

# European Aviation Safety Agency

## European Technical Standard Order

**Subject:** Aviation Child Safety Device (ACSD)

### 1 — Applicability

This ETSO provides the requirements which Aviation Child Safety Devices (ACSD) that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

### 2 — Procedures

#### 2.1 — General

Applicable procedures are detailed in CS-ETSO, Subpart A.

#### 2.2 — Specific

None.

### 3 — Technical Conditions

#### 3.1 — Basic

##### 3.1.1 — Minimum Performance Standard

Standards set forth in the SAE AS5276/1, Performance Standard for Child Restraint Systems in Transport Category Airplanes, dated 11/1/2000, asamended by Appendix 1 to this ETSO.

##### 3.1.2 — Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

##### 3.1.3 — Computer Software

None.

##### 3.1.4 — Electronic Hardware Qualification

None.

#### 3.2 — Specific

None.

##### 3.2.1 — Failure Condition Classification

### 4 — Marking

#### 4.1 — General

Marking as detailed in CS-ETSO, Subpart A, paragraph 1.2.

#### 4.2 — Specific

In addition, the ACSD shall be marked with the ACSD type designation (reference SAE AS52761,

**ETSO-C100c**

paragraph 2.5, as amended by Appendix 1).

Also, any applicable limitations or restrictions shall be marked to allow aircraft-specific or operational-specific installation limitations, such as: 'FOR USE ON [insert aircraft type or serial number] ONLY'; 'FOR USE ON AIRCRAFT USED IN PART [insert number] OPERATIONS ONLY'; 'FOR MILITARY USE ONLY'; or 'SEE DRAWING NO. [insert number] FOR INSTALLATION LIMITATIONS.'

## **5 — Availability of Referenced Document**

See CS-ETSO, Subpart A, paragraph 3.

**APPENDIX 1**

**MPS FOR AVIATION CHILD SAFETY DEVICE**

The applicable standard is SAE AS5276/1, 'Child Restraint Systems in Transport Category Airplanes', dated November 2000, with the following modifications:

<b>AS 5276/1 section:</b>	<b>Action:</b>
Entire document:	<p>Throughout the document, 'Aviation Child Safety Device (ACSD)' shall be used instead of 'CRS'.</p> <p>SAE AS5276/1 incorporates, as references, the following test standards:</p> <ol style="list-style-type: none"> <li>1. SAE RP J211, Instrumentation for Impact Tests.</li> <li>2. SAE AS8049A, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft and General Aviation Aircraft.</li> <li>3. SAE ARP4466, Dimensional Compatibility of Child Restraint System and Passenger Seat Systems in Civil Transport Airplanes.</li> <li>4. 49 CFR part 572, Anthropomorphic Test Dummies.</li> <li>5. CS 25.853(a) (Appendix F, Part I(a)(iv)).</li> </ol>
Section 1	To be disregarded.
Paragraph 2.1	<p>To be replaced with:</p> <p>2.1 Documents: The following publications form part of this AS to the extent specified herein. Other publications are provided for reference. In the event of conflict between the text of this document and the 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.</p>
Paragraph 2.1.1	<p>To be revised:</p> <p>2.1.1 SAE Publications: RP J211, Instrumentation for Impact Tests AS8049B, Performance Standard for Seats in Civil, Rotorcraft and Transport Aircraft and General Aviation Aircraft ARP4466, Dimensional Compatibility of Child Restraint Systems and Passenger Seat Systems in Civil Transport Airplanes</p>

**MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)**

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 2.1.2	<p>To be revised:</p> <p>2.1.2 Federal Aviation Administration (FAA) Regulations, Advisory Circulars, European Technical Standard Orders and Reports:</p> <p>EASA Part-21, Certification Procedures for Products and Parts CS-25, Airworthiness Standards: Transport Category Airplanes</p> <p>AC 91-62A, Use of Child Seats in Aircraft AC 120-87B, Use of Child Restraint Systems on Aircraft ETSO-C22g, Safety Belts ETSO-C39c, AIRCRAFT SEATS and BERTHS CERTIFIED BY STATIC TESTING ONLY ETSO-C127b, Rotorcraft, Transport Airplane, and Normal and Utility Airplane Seating Systems 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</p>
Paragraph 2.1.3	<p>To be revised:</p> <p>2.1.3 National Highway Traffic Safety Administration (NHTSA) Regulations and Documents:</p> <p>49 CFR 571.213, Federal Motor Vehicle Safety Standard No. 213 Child Restraint Systems 49 CFR 571.225, Federal Motor Vehicle Safety Standard No. 225 Child Restraint Anchorage Systems 49 CFR 572, Anthropomorphic Test Dummies NHTSA Drawing Package SAS-100-1000, dated June 1, 1993</p>
Paragraph 2.1.4	<p>To be revised:</p> <p>2.1.4 ANSI Publications: ANSI Z535.4 -1998 Product Safety Signs and Labels</p>

**APPENDIX 1**

**MPS FOR AVIATION CHILD SAFETY DEVICE (continued)**

<b>AS 5276/1 section:</b>	<b>Action:</b>																
Paragraph 2.3	<p>To be revised:</p> <p>2.3 Classification of Children: The physical characteristics of small children govern the proper ACSD for use. Mass, standing height, and developmental maturity (i.e. age) are important for proper ACSD configuration and orientation. As children develop at different rates, combined application of these characteristics in selecting an ACSD may be difficult. To assist in this process, <b>Table 1</b> defines three stages of child development each with a single dominant characteristic <u>underlined</u>. Where an occupant falls between categories, the dominant characteristic is used to determine the proper ACSD configuration and orientation.</p> <p>Table 1 — Definitions of Child Categories</p> <table border="1" data-bbox="533 976 1417 1184"> <thead> <tr> <th>Child category</th> <th>Mass, kg (lb)</th> <th>Height, cm (in.)</th> <th>Age, month</th> </tr> </thead> <tbody> <tr> <td>Newborn</td> <td><u>Birth to 5 (11)</u></td> <td>Birth to 65 (26)</td> <td>N/A</td> </tr> <tr> <td>Infant</td> <td>5–10 (11–22)</td> <td>65–85 (26–34)</td> <td><u>under 12</u></td> </tr> <tr> <td>Toddler</td> <td>10–18 (22–40)</td> <td><u>85–110 (34–44)</u></td> <td>over 12</td> </tr> </tbody> </table>	Child category	Mass, kg (lb)	Height, cm (in.)	Age, month	Newborn	<u>Birth to 5 (11)</u>	Birth to 65 (26)	N/A	Infant	5–10 (11–22)	65–85 (26–34)	<u>under 12</u>	Toddler	10–18 (22–40)	<u>85–110 (34–44)</u>	over 12
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Paragraph 2.5d	<p>To be revised:</p> <p>d. Any child that has attained his or her first birthday, with a mass greater than 10 kg (22 lb) and having a standing stature of less than 110 cm (44 in.) in height is considered a ‘toddler’ and should be seated in a forward-facing ACSD with both upper and lower torso restraint (Type III).</p>																
Paragraph 2.6	<p>New paragraph to be added:</p> <p>2.6 Definitions: Refer to 49 CFR 571.213 S4. for aircraft child safety device definitions.</p>																
Paragraph 3.2	<p>To be revised:</p> <p>3.2 ACSD Design/Functional Performance:</p>																
Paragraph 3.2.5	<p>To be revised:</p> <p>3.2.5 If an ACSD is equipped with a means of attaching to a rigid bar anchorage system, as prescribed by 49 CFR 571.225 S9, then the provided attachment hardware must comply with the requirements of 49 CFR 571.213 S5.9(a). If rigid prongs are provided for that attachment, they shall be retractable to the extent necessary to ensure proper positioning of the ACSD in an airplane passenger seat not equipped with rigid bar lower anchorages to avoid damage to the airplane seat or injury to nearby seat occupants.</p>																

APPENDIX 1

MPS FOR AVIATION CHILD SAFETY DEVICE *(continued)*

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 3.2.6	<p>New paragraph 3.2.6 to be added:</p> <p>Except for components designed to attach to a child restraint anchorage system, an ACSD must not have any means designed for attaching the system to an aircraft seat cushion or aircraft seat back and any component (except belts) that is designed to be inserted between the aircraft seat cushion and the aircraft seat back. An ACSD shall be capable of meeting the requirements of this standard when installed solely by the passenger seat lap belt (pelvic portion of the restraint). If the ACSD is equipped with a child restraint anchorage system, then it shall also be capable of meeting the requirements of this standard when installed solely by attachment to rigid bar lower anchorages as prescribed by 49 CFR 571.225 S9. No passenger seat belt may contact the child-occupant of the ACSD. Each belt that is part of an ACSD and that is designed to restrain the child using the system, shall, when tested in accordance with Section 4 of this standard, impose no loads on the child as a result from the mass of the system or from the mass of the standard seat assembly specified therein.</p>
Paragraph 3.2.7	<p>New paragraph 3.2.7 to be added:</p> <p>3.2.7 An ACSD shall comply with the force distribution requirements of 49 CFR 571.213 S5.2.1.1, S5.2.1.2, S5.2.2.1 (a), (b) and (c), S5.2.2.2, and S5.2.4.</p>
Paragraph 3.2.8	<p>New paragraph 3.2.8 to be added:</p> <p>3.2.8 ACSD belt systems shall comply with the requirements of 49 CFR 571.213 S5.4.1.2, S5.4.1.3, S5.4.2, S5.4.3.1, S5.4.3.3, S5.4.3.5. References to paragraph S6.1 therein shall be considered to refer to Section 4 of this standard.</p>
Paragraph 3.3	<p>To be revised:</p> <p>3.3 Fire Protection: Cushions, upholstery, and all other exposed materials used in the ACSD 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 CS 25.853(a) (Appendix F, Part I (a)(1)(ii)). Seat belts and shoulder harnesses shall meet the provisions of CS 25 (Appendix F, Part I (a)(iv)).</p>

**APPENDIX 1**

**MPS FOR AVIATION CHILD SAFETY DEVICE (continued)**

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 4	<p>To be revised:</p> <p>4. PERFORMANCE TEST SPECIFICATIONS: The dynamic test described in this section is used to evaluate the performance of the ACSD in a horizontal impact where the force is applied against the longitudinal axis of a forward-facing airplane passenger seat that holds the ACSD. The structural adequacy of the ACSD, the effectiveness of the ACSD attachments, and the adequacy of restraint of the child occupant, as prescribed in paragraph 4.1 of this AS, are the issues evaluated. One dynamic impact test shall be performed, with the ACSD 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 ACSD is intended for use. ACSD equipped with lower anchorage attachment hardware per 49 CFR 571.213 S5.9(a) must be tested with each category of child occupant when secured using the rigid bar lower anchorages, except when the ACSD is in full compliance with 49 CFR 571.213.</p>
Paragraph 4.1	<p>To be revised:</p> <p>4.1 Child-Occupant Simulation: One or more ATD representing the child categories for which the ACSD is intended for use shall be used to simulate a child-occupant in the dynamic test. Selection of the ATD shall be based on compliance with the following requirements:</p> <p>a. A newborn infant ATD, per 49 CFR part 572, Subpart K, shall be used to test a Type I ACSD.</p> <p>b. A newborn infant ATD and a 12-month-old child ATD, per 49 CFR part 572, Subpart R, shall be used to test a Type II ACSD.</p> <p>c. A 12-month-old child ATD and a 3-year-old child ATD, per 49 CFR part 572, Subpart P, shall be used to test a Type III ACSD.</p>
Paragraph 4.1.2	<p>To be revised:</p> <p>4.1.2 ATD Preparation and Clothing: All three types of ATDs used shall have a target point marker on each side of the head that is located on the transverse axis passing through the centre of mass of the ATD's head and perpendicular to the head's midsagittal plane. The 12-month-old and 3-year-old ATD's must also have target points located on each knee pivot axis. ATDs must be clothed and prepared for use, as prescribed in 49 CFR 571.213 S9.</p>

**APPENDIX 1**

**MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)**

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 4.2	<p>To be revised:</p> <p>4.2 Test Fixtures: The fixture on which the ACSD is installed for the dynamic test is based on the FMVSS-213 standard seat assembly test fixture defined in 49 CFR 571.213 S6.1.1(a)(1)(i). For the test specified by this AS, the back cushion, seat cushion, lap belts, and belt anchor points are different from the FMVSS-213 standard seat test fixture configuration. Appendix A to this AS presents the locations, dimensions, and materials used to reconfigure the FMVSS-213 standard seat assembly test fixture for the test specified by this AS.</p>
Paragraph 4.2.1	<p>To be revised:</p> <p>4.2.1 Passenger Seat Restraints: Airplane passenger seat lap belts shall be installed on the seat test fixture as the primary means of attaching the ACSD to the seat test fixture depicted in Appendix A to this AS. The buckle shall be a lift latch type release mechanism. The belts shall meet the requirements of ETSO-C22g and conform to the length dimensions shown in Appendix A, Figure A5, to this AS. The webbing shall be made of nylon.</p>
Paragraph 4.2.2	<p>New paragraph 4.2.2 to be added:</p> <p>4.2.2 Rigid Bar Lower Anchorages: If testing ACSD equipped with lower anchorage attachment hardware, the aforementioned modified seat test fixture must have rigid bar lower anchorages installed per Figures 1A and 1B of 49 CFR 571.213.</p>
Paragraph 4.5	<p>The last sentence of paragraph 4.5 Photometric Instrumentation shall be revised:</p> <p>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 ACSD tests, or the maximum rotation of the ACSD in aft-facing Type I and Type II ACSD tests.</p>
Paragraph 4.6	<p>To be revised:</p> <p>4.6 Test Severity: The dynamic impact pulse shall meet the requirements specified for Type A seats in AS8049B, i.e. the 16 g, 13.4 m/s (44 ft/s) horizontal test condition for transport category airplane seats. The pulse described in Figure 2A of 49 CFR 571.213 is acceptable to show compliance with this requirement. The yaw and floor deformation specified in AS8049B are not required.</p>



**APPENDIX 1**

**MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)**

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 4.7	<p>New paragraph 4.7 to be added:</p> <p>4.7 Test Conditions: During the test, maintain the environmental conditions specified in 49 CFR 571.213 S6.1.1(d).</p>
Paragraph 5.1	<p>To be revised:</p> <p>5.1 ACSD Installation: Install the ACSD at the centre of the seating position of the modified FMVSS-213 standard seat assembly test fixture in accordance with the manufacturers instructions provided with the system except that no tether strap shall be used. For the belted test condition, use only the aircraft lap belt. For tests with a child restraint anchor system, use only the lower anchorages of the child restraint anchor system.</p>
Paragraph 5.2	<p>New paragraph 5.2 to be added:</p> <p>5.2 ATD Installation: The ATD shall be placed in the ACSD. Position it, and attach the child restraint belts, if appropriate, per 49 CFR 571.213 S10.</p>
Paragraph 5.3	<p>To be revised:</p> <p>5.3 ACSD Integral Restraint Adjustment: The ACSD integral restraint system shall be routed through the ACSD and fastened over the ATD as called for by the manufacturer’s instructions and per 49 CFR 571.213 S6.1.2(d)(1)(i).</p>
Paragraph 5.4	<p>To be revised:</p> <p>5.4 ACSD Attachment Adjustment: The aircraft lap belt or child restraint anchor system straps attaching the ACSD to the standard seat assembly test fixture shall be adjusted per 49 CFR 571.213 S6.1.2(d)(1)(ii) or (iii) as appropriate.</p>
Paragraph 6.1	<p>To be revised:</p> <p>6.1 Excursion Limits: The ATD and ACSD excursions and initial positions described below shall be obtained by measuring the high-speed film or video images recorded during the test, or in the case of initial position, measured directly prior to the test.</p>

APPENDIX 1

MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 6.1.1	<p>To be revised:</p> <p>6.1.1 Test of Forward-Facing ACSD: The ACSD shall retain the ATD's torso within the system. No portion of the ATD head shall pass through a vertical transverse plane passing through a point 813 mm (32 in.) forward of the seat back pivot axis on the standard seat assembly test fixture shown in Appendix A, Figure A2. This limit is referred to as the head excursion limit.</p>
Paragraph 6.1.2	<p>The second paragraph shall be revised:</p> <p>6.1.2 Test of Aft-Facing ACSD: The angle between the ACSD back child support surface and the vertical transverse plane shall not exceed 70 degrees at any time during the test. The initial (pre-test) angle between the ACSD back child support surface and the vertical transverse plane shall not be less than 45 degrees.</p> <p>All portions of the ATD torso shall be retained within the ACSD. The centre of the target points on either side of the ATD head shall not pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the ACSD surfaces.</p>
Paragraph 6.2	<p>To be revised:</p> <p>The Head Injury Criterion (HIC36) is calculated according to the following equation:</p> $HIC = \left\{ (t_1 - t_2) \left[ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a(t) dt \right]^{2.5} \right\} \text{Max}$ <p>Where:</p> <p>t1, t2 = Any two points in time during the head impact which are not separated by more than a 36 millisecond time interval</p> <p>a(t) = The resultant head acceleration at the centre of gravity of the ATD head expressed as a multiple of g (the acceleration of gravity).</p> <p>The maximum value of the HIC36 computation from data acquired during the impact test, including rebound motion of the ATD and ACSD, shall not exceed a value of 1 000.</p>

APPENDIX 1

MPS FOR AVIATION CHILD SAFETY DEVICE *(continued)*

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 6.4	<p>A new second paragraph shall be added:</p> <p>The ACSD shall also meet the requirements of 49 CFR 571.213 S5.1.1. References to paragraph S6.1 therein shall be considered to refer to Section 4 of this standard.</p>
Paragraphs 7.1a through 7.1e	<p>Paragraphs 7.1a. through e. shall be disregarded.</p> <p>Marking of the article shall be in accordance with paragraphs 7.1f. through 7.1h., and paragraph 4 of this ETSO.</p>
Paragraph 7.1g	<p>The second paragraph shall be revised:</p> <p>'Place this Type I , II and III child restraint in a rear-facing position when using it with an infant weighing less than ____ pounds (____Kg).'</p>
Paragraphs 7.1h through 7.1m	<p>To be disregarded.</p>
Paragraph 7.1h	<p>New paragraph 7.1h to be added:</p> <p>7.1h The following statement on yellow background with black text, regarding the installation and use of ACSD:</p> <p><i>'WARNING! DEATH OR SERIOUS INJURY CAN OCCUR. Follow all instructions on this aviation child restraint and in the manufacturer's written instructions located [insert location].</i></p> <ul style="list-style-type: none"> <li>— <i>Do not place this device behind any wall or seat back in an airplane that has an airbag.</i></li> <li>— <i>Do not use in any passenger seat that has an inflatable seat belt.</i></li> <li>— <i>Use only in a forward-facing seat. Do not use in a rear-facing seat or a side-facing seat.</i></li> <li>— <i>Attach this aviation child restraint with the airplane passenger seat lap belt or rigid bar anchorage system if so equipped.</i></li> <li>— <i>This aviation child restraint is not designed to be used with a shoulder strap or any other tether strap to the seat or airplane.</i></li> <li>— <i>Snugly adjust the belts provided with this aviation child restraint around your child.'</i></li> </ul>


APPENDIX 1

MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)

<b>AS 5276/1 section:</b>	<b>Action:</b>
Paragraph 7.1i	<p>New paragraph 7.1i to be added:</p> <p>7.1i Additional label for ACSD that do not meet FMVSS-213. Any ACSD that meets the MPS of this TSO, but does not meet the requirements of FMVSS-213, the label in new Figure A6 must be permanently affixed to the webbing of the ACSD so that it is clearly visible when the ACSD is installed.</p>
Figure A1	<p>Figure A1 shall be revised as follows:</p> <p>The horizontal distance between the seat back pivot axis to the lap belt anchor axis shall be changed from 269 (10.6) to 246 (9.7).</p>
Figure A2	<p>Figure A2 shall be revised as follows:</p> <p>The horizontal distance between the seat back pivot axis to the lap belt anchor axis shall be changed from 269 (10.6) to 246 (9.7).</p> <p>A new item 9 shall be added: Aluminium rod: 25.4 (1.0) Dia. welded to the front edge of item 1 such that the rod surface is tangent to the plane of the bottom of the aluminium plate.</p>
Figure A3	<p>Figure A3 shall be revised as follows:</p> <p>The vertical dimension of the anchor pivot shall be changed from 47.8 (1.88) to 50.8 (2.0), and the vertical dimension of the anchor height from 60.5 (2.38) to 63.5 (2.5).</p>
Figure A4	<p>Figure A4 shall be revised as follows:</p> <p>A depiction of the 25.4 (1.0) Dia. rod defined in Figure A2 shall be added.</p>

APPENDIX 1

MPS FOR AVIATION CHILD SAFETY DEVICE (*continued*)

<b>AS 5276/1 section:</b>	<b>Action:</b>
Figure A6	<p>Figure A6 shall be replaced as follows:</p> <p>FIGURE A6 — Label for ACSD Not Meeting FMVSS-213</p>  <ul style="list-style-type: none"><li>— Box outline of label is red, 6-point line width.</li><li>— Box is 4.75 inches long by 1.25 inches high.</li><li>— Interior of box is yellow background.</li><li>— Text is Arial bold black letters.</li><li>— Large text is 18 point.</li><li>— Smaller text is 16 point.</li></ul>