of SAE AS 8049A. The use of any equivalent procedures must be established by the applicant and accepted in advance by the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having geographic purview of the applicant's facility (See subparagraph 2.2.1 of this Appendix).

2.1.4 Compliance with the dynamic impact test pass/fail criteria of Subsections 5.4.3, 5.4.4, and 5.4.9 of SAE AS 8049A for permanent deformation limits, HIC, and femur loads, respectively, is not required. However, the data must be reported, as required by subparagraph **5.a(12)** of this TSO.

2.1.5 Disregard the marking requirements specified in Section 6. MARKINGS: of SAE AS 8049A. Marking of the article shall be in accordance with paragraph **4** of this TSO.

2.2 Additions.

2.2.1 As applicable, at least 30 days prior to conducting any required TSO testing and prior to submitting an application for TSO authorization per 14 CFR 21.605(a), the applicant shall submit, to the FAA ACO manager, a proposed plan for demonstrating compliance with the requirements of this TSO for the following:

2.2.1.2 Those equivalent procedures the applicant has proposed to use to demonstrate compliance with dynamic test requirements of subparagraph 2.1.3 of this Appendix.

2.2.2 Under Section 3.2 Requirements: of SAE AS 8049A, add a new Subsection 3.2.15 to read as follows: Except for rearward facing seats, the pelvic restraint system shall be designed such that the vertical angle subtended by the projection of the pelvic restraint centerline and the seat reference point (SRP) water line shall not be greater than 55 degrees. The SRP water line is a line/plane passing through the SRP parallel to the horizon. The pelvic restraint centerline is formed by a line from the pelvic restraint anchorage to a point located 9.75 inches forward of the SRP and 7.00 inches above the SRP water line. In addition, the pelvic restraint anchorage point(s) must be located no further than 2.0 inches forward of the SRP (ref Figure 1A of SAE AS 8049A).

2.2.3 Replace Subsection 3.4.2 of SAE AS 8049A with the following: Type A-Transport Airplane and Type B-Transport Rotorcraft passenger, flight attendant, and observer seat cushion systems shall be tested and shall meet the fire protection provisions of Appendix F, Part II of 14 CFR Part 25, as required in 14 CFR 25.853(c) effective March 6, 1995, and 14 CFR 29.853(b) effective October 26, 1984, respectively, or the equivalent shall be demonstrated by analysis (similarity) to provide equivalent protection. Type B- Normal Rotorcraft upholstery shall be self extinguishing when tested to meet the fire protection provisions of 14 CFR 27.853(b) effective February 4, 1980. Type C1- and C2- Normal & Utility Airplane seat cushions shall be self extinguishing when tested to meet the fire protection provisions of paragraph (c) of Appendix F of 14 CFR Part 23, as required in 14 CFR 23.853(d)(3)(ii) effective February 2, 1995.

2.2.4 The following two items shall be included in Subsection 5.3.10.3 Test Data: of SAE AS 8049A: o. Post test retrieval of life preserver; and p. Evaluation of seat egress (See adjustable features in Subsection 3.2.6 and baggage stowed under seat in Subsection 3.2.7 of SAE AS 8049A. These two items will be part of the data submittal required by subparagraph **5.a(12)(iv)** of this TSO.

2.2.5 Under APPENDIX A PROCEDURES FOR EVALUATING PULSE SHAPES, revise Subsection A.6 STEP 5 (REFERENCE FIGURE A5): of SAE AS 8049A to read: Construct a line parallel to the ideal (minimum regulatory requirement) pulse and offset by 2 g in magnitude less than the ideal during the time interval between T_1 and T_3. Likewise construct a line parallel to the ideal pulse and offset by 2 g in magnitude less than the ideal (minimum regulatory requirement) pulse on the trailing side of the pulse from:

$$T_3 < t < T_1 + 1.33(T_3 - T_1)$$

If the magnitude of the acquired pulse is 2 g less than the ideal pulse shape at any point along the acquired pulse shape during the period $T_1 < t < T_1 + 1.33(T_3 - T_1)$, the pulse is unacceptable.

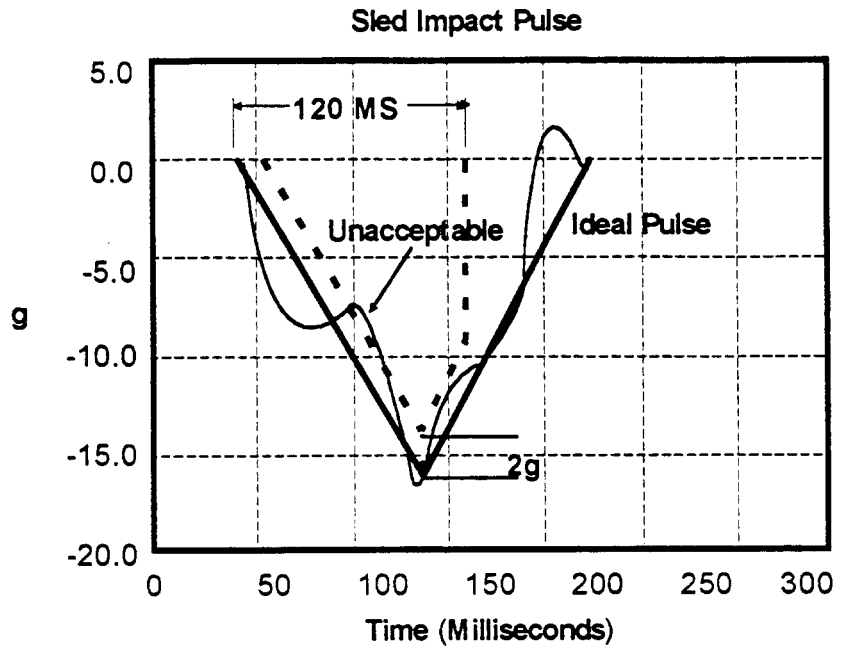
Sled Impact Pulse
5.0
0.0
-5.0
-10.0
-15.0
-20.0
g
120 MS
Unacceptable
Ideal Pulse
2g
0
50
100
150
200
250
300
Time (Milliseconds)

FIGURE 5A

APPENDIX 2. TEST CONDITIONS

SAE AS 8049A incorporates, as a reference, the following test standards for which a more recent version of these standards may be substituted, if approved by the FAA ACO manager having geographical purview over the manufacturer's facilities.

1. SAE J211- Instrumentation for Impact Tests.

2. Code of Federal Regulations, Title 49, Part 572, Anthropomorphic Test Dummies.