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Approved by： Yang Zhenmei

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Rotorcraft, Transport Airplane, and Small Airplane Seating Systems

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers of rotorcraft, transport airplane, and small airplane seating systems applying for a CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards(MPS) that rotorcraft, transport airplane, and small airplane seating systems must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date.

a. The applicant must submit an application according to this CTSO after its effective date. However, up to six months after this CTSO's effective date, if the applicant could show working against the prior MPS before the new change became effective, the application for previous revision could be accepted.

b. The CTSOA article approved under a previous CTSO may still be manufactured under the provisions of original approval after the effective date of this CTSO.

c. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.310 of CCAR-21R3.

3. Requirements.

New models of rotorcraft, transport airplane, and small airplane seating systems identified and manufactured on or after the effective date of this CTSO must meet the requirements in the following:

(1) SAE International's Aerospace Standard (AS) 8049B, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft, dated January 2005, as modified by appendix 1 of this CTSO;

(2) SAE Aerospace Recommended Practice (ARP) 5526C, Aircraft Seat Design Guidance and Clarifications, dated May 2011, as modified by appendix 1 of this CTSO;

(3) Appendix 2 of this CTSO (for specific elective requirements).

a. Functionality. This CTSO's standards apply to equipment intended to be utilized as aircraft seating systems of the following classifications:

(1) Seat Type and applicable Aircraft Category:

(a) Type A - Airplane. Aircraft Category: Transport

(b) Type B – Rotorcraft. Aircraft Category: Transport or Normal

(c) Type C - Small Airplane. Aircraft Category: Normal, Utility, Acrobatic, or Commuter

(2) Seat Subtype:

(a) Subtype 1 - Passenger

(b) Subtype 2 - Flight Attendant

(c) Subtype 3 - Observer

(d) Subtype 4 - Pilot / Copilot

(3) Seat Orientation:

(a) Forward Facing

(b) Rearward Facing

NOTE: Seats with installation limitations of angles more than 18 degrees from aircraft centerline are not addressed by this standard. See appendix 1 of this CTSO amending SAE AS8049B subsection 5.3.3.5.i.

b. Failure Condition Classifications. There is no standard minimum failure condition classification for this CTSO. The failure condition classification appropriate for the article will depend on the intended use of the article in a specific aircraft. The applicant may document the loss of function and malfunction failure condition classification for which the equipment is designed.

c. Functional Qualification. Demonstrate the required functional performance under the test conditions specified in:

(1) Sections 3.4 and 5 of SAE International's Aerospace Standard (AS) 8049B, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft, dated January 2005, as amended by appendix 1 of this CTSO;

(2) Section 3 of SAE Aerospace Recommended Practice (ARP) 5526C, Aircraft Seat Design Guidance and Clarifications, dated May 2011, as amended by appendix 1 of this CTSO; and

(3) Appendix 2 of this CTSO for specific elective requirements.

d. Deviations. For using alternative or equivalent means of compliance to the criteria in the MPS of this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. The applicant must apply for a deviation in accordance with section 21.310(b) of CCAR-21R3.

4. Marking.

a. Mark at least one major component permanently and legibly with all the information in section 21.312(d) of CCAR-21R3. The marking must include the serial number and:

(1) The specific seat MPS complied with as abbreviated by paragraphs 4.a.(1).(a) through 4.a.(1).(e) below. Separate each applicable identifier with a dash. For example, a transport airplane passenger seat that is forward facing meets the step load on the baggage bar standard, and meets higher static loads shall be marked as: Type A-T-1-FF -a-c.

(a) The seat type, use: “Type A” for Airplane, “Type B” for Rotorcraft, or “Type C” for Small Airplane.

(b) The seat type shall be followed by the aircraft category, use: “T” for Transport, “N” for Normal, “U” for Utility, “A” for Acrobatic, or “C” for Commuter.

(c) The aircraft category shall be followed by the appropriate seat subtype, use: “1” for Passenger, “2” for Flight Attendant, “3” for Observer, or “4” for Pilot/Copilot.

(d) The subtype shall be followed by the appropriate seat facing designation, use: “FF” for Forward Facing, or “RF” for Rearward Facing.

(e) The seat facing designations shall be followed by the applicable paragraph letter of the elective criteria defined in appendix 2 of this CTSO, use: “a” for Step Load on Baggage Bars, “b” for Flight Attendant Step Load, “c” for Testing to Higher Static Loads, “d” for Hand Holds, “e” for Flammability –Large Exposed Non-metallic Parts.

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

(3) The document reference that contains installation instructions and limitations per the requirements of section 5.a.(3).

(4) For Type A and Type B-Transport passenger, flight attendant and observer seating systems, mark each seat cushion to be qualified with “Meets provisions of CCAR-25 R4, Appendix F, Part II.”

b. Also, mark the following permanently and legibly, with at least the manufacturer’s name, subassembly part number, and the CTSO number:

(1) Each component that is easily removable (without hand tools); and

(2) Each subassembly of the article that manufacturer determined may be interchangeable.

5. Application Data Requirements.

The applicant must furnish the responsible certification personnel with technical data to support design and production approval. The data include a statement of conformance as specified in section 21.310(c)(3) of CCAR-21R3 and one copy each of the following:

a. A Manual(s) containing the following:

(1) Operating instructions and article limitations sufficient to describe the article’s operational capability.

(2) Describe in detail any deviations.

(3) Installation procedures and limitations sufficient to ensure that the aircraft seating system, when installed according to the installation or operational procedures, still meets this CTSO’s requirements. Limitations must identify any unique aspects of the installation (e.g. seat pitch, aircraft attachments, orientation angle, maximum seat weight, permanent deformation, etc.). The limitations must include a note with the following

statement:

“This article meets the minimum performance and quality control standards required by a CTSO. Installation of this article requires separate approval.”

(4) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of the aircraft seating system.

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

(6) List the specific elective MPS complied with under appendix 2 of this CTSO.

b. Instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of the aircraft seating system, including specific guidance on the limits of wear and damage permissible to the seat cushions and safety belt restraint system 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, as appropriate.

c. Nameplate drawing with the information required by paragraph 4 of this CTSO.

d. Identify functionality or performance contained in the article not

evaluated under paragraph 3 of this CTSO (that is, non-CTSO functions). Non-CTSO functions are accepted in parallel with the CTSO authorization. For those non-CTSO functions to be accepted, the applicant must declare these functions and include the following information with CTSO application:

(1) Description of the non-CTSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that the non-CTSO function(s) don’t interfere with the article’s compliance with the requirements of paragraph 3.

(2) Installation procedures and limitations sufficient to ensure that the non-CTSO function(s) meets the declared functions and performance specification(s) described in paragraph 5.d.(1).

(3) Instructions for continued performance applicable to the non-CTSO function(s) described in paragraph 5.d.(1).

(4) Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph 5.d.(1).

(5) Test plans, analysis and results, as appropriate, to verify that performance of the hosting CTSO article is not affected by the non-CTSO function(s).

(6) Test plans, analysis and results, as appropriate, to verify the

function and performance of the non-CTSO function(s) as described in paragraph 5.d.(1).

e. The quality system description required by section 21.143 and 21.310(c)(2) of CCAR-21R3, including functional test specifications. The quality system should ensure that it will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly.

f. Material and process specifications list.

g. List of all drawings and processes (including revision level) that define the article's design.

h. Manufacturer's CTSO qualification report showing results of testing accomplished according to paragraph 3.c of this CTSO.

i. Detailed seat cushion drawings used to establish approval as follows:

(1) Configuration drawings including foam, fire blocking layer, as required, and dress cover of all cushions.

(2) Materials specification for all cushions

6. Manufacturer Data Requirements.

Besides the data given directly to the authorities, have the following technical data available for review by the authorities:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Equipment calibration procedures.

c. Schematic drawings.

d. Wiring diagrams.

e. Material and process specifications.

f. If the article contains non-CTSO function(s), the applicant must also make available items 6.a through 6.e as they pertain to the non-CTSO function(s).

7. Furnished Data Requirements.

a. If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy or on-line access to the data in paragraphs 5.a and 5.b of this CTSO; as well as static and dynamic qualification test results on the seating system per AS8049B, section 5, as modified by Appendix 1 of this CTSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the CTSO, of the aircraft seating system.

b. If the article contains declared non-CTSO function(s), include one copy of the data in paragraphs 5.d.(1) through 5.d.(4).

8. Availability of Referenced Documents.

Order SAE documents from:

Society of Automotive Engineers, Inc.

400 Commonwealth Drive, WARRENDALE, PA 15096-001, USA.

You may also order them online from www.sae.org.

Appendix 1. MPS for Rotorcraft, Transport Airplane, and Small Airplane Seating Systems

1.0. This appendix prescribes MPS for SAE International's Aerospace Standard (AS) 8049B, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft, dated January 2005. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. In addition, the authorities have also modified AS8049B as follows:

Table 1- SAE AS8049B

When reading AS8049B…	Do the following:
Section 1	Disregard
Section 2	Disregard
Section 3	Apply all subsections unless disregarded or modified below: --- Page 5, disregard subsection 3.1 --- Page 6, replace subsection 3.2.7 to read as follows: 3.2.7 When an under-seat baggage restraint is incorporated in a passenger seat, it shall be designed to restrain at least 9.1 kg (20 lb) or its placarded weight of stowed items per passenger place under the *dynamic and static (forward and sideward directions only)* test conditions of this document in a manner that will not significantly impede rapid egress from the seat. --- Page 6, replace subsection 3.2.15 to read as follows: 3.2.15 Except for rearward facing seats *and seats equipped with multiple anchorage point pelvic restraints (e.g. Y-belts),* the pelvic restraint system shall be designed such that the vertical angle *between the pelvic restraint centerline and the seat reference point (SRP) waterline shall range from 35° to 55°*. The SRP water line is a line/plane passing through the SRP parallel to the floor waterline. The pelvic restraint centerline is formed by a line from the pelvic

	restraint anchorage to a point located 250 mm (9.75 in) forward of the SRP and 180 mm (7.0 in) 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). See AC 21-34 for additional guidance for acceptable seat belt geometry.* --- Page 6, add subsection 3.2.16 to read as follows: *3.2.16 All hinged armrest caps installed along an aisle must close as a result of normal movement along the aisle. Caps must not snag clothing or present any other impediment to egress when contacted by a person moving in either direction along the aisle.* --- Page 6, add subsection 3.2.17, to read as follows: *3.2.17 Safety belt restraint systems must be equipped with a metal-to-metal latching device.* --- Page 6, add subsection 3.2.18 to read as follows: *3.2.18 Design seat stowage compartments to prevent the contents becoming a hazard by shifting under the load conditions identified in Table 4 and subsection 5.3.1. Specify the maximum weight of the contents allowed in each stowage compartment, and report it in accordance with paragraph 5.a of this CTSO.* --- Page 6, add subsection 3.2.19 to read as follows: *3.2.19 The seat reference point (SRP) must be determined using only one of the methods described in Figure 1B. The selected method shall be documented, and must be used consistently when evaluating all variations of the seat CTSOA model or future changes to the seat CTSOA model design.* --- Page 10, replace subsection 3.4.1 to read as follows: *3.4.1 Test the materials in Type A Transport and Type B Transport seating systems, ensuring they meet the fire protection properties specified in CCAR-25R4, Appendix F, Part I, paragraph (a)(1). The applicant may demonstrate the material's fire protection properties using the methods provided in the FAA policy statement, PS-ANM-25.853-01-R2, Flammability*

	Testing of Interior Materials, which may permit substantiation based on previously tested materials. The definition and use of parts that are considered small parts that would not contribute significantly to the propagation of a fire must be approved in advance by the authorities to which this CTSO data is to be submitted. When inflatable restraints are included, the airbag material shall meet the flammability requirements of CCAR-25, Appendix F, Part I(a)(iv). *Note: Inflatable restraints are a new and novel technology that may be subject to significant additional special conditions and certification requirements for installation approval.* *Materials in Normal, Utility and Acrobatic category Type C seating systems must have flame-resistant properties. Test the materials to meet the requirements of paragraph 8.b of FAA advisory circular (AC) 23-2A, Change 1, Flammability Tests. Commuter category Type C seating systems shall meet the flammability performance requirements defined in CCAR 23.853(d)(3), and tested as prescribed in CCAR-23R3, Appendix F.* *Materials in Type B Normal Rotorcraft seating systems must have flame-resistant properties. Test the materials to meet the requirements of paragraph 8.b of FAA advisory circular 23-2A, Flammability Test, dated May 11, 2007. You may also demonstrate the material's fire protection properties by analysis (similarity) to provide equivalent protection.* *Type A - Transport airplane insulation on electrical wire and electrical cable, and materials used to provide additional protection for the wire and cable, must be self-extinguishing when tested in accordance with the applicable portions of Appendix F, part I, as defined in CCAR-25R4.* *Type B – Rotorcraft insulation on electrical wire and cable must be self-extinguishing when tested in accordance with Appendix F, Part I(a)(3), as defined in CCAR-25R4.* *Type C seats with insulation on electrical wire and electrical cable must be self-extinguishing when tested at an angle of 60 degrees in accordance with the applicable portions of Appendix F as defined in CCAR-23R3. The average burn length must not exceed 3 inches (76 mm) and the average flame time after removal of the flame source must not exceed 30 seconds. Drippings from the test specimen must not continue to flame for more than an average of 3 seconds after falling.* --- Page 10, replace subsection 3.4.2 to read as follows: Type A *Transport and Type B Transport* - passenger, flight attendant, and observer seat cushion systems shall be tested to and shall meet the fire

protection provisions of CCAR-25R4 *Appendix F, Part II. You may also demonstrate the material's fire protection by following AC 25.853-1, Flammability Requirements for Aircraft Seat Cushions, and, where applicable, ANM-115-07-002, Policy Statement on certification for flammability of lightweight seat cushions.*

Page 12, replace subsection 3.5.7 to read as follows:

3.5.7 Deployable Items: Certain items on the seat, such as food trays, legrests, arm caps over in-arm tray tables, etc., are used by passengers in flight and are required to be stowed for taxi, takeoff and landing. Deployment of such items should be treated as "permanent deformation" if the item deploys into an area that must be used by multiple passengers (in addition to the occupant of the seat) for egress. The location of the measuring point used for determining the deformation of the deployed item shall be either at the point of full deployment or at the point of the actual deployment if a partially deployed item resists further deployment upon application of a static load of 45 N (10 lb) along the direction of the inertial load path. Such deployments can be considered acceptable, even if they exceed the provisions of 3.5 and its subparagraphs, if they are readily pushed out of the way by normal passenger movement, and remain in a position that does not affect egress *(i.e., when pushed out of the way it remains in that position). Normal passenger movement is the act of the seated occupant getting up out of the seat and moving to egress the airplane (i.e., unbuckling their restraint, standing, turning towards the aisle and moving into the aisle). It does not include additional movements to lift or stow items, or latching an item in place.* Any items that remain in a position that would affect egress shall be reported as permanent deformation.

If the food tray table deploys as a result of being struck by the ATD head during a row-to-row HIC test and the food tray table is easily pushed out of the way, the deployment is acceptable and does not need to be considered as permanent deformation (except for seats installed where deployment may affect egress through a required exit path – see below). It is not required for the food tray table to remain in a position that does not affect egress. "Easily pushed out of the way" is not required to be by normal passenger movement. Determination of the food tray deploying as a result of being struck by the ATD head during the test shall be made by evaluation of the high speed film/video.

If the food tray table deploys as a result of being struck by the ATD head during the test and the food tray table is not easily pushed out of the way, the deployment shall be treated as permanent deformation.

Any food tray deployment on a seat that will be installed where deployment may affect egress through a required exit path, regardless of being struck by the ATD

	head, shall be treated as permanent deformation.
Section 4	Apply all subsections unless disregarded or modified below: --- Page 16, replace note (1) in Table 4 to read as follows: *(1) The 4.0 ultimate load factor applies to the seat assembly (except for the fittings). The highest special factor of safety (e.g. casting) applicable to any part (except for the fittings) shall be applied to the 4.0 ultimate load factor. Fittings (as defined in paragraph 4.1.3) must meet a minimum applied load factor of 4.0g. The 4.0 applied load factor for the fittings includes the 1.33 fitting factor. If multiple special factors of safety are applicable to the fittings (e.g. fitting factor and casting factor), then as indicated in paragraph 4.1.4, the fitting shall be tested statically to the highest applicable special factor of safety. Since for the fittings the 4.0g applied load factor already includes the 1.33 fitting factor, the 1.33 fitting factor is divided out before the highest special factor of safety is applied.* --- Page 16, replace note (2) in Table 4 to read as follows: (2) Elective: Increase these load factors as necessary for reduced weight gust/flight loads or landing requirements. *Loads at angles other than those prescribed by Table 4 may be tested.* All seat adjustment positions and occupancy variations, including those used in flight, must be evaluated when using these increased load factors. *Document the increased load factors and report them in accordance with paragraphs 5.a and 5.h of this CTSO. You must also mark them on the CTSO placard. (See Appendix 2 of CTSO-C127b.)* --- Page 16, replace note (4) in Table 4 to read as follows: (4) Normal, Utility, *Acrobatic* and Commuter Category. --- Page 16, delete note (7) in Table 4 Explanation: The seating system's manufacturer doesn't control the CCAR-23R3 requirements applying to the seat installation. The manufacturer may test to load factors higher than required in Table 4 under the provisions in Appendix 2, paragraph c, of this CTSO. --- Page 16, add a reference of note (8) to be applicable to the *Upward load* direction for *Type C Seat in Table 4.* Add note (8) to Table 4 to read as follows:

	(8) Use a factor of 4.5 for Acrobatic Category seats.
Section 5	Apply all subsections unless disregarded or modified below: ---------- Page 21, replace subsection 5.1.9 to read as follows: 5.1.9 The load due to any item of mass, including the seat that is not restrained by the occupant restraint system must be applied in a representative manner at the c.g. of the mass, *or with a corrective factor applied in a conservative manner relative to the c.g. of the item of mass.* *Note: If you demonstrate retention of an item of mass attached to the seat (by the dynamic qualification tests of subsection 5.3), you don't need to further demonstrate static retention for the forward and down static conditions. However, you must still demonstrate retention of items of mass for the side and aft static conditions.* ---------- Page 23, replace subsection 5.2.2 to read as follows: 5.2.2 The seat structure must be able to support ultimate loads without failure for at least 3 seconds. If it can be shown that failure of an armrest on a seat assembly does not reduce the degree of safety afforded the occupant(s) or become a hazard, such failure will not be cause for rejection. *Note: If you demonstrate the retention of an item of mass attached to the seat by the dynamic qualification tests of subsection 5.3, you don't need to further demonstrate static retention for the forward and down static conditions. However, you must still demonstrate retention of items of mass for the side and aft static conditions.* ---------- Page 23, replace 5.3 to read as follows: 5.3 Dynamic Qualification Tests: This section specifies the dynamic tests to satisfy the requirements of this document. *For Type A Seats: You may demonstrate compliance with the dynamic test procedures and documentation of subsections 5.3.1 Dynamic Impact Test Parameters: through subsection 5.3.9.2 Impact Pulse Shape: of SAE AS 8049B by the equivalent procedures of AC 25.562-1B. The equivalent method shall be documented in the document that contains installation instructions and limitations per the requirements of section 5.a.3 of this CTSO, and must be used consistently when evaluating all variations of the seat or future changes to the seat design.* *For Type A Seats: You can also use the simplified procedures for head injury criteria (HIC) outlined AC 25.562-1B instead of the test conditions in AS8049B subsection 5.3.6.2.* *Except for Hybrid III ATDs (49 CFR Part 572, Subpart E) modified in accordance with SAE Technical Paper 1999-01-1609, use of an equivalent ATD must be established by the applicant and accepted by the authorities.*

	--- Page 23, replace subsection 5.3.1.2 to read as follows: 5.3.1.2 Test 2 (Figures 6, 7A, and 7B), as a single row seat test, determines the performance of a system in a test condition where the predominant impact force component is along the aircraft longitudinal axis and is combined with a lateral impact force component. This test evaluates the structural adequacy of the seat, permanent deformation of the structure, the pelvic restraint and upper torso restraint (if applicable) behavior and loads, and may yield data on ATD head displacement, velocity, and acceleration time histories and the seat leg loads imposed on the seat tracks or attachment fittings. *For seats intended to be installed at an angle relative to the longitudinal axis of the aircraft that is greater than 2º (but less than 18 º), the test yaw angle for the test that substantiates those seats shall be 10º plus or minus the intended installation angle (if more critical) depending on which yaw angle results in the most critical attachment fitting resultant loads.* --- Page 37, replace subsection 5.3.3.5.i to read as follows: i. Side-Facing Seats: *Seats with installation limitations of angles more than 18 degrees from aircraft centerline are not addressed by this standard.* --- Page 37, replace subsection 5.3.3.6 to read as follows: 5.3.3.6 Multiple Row Test Fixtures: In tests of passenger seats that are normally installed in repetitive rows in the aircraft, head and knee impact conditions are best evaluated through tests that use at least two rows of seats. These conditions are usually critical only in Test 2. This test allows direct measurements of the head and femur injury data. a. The fixture shall be capable of setting the aircraft longitudinal axis at a yaw angle of -10° and +10°. The fixture should also allow adjustment of the seat pitch. b. To allow direct measurement of head acceleration for head injury assessment for a seat installation where the head of the occupant is within striking distance of structure, a representative impact surface may be attached to the test fixture in front of the front row seat at the orientation and distance from the seat representing the aircraft installation. *c. Test 2 (Figures 6, 7A, & 7B) conducted solely to collect head/knee path data should be conducted with 0º yaw and without floor deformation. The test must be conducted on the seat with the greatest overhang among the seats selected for the applicable forward longitudinal dynamic structural test. It is acceptable to use the opposite-hand part for this seat. The occupancy used in the applicable forward longitudinal dynamic structural test must be used for this test. For consistency, a floor should be used for tests used to gather head path data. It is acceptable to collect ATD head path data in the applicable forward longitudinal dynamic structural test.* *d. Seats designed for seat tracks that are not in-line and parallel (track-break*

	seats) typically require special floor attachment fittings. The installation of the seat tracks on the test fixture for these seats is unique, and depends on the intended seat location in the airplane. The test setup must represent the seat track orientation on the airplane (that is, angles, offsets, forward/aft distance, and so forth) of seat tracks under the aft attachments vs. the forward attachments). --- Page 43, replace subsection 5.3.5 to read as follows: 5.3.5 Selection of Test Articles: Many seat designs comprise a family of seats that have the same basic structural design but differ in detail. For example, a basic seat frame configuration can allow for several different seat leg locations to permit installation in different aircraft. If these differences are of a nature that their effect can be determined by rational analysis, then the analysis can determine the most critical configuration. As a minimum, the most *critically* stressed configuration shall be selected for the dynamic tests so that the other configurations could be accepted by comparison with that configuration. There are two factors that must be considered in selecting the critical structural test configurations. First, the seat to aircraft interface loads (undeformed seat) can be determined by rational analysis for the seat design and load configurations. The rational analysis can be based on static or dynamic seat/occupant analytical methods. The rational analysis can form the basis for selecting the most highly stressed critical configuration based on load. Additionally, the effects of seat deformation should be considered. As noted, a family of seats typically includes seat models with varied seat leg locations. The effects of floor deformation are more critical for narrowly spaced legs. Thus, a test or rational analysis of the seat model with the minimum seat leg spacing must be conducted to evaluate the most highly stressed critical configuration based on deformation. --- Page 44, replace subsection 5.3.5.1 to read as follows: 5.3.5.1 In all cases, the test article must be representative of the final production article in all structural elements, and shall include the seat, seat cushions, restraints and armrests. It must also include a functioning position adjustment mechanism and correctly adjusted break over (if present). Weights simulating luggage carried by luggage restraint bars [9.1 kg (20 lb) per passenger place] need only be representative masses. Items 0.15 kg (0.33 lb) or greater that are part of the seat and affect the dynamic performance of the seat, including occupant injury and egress, must be representative of the production item and production means of attachment on the test article. Items 0.15 kg (0.33 lb) or greater that are part of the seat but do not affect the dynamic performance of the seat, including occupant injury and egress, may be representative masses, but the production means of attachment must be on the test article.

	Items less than 0.15 kg (0.33 lb) and their means of attachment are not required to be on the test article. However, the mass of the item must be included on the test article as ballast. Wiring harnesses, regardless of weight, may be represented on the test article by ballast weights. The production means of attachment need not be included in the test. Life vests must be installed on the test article, if provisions are provided, but are not required to be the production life vest. Any life vest of equivalent weight, or greater, may be included on the test article. The life vest may be ballasted to substantiate heavier life vests. *The life vest must represent the size and configuration of the production life vest if its size or configuration could affect retention of the life vest.* *If an item of mass that does not affect the dynamic performance of the seat fails during a test that is otherwise acceptable, then you may validate the design by a 24g static test. The failed test article must be redesigned unless the failure is attributable to test setup or non-representative test article. The certified gross weight of the test article must be adjusted to account for any separation of mass due to failure. Apply the load for the 24g test in the same direction as the load vector in the dynamic test where the failure occurred. Any preload, such as due to floor warpage, of the failed article must be represented in the static 24g test.* In any case, the separation of an item of mass should not leave any sharp or injurious edges. Function of equipment or subsystems after the test is not required. Once it has been demonstrated that an item of mass can be retained in its critical loading case, subsequent tests may be conducted with the item secured for test purposes. --- Page 45, replace subsection 5.3.6.3 to read as follows: 5.3.6.3 If a non-symmetrical upper torso restraint system (such as a single diagonal shoulder belt) is used in a system, it shall be installed on the test fixture in a position representative of that in the aircraft. For a forward-facing seat equipped with a single diagonal shoulder belt, the Test 2 yaw direction should be selected such that the belt passes over the *leading* shoulder. *Note: For a Type A seat, additional tests may be required with the single diagonal shoulder belt passing over the trailing shoulder in order to evaluate retention of the harness on the occupant shoulder. As applicable, test per AC-25.562-1B, paragraph 3.b.(3).* --- Page 50, replace subsection 5.3.9.2 to read as follows: 5.3.9.2 Impact Pulse Shape: Data for evaluating the impact pulse shape are obtained from an accelerometer that measures the acceleration in the direction parallel to the inertial response shown in Figures 6, 7A, and 7B. The impact pulses intended for the tests discussed in this document have an isosceles triangle shape. These ideal pulses are considered minimum test conditions. Since the actual acquired test pulses will differ from the ideal, it is necessary to

	evaluate the acquired test pulses to insure the minimum requirements are satisfied. The five properties of the ideal pulse that must be satisfied by the acquired test pulse are (referring to Figures 6, 7A, and 7B, and as discussed in Appendix A): Pulse shape: isosceles triangle Greq: peak deceleration required by test condition Treq: rise time required by test condition V: total velocity change required by test condition Vtr: velocity change required during Treq (Vtr = V/2) A graphical technique can be used to evaluate pulse shapes that are not precise isosceles triangles. Appendix A presents the graphical method of evaluating the acquired pulse (the recorded test sled acceleration versus time). For the acquired pulse to be acceptable, t*he requirements of Appendix A shall be met.* --- Page 54, replace subsection 5.3.9.9 to read as follows: 5.3.9.9 Femur Load (Type A Seats): Data for measuring femur loads can be collected in the tests discussed in this document if the ATD's legs contact seats or other structure. The maximum compressive load in the femur can be obtained directly from a plot or listing of each femur load transducer output. If the value of peak acceleration measured in the test exceeds the level given in Figure 6, 7A, or 7B, the femur load measured in the test may be adjusted by no more than 10% by multiplying the measured values by the ratio of the peak acceleration given in Figure 6, 7A, or 7B divided by the measured peak acceleration, if necessary. Data need not be recorded in each individual test if rational comparative analysis is available for showing compliance. For large clearance installations (distance from seat SRP to strike target is greater than 100 cm (40 in) nominally), no data is necessary to substantiate femur loads. *However, appropriate limitations must be included in the installation instructions and limitations required in CTSO paragraph 5.a.* *Extensive seat testing has shown that the femur loading criterion is not usually exceeded therefore, recording femur loads may not be necessary during the test if you can show compliance by rational comparative analysis using data from previous tests. However, the rational analysis must show that the testing applies to the seat design, and you must include appropriate limitations in the installation instructions and limitations required in this CTSO, paragraph 5.a.* --- Page 54, replace subsection 5.3.9.11 to read as follows: 5.3.9.11 Seat Deformation: The permanent deformations affecting aircraft evacuation shall be evaluated and documented. The floor deformation fixture may be returned to the flat floor condition for documenting seat deformation. This documentation can take the form of dimensioned scale drawings that show the seat in its deformed condition relative to a reference origin, such as a floor track fitting which can be related

	to the aircraft interior. If the seat deformation is not critical, still photographs of the seat (with dimensional targets or grids in place so that measurements can be made) will provide adequate documentation. Any actions necessary for proper seat functions, such as stowage of the seat when the ATD is removed, shall be observed and documented. *Safety belt restraint systems must not yield to the extent they would impede rapid evacuation of the occupant.* ---------- Page 56, replace subsections 5.3.10.1.1.e and 5.3.10.1.1.f to read as follows: e. A statement confirming that the data collection was done in accordance with the requirements of this document, or a detailed description of the actual procedure used and technical analysis showing equivalence to the requirements of this document. *Note: Unless otherwise specified in the CTSO, you must obtain authorities approval for any deviations from the requirements of AS8049B subsections identified as MPS of this CTSO. Address deviations according to this CTSO, paragraph 3.d.* f. Manufacturer, governing specification, serial number, and test weight of ATDs used in the tests, and a description of any modifications or repairs performed on the ATDs that could cause them to deviate from the specification. *Note: Unless otherwise specified in the CTSO, you must obtain authorities approval for any deviations from the requirements of AS8049B subsections identified as MPS of this CTSO. Address deviations according to this CTSO, paragraph 3.d.*
Section 6	Disregard and refer to paragraph 4 of the CTSO
Section 7	Disregard
Appendix A	No Changes

2.0. This paragraph prescribes MPS for SAE International ARP5526C, Aircraft Seat Design Guidance and Clarifications, dated May 2011. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. In addition, authorities have also modified ARP5526C as follows:

Table 2 SAE ARP5526C

When reading ARP5526C…	Do the following:
Section 1	Disregard

Section 2	Disregard
Section 3	Disregard all subsections in Section 3 not listed below. The following subsections apply as modified: Page 5, replace subsection 3.2.2 to read as follows: 3.2.2 Definition and Criteria: 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. *Restraint system anchorages should provide self-aligning features. If self-aligning features are not provided, the static and dynamic tests in this document should be conducted with the restraints and anchorages positioned in the most adverse configuration allowed by the design. The anchorage system shall minimize the possibility of incorrect installation or inadvertent disconnection of the restraints.* The seat belt installation should not appear to the belted occupant to be properly adjusted (snug) while there is significant [2.54 cm (one inch) 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 test 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 22.2 N (five pounds) 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 Section 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 test 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. ---------- Page 9, replace subsection 3.3.2 to read as follows: *3.3.2 Definition and Criteria: The term life preserver, life vest and life jacket may be used interchangeably. When life preserver stowage provisions are included as part of the seat design, the stowage provisions shall provide access to a life preserver for each seating position. The life preserver stowage shall be designed and located such that the requirements of this section are met. Per paragraph 5.a of this CTSO, the installation, operating and maintenance instructions shall also reflect the requirements of this section. For example, installation instructions shall account for the allowable life preserver weight and size, marking requirements, as well as the required unobstructed area to remove the life preserver from the container. Furthermore, the operating instructions must report the detailed content of the simulated preflight briefing and any special instructions for unique aspects of the design operation that should be considered for operational use and continued performance.* *a. The life preserver shall be restrained under all applicable loading conditions; i.e., the retention device shall not allow the preserver to come free during emergency landing static and dynamic conditions, taxi, takeoff, landing, turbulence, and during stowage and removal of under seat baggage.* *b. Any life preserver locating placard installed on the seat shall accurately state the location of the life preserver and be adequately marked per 3.8.2 of this ARP5526 Revision C document (e.g. "Life preserver under center armrest"). For life preserver locations other than under the seat or under a console between the seats, mark "Life preserver" or "Life preserver inside" on the container or compartment, unless the location is identified with a pull strap. Pull straps shall be red or labeled "PULL" or "PULL FOR LIFE PRESERVER" in contrasting color. A symbolic placard may be used in lieu of text.* *For seats intended to be installed in sequential rows, a placard may be on the seat back stating the location of the life preserver for the occupant seated behind.* *c. The retrieval path of the life preserver shall be free of obstructions due to life preserver container movement and/or seat or aircraft components (e.g., seat legs, cushions, baggage bars, shrouds, etc.) when the seat is in the configuration for taxi, takeoff and landing.* *d. The life preserver stowage shall not present any sharp edges or points that could damage the life preserver or cause injury.* *e. For under seat pan storage on passenger seats(excluding center console*

	storage): *1) A pull strap shall be connected to the life preserver, or a pull strap or latch shall be on the compartment opening, such that when the strap or latch is pulled, the preserver is presented on the strap or the occupant can reach into the compartment to retrieve the preserver (i.e., one or two motions of the occupant result in retrieval of the life preserver).* *2) The life preserver shall be located no more than 3 inches aft of the front edge of the seat bottom, i.e., the seat frame or cushion, whichever is further forward.* *3) Unless limited by seat cushions or structure (e.g. seat leg, floor, etc.), designs utilizing a pull strap shall permit life preserver retrieval when pulled from any angle between* *a) 45 degrees up and 50 degrees down from the horizontal.* *b) 45 degrees left and 45 degrees right from the container centerline.* *4) For designs utilizing a pull strap, normal seat operation or under seat baggage storage activities shall not sweep the pull strap into an unreachable location.* *5) The life preserver container, or compartment, as installed on the seat shall protect the life preserver from inadvertent damage from normal passenger movement such as the stowage and removal of underseat baggage.* *f. Demonstrate that the life preserver shall be within easy reach of, and shall be readily removed by a seated and belted occupant (shoulder strap(s) may be removed prior to demonstration), for all seat orientations and installations that are intended for use during taxi, takeoff and landing. In lieu of an actual life preserver, a representative object (e.g. size and weight) may be utilized for testing. The evaluation to quickly retrieve the preserver is to begin with the occupant moving their hand(s) from the seated position to reach for the preserver and to end with the occupant having the preserver in their hand(s) and fully removed from the stowage container. It does not include the time for the occupant to return to the upright position, to remove a pull strap from the preserver (if used) or to open the preserver package provided by the preserver manufacturer. Test the critical configuration(s) to demonstrate retrieval in less than 10 seconds by a minimum of 5 test subjects with a success rate of no less than 75 percent. The test shall evaluate three anticipated occupant test subject size categories: 5th, 50th and 95th percentile. At least one occupant from each size category shall demonstrate successful retrieval within 10 seconds. Test subjects for either the 5th or 95th percentile occupant category shall not exceed 40% of the overall test subject population.* *1) For passenger seats the test subjects shall be naïve. For the purpose of this test naïve test subjects shall be defined as: they shall have had no experience within the prior 24 months in retrieving a life preserver. Subjects must receive no retrieval information other than a typical preflight briefing. The occupant size categories to be evaluated shall be defined as:* *a. A 5th percentile is no more than 60 in (1.5 m) tall* *b. A 50th percentile is at least 63 in (1.6m) tall but no more than 70 in (1.8 m)*

	tall. *c. A 95th percentile weighs at least 244 lb (110.7 kg).* *2) For flight attendant and observer seats the test subjects do not need to be naïve. The occupant size categories to be evaluated shall be defined as:* *a. A 5th percentile is no more than 60 in (1.5 m) tall* *b. A 50th percentile is at least 63 in (1.6m) tall but no more than 70 in (1.8 m) tall.* *c. A 95th percentile weighs at least 244 lb (110.7 kg).* *3) For pilot/copilot seats the test subjects do not need to be naïve. The occupant size categories to be evaluated shall be defined as:* *a. A 5th percentile is no more than 62 in (1.57 m) tall* *b. A 50th percentile is at least 63 in (1.6m) tall but no more than 70 in (1.8 m) tall.* *c. A 95th percentile weighs at least 244 lb (110.7 kg).* --- 3.6.2 For Type A seats, apply as written 3.7.2 For Type A seats, apply as written --- Page 13, replace subsection 3.8.2 to read as follows: 3.8.2 Definition and Criteria: Safety placards on occupant seats should be permanently affixed, located such that they cannot be easily obscured and of a type that cannot be easily erased. The lettering height and color contrast should be sufficient to allow the placard to be read by the intended occupant (e.g. placards located on the back of the seat should be designed to allow the occupant seated behind to easily read it at the anticipated installed pitch.) --- 3.9.2 Apply as written 3.10.2 Apply as written 3.11.2 Apply as written --- Page 20, replace subsection 3.12.2 to read as follows: 3.12.2 Definition and Criteria: Edges that could cut skin during normal use (including in edges on electrical equipment) should be eliminated and for maintenance should be minimized. *To be considered non-injurious, edges that are accessible (as defined in section 3.11.2.1) and could cut skin during normal use shall meet either of the standards listed below:* *1. NASA Standard 3000 Volume I (NASA–STD-3000 Vol I), Man-Systems Integration Standards, Revision B, July 1995, Section 6.3.3, or* *2. UL 1439, Standard for Tests for Sharpness of Edges on Equipment, Edition 4, February 26, 1998, with revisions through 6/1/2004.* In addition, the seat should not have any feature whose edges or corners are exposed when deployed, that presents an impediment to an occupant's egress (e.g., cocktail table, seat back and in-arm video, flip-out PCU, ashtray, etc.) ---

	3.13.2 Apply as written 3.14.2 Apply as written 3.15.2 Apply as written 3.17.2 For Type A passenger seats , apply as written 3.20.2 Apply as written
Appendix A	Apply Appendix A as necessary to comply with the requirements of this CTSO.
Appendix B	Disregard all subsections in Appendix B not listed below. The following subsections apply as modified: ---------- B.1.1.14 Apply as written B.1.1.26 Apply as written ---------- Page 46 replace subsection B.1.1.28 to read as follows: B.1.1.28 Where seat recline could adversely affect emergency evacuation, passenger seat recline and control mechanisms should have an override feature so that the reclined seat back may be moved to the upright position without releasing the recline control button.

Appendix 2. Elective for Rotorcraft, Transport Airplane, and Small Airplane Seating Systems

Complying with the MPS in these paragraphs is elective. However, if the applicant elect to comply with one or more, the applicant must follow the MPS. Address deviations from an elective MPS per paragraph 3.d of the CTSO. Per CTSO paragraph 5.a.(6), document and report which elective MPS subparagraphs applicant complied with so that applicant receive credit under this CTSO. In addition, see CTSO paragraph 4.a.(1) for marking requirements, as well as 5.a and 5.h for reporting requirements.

a. Step Load on Baggage Bars: For seats where the baggage restraint allows application of a foot step load, apply the test criteria of ARP5526C subsection 3.7.2. The testing must not degrade either the basic forward or side load carrying capabilities noted in AS8049B Table 4, or result in deformation, posing a tripping hazard.

b. Flight Attendant Step Load: For seats that include a built-in flight attendant step in the seat design, demonstrate that such a step design meets expected service loads. Apply ARP5526C, Appendix B, subsection B.1.1.29 Table B1, to qualify the design.

c. Testing to Higher Static Loads: To substantiate the seat to load factors higher than those specified in Table 4 of AS8049B or to combine load factors, applicant must report the higher load factors along with paragraphs 5.a and 5.h requirements. Applicant must mark the higher load

factors on the CTSO placard.

d. Hand Holds: For seats designed to provide a handhold for passengers moving about the airplane, apply ARP5526C, Section 3.1.2.

e. Flammability –Large Exposed Non-metallic Parts: For Type A seats incorporating large non-metallic panels in their design, test and meet the fire protection provisions of Appendix F, parts IV and part V (heat release and smoke emission) of CCAR-25 R4. Applicant may demonstrate the material’s fire protection properties using the methods provided in the FAA policy statement, PS-ANM-25.853-01-R2, Flammability Testing of Interior Materials, which may permit substantiation based on previously tested materials. In addition, applicant must report which parts meet the requirements of Appendix F, parts IV and part V as part of the Furnished Data Requirements in paragraph 7 of this CTSO.