



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C90d

Effective
Date: 09/30/2011

Technical Standard Order

Subject: Cargo Pallets, Nets and Containers (Unit Load Devices)

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration (FAA)) tell you what minimum performance standards (MPS) your cargo unit load devices (ULDs) must first meet for approval and identification with the applicable TSO marking. See Appendix 1 for definitions.

2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date.
 - a. All prior revisions to this TSO are no longer effective. Generally, we will not accept applications for the previous revision after the effective date of this TSO. We may do so, however, up to six months after the effective date, if we know that the applicant was working against the prior MPS before the new change became effective.

 - b. ULDs approved under a previous TSOA/LODA may still be manufactured under the provisions of its original approval.

3. **REQUIREMENTS.**
 - a. New models of Type 1 ULDs identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in Aerospace Industries Association (AIA), National Aerospace Standard (NAS) 3610 Rev. 10, *Specifications for Cargo Unit Load Devices*, dated November 1, 1990, with the applicable exceptions identified in paragraph 3.c.

 - b. New models of Type 2 ULDs identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in Society of Automotive Engineers, Inc. (SAE) Aerospace Standard (AS) 36100, *Air Cargo Unit Load Devices – Performance Requirements and Test Parameters*, Rev. A, dated April 2006, with the applicable exceptions identified in paragraph 3.c.

 - c. **Exceptions:**
 - (1) Instead of NAS 3610 Rev. 10, paragraph 3.5, use paragraph 4. of this TSO which provides the marking requirements for Type 1 ULDs.

(2) Instead of NAS 3610 Rev. 10, paragraph 3.7, use paragraph **3.f.** of this TSO which provides the fire protection requirements for Type 1 ULDs.

(3) Instead of NAS 3610 Rev. 10, sheet 87, Figure 31, use revised Figure 31 from sheet 88.

(4) For Figure 32 (missing from NAS 3610 Rev 10), use Figure 32 of NAS 3610 Rev. 9, dated November 1987 or NAS 3610 Rev. 8, dated September 1987.

(5) Instead of SAE AS 36100 Rev. A, Paragraph 4.5, use paragraph **4.** of this TSO which provides the marking requirements for Type 2 ULDs.

(6) Instead of SAE AS 36100 Rev. A, Paragraph 4.7, use paragraph **3.f.** of this TSO which provides the fire protection requirements for Type 2 ULDs.

d. Functionality. This TSO applies to ULDs used to load luggage, freight, and mail on aircraft.

e. Material Performance.

(1) Consider environmental degradation due to aging, ultra-violet (UV)-exposure, weathering, etc. for any materials used in the construction of pallets, nets and containers.

(2) For textile performance see SAE Aerospace Information Report (AIR) 1490B, *Environmental Degradation of Textiles*, dated December 2007, 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. A, Paragraph 4.11.

NOTE: Environmental degradation data other than that documented in AIR1490B may be used if you substantiate the data and it is approved by the FAA aircraft certification office (ACO) manager responsible for administering your TSO or LODA. A net must meet the minimum performance requirements of this TSO at any time during its service life.

f. Fire Protection. The materials used in the construction of pallets, nets and containers must meet the appropriate provisions in 14 CFR part 25, Appendix F, part I, paragraph (a)(2)(iv).

g. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under the provision of 14 CFR § 21.618.

h. Test Methods. Use SAE standard AS 36102, *Air Cargo Unit Load Devices - Testing Methods*, dated March 2005 to establish acceptable testing methods and load distributions for Type 2 ULDs.

4. MARKING.

a. Mark at least one major component of the ULD permanently and legibly with all the information in 14 CFR § 45.15b. Mark the ULDs in an area clearly visible after the article (or combination of articles) 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) The identification of the article in the code system explained in:
 - (a) In NAS 3610 Rev. 10, Paragraph 1.2.1, for Type 1ULDs.
 - (b) In SAE AS 36100 Rev. A, Paragraph 3.5, for Type 2 ULDs.
- (4) The manufacturer's serial number of the article, with the option to add the date of manufacture.
- (5) The applicable TSO number.
- (6) The nominal weight of the article in the format:

Weight: _____kg (_____lb).
- (7) If the article must be installed in a specific direction, the words "FORWARD," "AFT," and "SIDE" must be conspicuously and appropriately placed.
- (8) The burning rate determined for the article under paragraph **3.f.** of this TSO.
- (9) Any limitations or restrictions.
- (10) 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 **4.b.** with its expiration date.

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly or component part number, and the TSO 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 14 CFR § 45.15d.

c. If the article includes a deviation per paragraph **3.g.** of this TSO, the deviation should be identified by the abbreviation "DEV" and marked after the applicable TSO number.

5. APPLICATION DATA REQUIREMENTS. You must give the FAA ACO manager responsible for your facility a statement of conformance as specified in 14 CFR § 21.603(a)(1) and one copy each of the following technical data to support your design and production approval. LODA applicants must submit the same data (excluding paragraph **5.e.**) through their civil aviation authority.

a. A manual containing the following:

- (1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability.
- (2) A detailed description of any deviation(s).
- (3) Installation procedures and limitations sufficient to ensure that the ULD, when installed according to the installation or operational procedures, still meets this TSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must include a note with the following statement:

“This article meets the minimum performance and quality system standards required by a technical standard order (TSO). Installation of this article on an aircraft requires separate approval.”

- (4) A list of line replaceable components, by part number, that makes up the ULD. Include vendor part number cross-references, when applicable.

b. Instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of ULDs. 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 TSO.

d. Identify functionality or performance contained in the article not evaluated under paragraph **3.** of this TSO (that is, non-TSO functions). Non-TSO functions are accepted in parallel with the TSO authorization. For those non-TSO functions to be accepted, you must declare these functions and include the following information with your TSO application.

(1) Description of the non-TSO function(s), such as performance specifications and software, hardware, and environmental qualification levels. Include a statement confirming that the non-TSO function(s) does not interfere with the article's compliance with the requirements of paragraph **3.**

(2) Installation procedures and limitations sufficient to ensure that the non-TSO 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-TSO 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 TSO article is not affected by the non-TSO function(s).

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

e. The quality system description required by 14 CFR § 21.608, including functional test specifications. Each applicant must provide a document required by 14 CFR § 21.605 describing how the applicant's organization will ensure compliance with the provisions of 14 CFR Subpart O. The quality system should ensure that you will detect any change to the approved design that could adversely affect compliance with the TSO MPS, and reject the article accordingly. (Not required for LODA applicants.)

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 TSO qualification report showing results of testing accomplished according to paragraph **3.** of this TSO.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to the responsible ACO, have the following technical data available for review by the responsible ACO:

- a. Functional qualification specifications for qualifying each production article to ensure compliance with this TSO.
- b. Equipment calibration procedures.
- c. Schematic or dimensional drawings.
- d. Wiring diagrams.
- e. Material and process specifications.
- f. If the article contains non-TSO function(s), you must also make available items **6.a.** through **6.e.** as they pertain to the non-TSO function(s).

7. FURNISHED DATA REQUIREMENTS.

a. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy (i.e. paper, CD, DVD, or other media) or on-line access to the data in paragraphs **5.a.** and **5.b.** of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO of the ULDs

b. If the article contains declared non-TSO 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 SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA, 15096-0001. Telephones (724) 606 7373, fax (724) 776-0790. You can also order copies online at www.sae.org.

b. Order AIA documents from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928. Telephone (703) 358-1000. You can also order copies online at www.aia-aerospace.org.

c. Order copies of 14 CFR parts from the Superintendent of Documents, US Government Printing Office, P.O. Box 979050, St. Louis, MO 63197-9000. Telephone (202) 512-1800, fax (202) 512-2104. You can also order copies online at www.access.gpo.gov.

d. You can find a current list of technical standard orders and advisory circulars on the FAA Internet website Regulatory and Guidance Library at <http://rgl.faa.gov/>. You will also find the TSO Index of Articles at the same site.

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APPENDIX 1. DEFINITIONS for TSO C90

Type 1 ULD: 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 Title 14 CFR part 25, including the 9.0g forward ultimate inertia force of 14 CFR § 25.561(b)(3)(ii). (Reference SAE AS 36100 Rev. A)

Type 2 ULD: Unit load devices (ULDs) 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 Title 14 CFR part 25, except for the 9.0g forward ultimate inertia force of 14 CFR § 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. (Reference SAE AS 36100 Rev. A)

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