



Number: CTSO-C90e

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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.

ULD Pallets, ULD Nets and ULD Containers (Unit Load Devices)

1. PURPOSE

This China Civil Aviation Technical Standard Order (CTSO-C90e) is for manufacturers applying a CTSO authorization (CTSOA) for their ULD pallets, ULD nets and ULD containers (ULDs in general). This CTSO specifies the minimum performance standards (MPS) that Unit Load Devices (ULDs) must meet in order to be approved and identified using the applicable CTSO markings. This CTSO also includes requirements to enable a ULD be additionally classified as a Fire Resistant Container (FRC).

2. APPLICABILITY

This CTSO affects new application submitted after its effective date.

a. From the effective date of this CTSO, applicants who wish to obtain the CTSOA of Unit Load Devices should submit applications in

accordance with this CTSO. CTSO-C90d will also remain effective until 6 months from this CTSO release. After this date, we will no longer accept new applications for CTSO-C90d.

b. Since the effective date of this CTSO, Unit Load Devices approved under a previous CTSO may still be manufactured under the provisions of its original approval.

3. REQUIREMENTS

(1) Type I ULDs approved under this CTSO must meet the requirements in:

Aerospace Industries Association (AIA) National Aerospace Standard (NAS) 3610 Revision 10, Specifications for Cargo Unit Load Devices, dated November 1, 1990 as modified by Appendix 1 of this CTSO, when applicable.

(2) Type II ULDs approved under this CTSO must meet the requirements in:

SAE Aerospace Standard (AS) 36100C, Air Cargo Unit Load Devices- Performance Requirements and Test Parameters, dated September of 2020 as modified by Appendix 2 of this CTSO.

NOTE: References Appendix 4 of this CTSO for definitions of Type I and Type II ULDs and ULDs in general.

(3) Testing methods that support compliance with the requirements in AS36100C and NAS3610 are found in:

SAE AS36102B, Air Cargo Unit Load Devices-Testing Methods, dated March of 2017, as applicable.

(4) FRCs approved under this CTSO must meet all applicable ULD requirements and the requirements in:

SAE AS8992, Fire Resistance Container Design, Performance and Testing Requirements, dated October of 2020, as modified by Appendix 3 of this CTSO, when the ULD container integrates fire containment functionality.

a. Functionality.

This CTSO's standards apply to ULDs intended to group and restrain cargo, stores, baggage and mail on aircraft. It also applies to FRCs used to improve fire protection in aircraft cargo compartments.

b. Failure Condition Classifications.

There is no standard minimum failure condition classification for this CTSO. The failure condition classification appropriate for the equipment will depend on the intended use of the equipment in a specific aircraft. Document the loss of function and malfunction failure condition classification for which the equipment is designed.

c. Environmental Qualification.

(1) For ULDs and FRCs, consider the potential for environmental degradation due to aging, ultra-violet (UV)-exposure, weathering, etc. for

any materials used in the construction of pallets, nets and containers. Where applicable, testing should take into account the requirements of RTCA DO-160G and its modified version, and be accordingly subject to an Environmental Qualification Form identifying the performed tests. Note: Refer to RTCA-DO160G Appendix A for Environmental Qualification Form.

(2) For textile performance of nets, see SAE Aerospace Information Report (AIR) 1490C, Environmental Degradation of Textiles, dated April of 2019, for available data for textile performance when exposed to environmental factors. These data will be taken into account for consideration of the effects of environmental degradation on nets commensurate with the expected storage and service life to satisfy SAE AS 36100 Rev. C, Paragraph 4.11.

NOTE: Environmental degradation data other than that documented in AIR1490C may be used if you substantiate the data and it is approved by CAAC. A net must meet the minimum performance requirements of this CTSO at any time during its service life.

(3) FRC shall meet the additional environmental requirements in AS8992 paragraphs 3.6 and 4.2.

d. Flammability Requirements.

ULDs shall meet the requirements summarized in Table 1. The

requirements are located in CCAR-25-R4 Appendix F.

(1) Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials (follow requirements for 12 second test)

(2) 45-Degree Bunsen Burner Test for Cargo Compartment Liners and Waste Stowage Compartment Materials

(3) Horizontal Bunsen Burner Test for Cabin and Cargo Compartment Materials (use 2.5 inches/minute burn rate criteria)

ULDs additionally classified as FRCs shall meet the flammability requirements of AS8992 Section 4.

ULD pallets and nets used with Fire Containment Covers (FCCs) should be marked with “FIRE CONTAINMENT COMPATIBLE” per paragraph 4.d of this CTSO if the article meets the performance and testing requirements of AS6453, “Fire Containment Cover – Design, Performance, and Testing Requirements” (dated August of 2013 and its modified version). Table 1 summarizes these flammability requirements, however refers to the most recent version of AS6453 for additional information and required order of testing.

Table 1: Summary of Flammability Requirements for ULDs and FRCs

Article/Component	Vertical Bunsen Burner Test (12 second test)	45-Degree Bunsen Burner Test	Horizontal Bunsen Burner Test (2.5 inches/minute burn rate criteria)
ULDs side panels, rigid doors, non-metallic pallets and ceiling	X	X	
ULD curtain-style doors	X		

ULD nets			X
ULD nets compatible with FCCs	X		
Non-metallic ULD pallets compatible with FCCs	X	X	

e. 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. Apply for a deviation pursuant to Paragraph 21.368 in CCAR-21-R4.

4. MARKING.

a. Mark at least one major component permanently and legibly with all of the information in CCAR-21-R4 Paragraph 21.423 (b). Mark the ULD in an area that will typically remain visible after the ULD is loaded with cargo. The marking must include:

- (1) The name and address of the manufacturer;
- (2) The name, type, part number, or model designation of the article;
- (3) Identification of the article as explained in:

(a) NAS 3610 Rev. 10, Paragraph 1.2.1 for Type I ULDs;

(b) SAE AS 36100 Revision C, Paragraph 3.5 for Type II

ULDs;

(4) The manufacturer's serial number of the article, with the option to add the date of manufacture;

- (5) The applicable CTSO number;
- (6) If the article is not omni-directional, the words “FORWARD”, “AFT”, and “SIDE” must be appropriately placed;
- (7) If applicable, mark the expiration date in the format “EXP YYYY-MM”
 - (a) Mark the expiration date of a ULD as a limitation;
 - (b) Mark each component or subassembly, as described, in paragraph with its expiration date.
- (8) Any limitations or restrictions;
- (9) If the article includes a deviation as per paragraph 3.e. of this CTSO, the deviation should be identified by the abbreviation “DEV” and marked after the applicable CTSO number.

b. ULD Sub-Assemblies: Mark the following permanently and legibly, with at least the manufacturer’s name, subassembly, or component part number, and the CTSO number:

- (1) Each component or subassembly that is easily removable (without hand tools), and,
- (2) Each component or subassembly of the article that you determine may be interchangeable.

NOTE: Subassemblies and components that are extremely difficult to mark (for example lashing lines) may be tagged per CCAR-21-R4 Paragraph 21.423(d).

c. ULDs additionally classified as FRCs: FRCs must also be marked per the requirements in paragraphs 5.1.a, 5.1.c, and 5.2 to 5.4 of AS8992.

d. Nets and Pallets Compatible for Use with Fire Containment Covers: Refer to AS6453, “Fire Containment Cover–Design, Performance, and Testing Requirements”, dated testing requirements for pallets and nets that are operationally suited for use with a Fire Containment Cover (FCC) approved under CTSO-C203 and SAE AS6453. If the pallet or net meets the testing requirements in that standard, they may be marked under this CTSO as follows:

(1) Net: “FIRE CONTAINMENT COMPATIBLE WITH SAE AS6453 CERTIFIED FIRE COVER” in bold characters at least 40 mm (1.6 inch) high.

NOTE: Include the revision number of AS6453 in the marking.

(2) Pallets (Non-Metallic): “FIRE CONTAINMENT COMPATIBLE” in legible character.

5. APPLICATION DATA REQUIREMENTS.

You must give CAAC a statement of conformance, pursuant to Paragraph 21.353(a)(1) in CCAR-21-R4 and one copy each of the following technical data to support your design and production approval.

a. Manuals containing the following:

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

(2) Detailed description of any deviations;

(3) Installation procedures and limitation sufficient to ensure that the articles still meets this CTSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must also include a note with the following statement:

“This article meets the minimum requirements of this technical standard order and the quality control standard. Installation of this article requires separate approval.”

(4) Schematic drawings, wiring diagrams, and any other documentation necessary for the operational use and/or installation of the ULD (including FRC);

(5) By-part-number list of replaceable components that makes up the ULD (including FRC). Include vendor part number cross-references, when applicable;

b. Instructions covering periodic maintenance, calibration, and repair, to ensure that the ULD (including FRC) continues to meet the CTSO approved design. Include recommended inspection intervals and service life, as appropriate.

c. A drawing depicting how the article will be marked 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 (defined as non-CTSO

functions). Non-CTSO functions can be accepted in parallel with the CTSOA, and must receive final approval from the operator of the aircraft. However, note that integrating powered devices into a ULD (including FRC) shall be accepted as per the standard acceptable to the CAAC authority together with CTSOA, given that the requirements in this CTSO are primarily to ensure certain structural and flammability requirements are met. Reference SAE6163TM Temperature Controlled Container-Performance Requirements and Test Parameters, dated December of 2015, for requirements that address common ULD non-CTSO functions related to temperature controlled ULDs. For applicable non-CTSO functions to be accepted, the Applicant must declare these functions and include the following information with your 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) do not 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 non-CTSO function(s) performance data defined in paragraph 5.d.(1).

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

(6) Test plans and analysis as appropriate, to verify that the function and performance of the non-CTSO function(s) as described in paragraph 5.d.(1).

e. The quality manual required by CCAR-21-R4 21.358, including functional test specifications. The quality system must ensure that you will detect any change to the approved design that could adversely affect compliance with the CTSO MPS and reject the article accordingly.

f. A description of your organization as required by CCAR-21-R4 Paragraph 21.355.

g. Material and process specifications list.

h. A list of all drawings and processes (including revision level) that define the article's design.

i. Manufacturer's CTSO qualification report showing results of testing accomplished according to paragraphs 3.c and 3.d of this CTSO.

6. MANUFACTURER DATA REQUIREMENTS

Besides the data given directly to CAAC, have the following technical data available for review by the responsible for Airworthiness Department of CAAC:

- a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO;
- b. Article calibration procedures;
- c. Schematic drawings;
- d. Wiring diagrams;
- e. Material and process specifications;
- f. The results of the environmental qualification and flammability tests conducted according to paragraphs 3.c and 3.d of this CTSO;
- g. If the article contains non-CTSO function(s), you must also make items 6.a through 6.f available as they pertain to the non-CTSO function(s).

7. FURNISHED DATA REQUIREMENTS

a. When furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy or online access to the data in paragraphs 5.a and 5.b of this CTSO. Add any other data needed for the proper installation, certification, use, or continued compliance with the CTSO, of the ULD or FRC.

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. HOW TO GET REFERENCED DOCUMENTS

a. Order RTCA documents from RTCA, Inc., 1150 18th Street NW., Suite 910, Washington, DC 20036. Telephone: (202) 833-9339; fax: (202) 833-9434. You can also order copies online at www.rtca.org

b. Order SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone: (724) 776-4970, fax: (724) 776-0790. You can also order copies online at www.sae.org

APPENDIX 1 MINIMUM PERFORMANCE STANDARDS FOR TYPE
1 ULDS

1 Purpose: This appendix prescribes the MPS for Type I ULDs. The applicable standard is AIA NAS 3610 Rev. 10, Specifications for Cargo Unit Load Devices, dated November 1, 1990, as modified by this appendix.

<i>When reading NAS3610 Rev 10</i>	<i>Do the following:</i>
Paragraph 3.5	Replace with section 4 of this CTSO for marking requirements.
Paragraph 3.7	Replace with paragraph 3.d of this CTSO.
Sheet 87, Figure 31	Use revised Figure 31 from sheet 88.
Figure 32 (missing from NAS3610 Rev 10)	Use Figure 32 of NAS 3610 Rev. 9, dated November 1987 or NAS 3610 Rev. 8, dated September 1987

APPENDIX 2. MINIMUM PERFORMANCE STANDARD (MPS) FOR TYPE II ULDs

Purpose: This appendix prescribes the MPS for Type II ULDs. The applicable standard is SAE Aerospace Standard (AS) 36100, Air Cargo Unit Load Devices – Performance Requirements and Test Parameters, Rev. C, dated September 2020 as modified by this appendix.

<i>When reading AS 36100C</i>	<i>Do the following:</i>
Paragraphs 1.1 – 1.2	Disregard
Paragraph 4.5	Replace with section 4 of this CTSO for marking requirements.
Paragraph 4.6	Disregard
Paragraph 4.7	Replace with paragraph 3.d of this CTSO.
Section 6	Disregard

APPENDIX 3. MINIMUM PERFORMANCE STANDARD (MPS) FOR FIRE RESISTANT CONTAINERS

Purpose: This appendix prescribes the MPS for Fire Resistant Containers. The applicable standard is SAE AS8992, Fire Resistant Container Design, Performance, and Testing Requirements, dated October of 2020, as modified by this appendix.

<i>When reading AS8992</i>	<i>Do the following:</i>
Paragraph 3.1.2 NOTE	Disregard
Paragraph 3.3.4	Disregard
Paragraph 3.3.5	Disregard
Paragraph 3.4	Disregard
Section 5	ULDs classified as FRCs must meet the marking requirements of this section in addition to sections 4.a and 4.b of this CTSO. Disregard paragraph 5.1.b of AS8992, as it is duplicative to paragraphs 4.a and 4.b of this CTSO.

APPENDIX 4 TERM

Type I Unit Load Devices (ULDs) designed for use in an approved aircraft restraint system that conforms to all flight and ground cargo restraint and occupant protection requirements of CCAR-25-R4, including the 9.0g forward ultimate inertia force of § 25.561 (b)(3)(ii) . (Refer to SAE AS 36100C).

Type II Unit Load Devices (ULDs) II designed for use in an approved aircraft cargo compartment and restraint system that conforms to the flight and ground cargo restraint and occupant protection requirements of CCAR-25-R4, except the 9.0g forward ultimate inertia force of § 25.561 (b)(3)(ii), which is complied with either by supplementary installation of a barrier net or bulkhead, or by specifying an approved placement of the ULD in the aircraft. (Refer to SAE AS 36100C).

Unit Load Device (ULD): Device for grouping, transferring and restraining cargo for transit. It may consist of a pallet with a net or it may be a container. (Refer to SAE AS 36100C).

(The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.)