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

TSO-C100b

Effective Date: 7/16/02

Technical Standard Order

Subject: Child Restraint Systems (CRS)

1. PURPOSE. This Technical Standard Order (TSO) tells persons seeking a TSO authorization or letter of design approval what minimum performance standards (MPS) their child restraint systems must first meet in order to obtain approval and be identified with the applicable TSO marking.

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 and, in general, applications will not be accepted after the effective date of this TSO. However, applications submitted against the previous version of this TSO may be accepted up to six months after the effective date of this TSO, in cases where we know that the applicant was working against the earlier MPS before the new change became effective. Major design changes to CRS approved under previous versions of this TSO require a new authorization under this TSO, per Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).

3. REQUIREMENTS. New models of CRS that are to be so identified and manufactured on or after the effective date of this TSO must meet the MPS, qualification and minimum documentation requirements in Society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS), Document No. AS 5276/1, "Performance Standard for Child Restraint Systems in Transport Category Airplanes," dated September 2000, as amended by Appendix 1 of this TSO.

a. Functional Qualification. The required performance shall be demonstrated under the test conditions specified in Appendix 2.

b. Environmental Qualification. There are no environmental test procedures referenced in this TSO or SAE AS 5276.

c. Deviations. The FAA has provisions for using alternative or equivalent means of compliance to the criteria 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 per 14 CFR § 21.609.

4. MARKING. Under 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 § 21.607(d), except for the following: the option in 14 CFR § 21.607(d)(2), where the name, type and part number must be used in lieu of the optional model number; and the option in 14 CFR § 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number.

b. In addition to the requirements of 14 CFR § 21.607(d), each separate component that is easily removable (without hand tools), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's sub-assembly part number, and the TSO number.

5. DATA REQUIREMENTS.

a. Application Data. Under 14 CFR § 21.605(a)(2), the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), responsible for 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 equipment.

(2) Installation procedures and limitations. The limitations shall be sufficient to ensure that the CRS, when installed according to the installation procedures, continues to meet the requirements of this TSO. The limitations shall also identify any unique aspects of the installation. Finally, the limitations also shall include 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 installing 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 have separate approval for installation in an aircraft. The article may be installed only if performed under 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 CRS complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair, for the continued airworthiness of installed CRS, including recommended inspection intervals and service life.

(7) Material and process specifications list.

(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 providing the information required by paragraph **4.** of this TSO.

(11) A list of all drawings and processes, including revision level, 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.

b. Manufacturer Data. In addition to the data to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO responsible for 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.

(6) Material and process specifications.

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

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. You may buy copies of SAE AS 5276/1, AS 8049A, ARP 4466 and RP J211 from the Society of Automotive Engineers, Inc., Department 331, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Copies also can be obtained through the SAE Internet website @ www.sae.org.

b. You may buy copies of 14 CFR part 21, Subpart O, 14 CFR part 25, and 49 CFR parts 571 and 572 from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325. Copies also can be obtained from the Government Printing Office (GPO), electronic CFR Internet website @ www.access.gpo.gov/ecfr/.

c. You may get the following publications free of charge: Advisory Circular (AC) 20-110, "Index of Aviation Technical Standard Orders," AC 20-36, “Index of Articles Certified under the Technical Standard Order System,” AC 91-62, “Use of Child Seats in Aircraft,” DOT/FAA/AR-00/12, Aircraft Materials Fire Test Handbook” and TSO-C22g, “Safety Belts” may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, telephone (301) 322-44779 or FAX (301) 386-5394. Copies also may be obtained from the FAA Internet website @ www.faa.gov/avr/air/airhome.htm and select from the “Available Information” drop down list

/s/David Hempe

David Hempe
Manager, Aircraft Engineering Division
Aircraft Certification Service

APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR CRS

This appendix prescribes the MPS for CRS, modified by the FAA in this TSO. The applicable standard is SAE AS5276/1, "Child Restraint Systems in Transport Category Airplanes" dated October 2000, and is modified with FAA additions in *italics*, as follows:

1. Page 1, paragraphs 1. (SCOPE), 1.1 (PURPOSE), and 1.2 (APPLICABILITY), page 2, paragraph 2. (REFERENCES), 2.1 and 2.1.1. Disregard these paragraphs as similar text appears in TSO.

2. Page 2, paragraph 2.1.2 reads as follows:

> Federal Aviation Administration (FAA) Regulations, Advisory Circulars, and Reports: Available from the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402-9352:
>
> 14 CFR 21, Certification Procedures for Products and Parts
> 14 CFR 25, Airworthiness Standards: Transport Category Airplanes
> 14 CFR 121, Operating Requirements: Domestic, Flag and Supplemental Operations
> AC 91-62B, FAA Advisory Circular: Use of Child Seats in Aircraft
> TSO C22, Safety Belts
> DOT/FAA/AAM/-94/19, The Performance of Child Restraint Devices in Transportation Category Seats. Gowdy and DeWeese, FAA Office of Aviation Medicine Report, September 1994
> *DOT/FAA/AR-00/12, Aircraft Materials Fire Test Handbook.*

3. Page 4, replace paragraph 3.2 as follows:

> *To secure a CRS in an airplane passenger seat, the device shall rely upon the passenger seat lap belt (pelvic restraint) or possibly rigid bar lower anchorages if the airplane seat is so equipped, as prescribed by 49 CFR § 571.225 S9. The latter would require the CRS to be equipped with lower anchorage hardware per 49 CFR § 571.213 S5.9(a), that is, adjustable webbing attachments or retractable/stowable rigid prongs.*

4. Page 5, paragraph 3.2.5 reads as follows:

> Where a CRS is equipped with prongs that attach the CRS to a rigid bar anchorage system in automobiles, *as referenced in 49 CFR § 571.225* those prongs shall be retractable, in order to ensure proper positioning of the CRS in the airplane passenger seat and to avoid damage to the airplane seat.

5. Page 5, paragraph 3.3 Fire Protection with FAA modification reads as follows:

> Cushions, upholstery, and all other exposed materials *except small parts (knobs, triggers, fasteners, seals and electrical parts) that would not contribute significantly to the propagation of a fire* shall meet the fire protection provisions of 14 CFR § 25.853(a)

[Appendix F, Part *I* (a)(1)(ii)] in effect on February 2, 1995. *Seat belts and shoulder harnesses shall meet [Appendix F, Part I (a)(iv)] in effect on February 2, 1995*

6. Page 5, replace paragraph 4, PERFORMANCE TEST SPECIFICATIONS as follows:

The dynamic test described in this section is used to evaluate the performance of the CRS in a horizontal impact where the force is applied against the longitudinal axis of a forward facing airplane passenger seat that holds the CRS. The structural adequacy of the CRS, the effectiveness of the CRS attachments, and the adequacy of restraint of the child occupant, as prescribed in 4.1, are the issues evaluated. *One dynamic impact test shall be performed, with the CRS secured using the passenger seat lap belt, for each category of child-occupant, as defined in paragraph 2.3 of this AS, for which the CRS is intended for use. In addition, CRS that are equipped with lower anchorage attachment hardware per 49 CFR § 571.213 S5.9(a) may be tested with each category of child-occupant when secured using the rigid bar lower anchorages.*

7. Page 6, paragraph 4.2, Test Fixtures, reads as follows:

The fixture on which the CRS is installed for the dynamic test is based on the seat fixture defined in 49 CFR § 571.213. s61.1(a)(1), (FMVSS-213) *or a fixture that has been modified to accept the rigid bar lower anchorages per 49 CFR § 571.225 S9*. For the test specified by this AS, the back cushion, seat cushion, lap belts and belt anchor points are different from the standard FMVSS-213 seat configuration. Appendix A of this AS present the locations, dimensions, and materials used to configure the FMVSS-213 fixture for the test specified by this AS.

8. Page 6, paragraph 4.2.1 reads as follows:

4.2.1 Passenger Seat Restraints: Airplane passenger seat lap belts shall be installed on the test fixture *as the primary means of attaching the CRS to the seat fixture depicted in Appendix A of this AS*. The buckle shall be a lift latch type release mechanism. The belts shall meet the requirements of FAA TSO-C22 and conform to the length dimensions shown in Appendix A, Figure A5 of this AS. The webbing shall be made of nylon.

9. Page 6, new paragraph 4.2.2 reads as follows:

4.2.2 Rigid Bar Lower Anchorages: Alternatively, CRS equipped with lower anchorage attachment hardware may be tested using the aforementioned modified test procedure.

10. Page 7, the last sentence of paragraph 4.5 Photometric Instrumentation reads as follows:

The resolution of the images shall be sufficient to enable accurate measurements of the maximum excursion of the head and knee of the ATD in Type *III* CRS tests, or the maximum rotation of the CRS in Type I and aft facing Type II CRS tests.

11. Page 7, new paragraph heading 5.1.1 reads as follows:

5.1.1 Passenger Seat Restraint: The CRS shall be installed in the test fixture and secured using the passenger seat lap belt in the manner specified by the manufacturer's instructions provided with the CRS. The maximum force applied to the free end of the lap belt webbing being pulled through the belt buckle tension retention mechanism shall not exceed 67 N (15lb) and the maximum force shall be applied for a period no longer than 3s. No other force may be applied to the CRS during the adjustment of the passenger seat lap belt. The CRS shall not be repositioned after the passenger seat lap belt has been tightened.

12. Page 7, new paragraph 5.1.2. reads as follows:

5.1.2 Rigid Bar Lower Anchorages: The CRS may be installed in the modified test fixture and secured to the rigid bar lower anchorages as follows:

13. Page 7, new paragraph 5.1.2.1. reads as follows:

5.1.2.1 Flexible Lower Anchorage CRS Attachment: CRS equipped with adjustable webbing and latch plates may be secured to the rigid bar lower anchorages on the passenger seat. The maximum force applied to the free ends of the CRS's lower anchorage attachment webbing when pulled through the tension retention mechanism shall be the same as paragraph 5.1 of this AS. These types of CRS may also be secured to the passenger seat by attaching them to the passenger seat lap belt anchorage in the manner specified by the manufacturer's instructions provided with the CRS.

14. Page 7, new paragraph 5.1.2.2 reads as follows:

5.1.2.2 Rigid Lower CRS Attachment: CRS equipped with rigid prongs may be secured to the rigid bar lower anchorages in the manner specified by the manufacturer's instructions provided with the CRS.

15. Page 9, new second paragraph 6.1.2 reads as follows:

All portions of the ATD torso shall be retained within the CRS. The *center point of the* target points on either side of the ATD head, shall pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the CRS surfaces.

16. Page 10, new paragraph 6.5.1 reads as follows:

6.5.1 Post Test Release of Integral Restraints on the CRS: The force to release the buckle on the CRS integral restraints (*see 5.4*) shall not exceed *16 pounds.*

17. Page 10, disregard paragraphs 7.1a. through e. Marking of the article shall be in accordance with paragraphs 7.1f through *7.1h,* and the paragraph 4 of this TSO.

18. Page 11, disregard paragraphs 7.1h through m. New paragraph 7.1h reads as follows:

h. The following statement on yellow background with black text, regarding the installation and use of CRS:

"WARNING! DEATH OR SERIOUS INJURY CAN OCCUR. Follow all instructions on this child restraint and in the manufacturer's written instructions located _____.

- Do not place this device behind any wall or seat back in an airplane that has an airbag.
- Do not use in any passenger seat that has an inflatable seat belt.
- Use only in a forward facing seat. Do not use in a rear facing seat or a side facing seat.
- Attach this child restraint with the airplane passenger seat lap belt or rigid bar anchorage system if so equipped. This child restraint is not designed to be used with a shoulder strap or any other tether strap to the seat or airplane.
- Snugly adjust the belts provided with this child restraint around your child."

15. Page 12, paragraph 7.1l. Disregard this paragraph, as it has been included in the new paragraph 7.1h.

20. Page 16, Figure A6. Disregard this Figure, as it no longer applies. The substance of this warning is now in paragraph 7.1h.

APPENDIX 2. TEST CONDITIONS

SAE AS 5276/1 incorporates, as references, the following test standards:

1. SAE RP J211, Instrumentation for Impact Tests
2. SAE AS8049A, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft and General Aviation Aircraft
3. SAE ARP4466, Dimensional Compatibility of Child Restraint Systems and Passenger Seat Systems in Civil Transport Airplanes
4. 49 CFR Part 572, Anthropomorphic Test Dummies
5. 14 CFR § 25.853(a) [Appendix F, Part I(a)(iv)]

More recent version of these standards may be substituted, if approved by the FAA ACO manager responsible for the manufacturer's facilities.