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Air cargo — Certified lower deck containers — Design and testing

Fret aérien — Conteneurs certifiés de pont inférieur — Conception et essais

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

This third edition cancels and replaces the second edition (ISO 6517:1992), which has been technically revised to take into account ISO 21100 and TSO/ETSO C90d.

Introduction

The basic functions of lower deck air cargo containers are:

a) the unitization of baggage, cargo or mail during ground handling and transportation, and

b) the restraint of their contents against accelerations encountered in flight.

Throughout this International Standard, the minimum essential criteria are identified by use of the key word "shall". Recommended criteria are identified by use of the key word "should" and, while not mandatory, are considered to be of primary importance in providing safe, economical and usable containers. Deviation from recommended criteria should only occur after careful consideration and thorough service evaluation have shown alternate methods to provide an equivalent level of quality and safety.

The requirements of this International Standard are expressed in the applicable SI units, with approximate inch-pound units conversion between brackets for convenience in those countries using that system. Where it is deemed necessary to use exact values, the SI unit ones are to be used. Per exception, the exact figures are those in inches for container base overall outside dimensions.

Air cargo — Certified lower deck containers — Design and testing

1 Scope

1.1 This International Standard covers the minimum design and operational testing requirements for general purpose base-restrained containers exclusively intended for the lower deck compartments of main line civil transport aircraft, capable of being used by either airlines or shippers and requiring airworthiness authority approval (certification).

NOTE 1 The metric equivalents for dimensions have been rounded up or down to the nearest millimetre, except in critical dimensions. Masses have been rounded up to the nearest kilogram and forces have been rounded up to the nearest 10 N.

NOTE 2 Containers with other base sizes than those specified by this International Standard can also be built to a lower deck contour, but they need not be carried exclusively on the lower deck. See ISO 10327.

1.2 This International Standard does not cover the performance requirements and ultimate load testing parameters for approval by airworthiness authorities (certification), which are covered in ISO 21100 or, for units approved prior to 2012, ISO 8097:2001. The design and operational testing requirements of this International Standard are additional to those of these standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4116:1986, *Air cargo equipment — Ground equipment requirements for compatibility with aircraft unit load devices*

ISO 7166:1985, *Aircraft — Rail and stud configuration for passenger equipment and cargo restraint*

ISO 8097:2001, *Aircraft — Minimum airworthiness requirements and test conditions for certified air cargo unit load devices* (Endorsement of NAS 3610 10th edition)

ISO/TR 8647:1990, *Environmental degradation of textiles used in air cargo restraint equipment*

ISO 10046:1996, *Aircraft — Methodology of calculating cargo compartment volumes*

ISO 10327:1995, *Aircraft — Certified aircraft container for air cargo — Specification and testing*

ISO 11242:1996, *Aircraft — Pressure equalization requirements for cargo containers*

ISO 21100:—[1], *Air cargo unit load devices — Performance requirements and test parameters*

CAAC CCAR-21, *Certification Procedures for Products and Parts*[2]

CAAC CCAR-25, *Airworthiness Standards – Transport Category Airplanes*, paragraph 25.855, *Cargo or baggage compartments*, and Appendix F[2]

CAAC CCAR-121, *Air Carriers Certification and Operations system*[2]

1) To be published. (Technical revision of ISO/PAS 21100:2011.)

2) The Civil Aviation Administration of China (CAAC) listed documents constitute the Chinese government transport aircraft airworthiness approval Regulations.

CAAC Chinese Technical Standard Order CTSO C90d — *Cargo pallets, nets and containers*[2)]

EASA Part 21 — *Certification of aircraft and related products, parts and appliances, and of design and production organisations* (Commission Regulation (EU) No 748/2012)[3)]

EASA CS-25 — *Certification Specifications for Large Aeroplanes*, paragraph 25.855, *Cargo or baggage compartments*, and Appendix F[3)]

EASA (European Aviation Safety Agency) EU-OPS 1.035 — *Quality system*[3)]

EASA European Technical Standard Order ETSO C90d — *Cargo pallets, nets and containers (Unit Load Devices)*[3)]

Japanese Airworthiness Standard Part 3 (Civil Aeronautics Law Article 10 § 4)[4)]

U.S. Code of Federal Regulations Title 14 CFR Part 21 — *Certification Procedures for Products and Parts*[5)]

U.S. Code of Federal Regulations Title 14 Part 25 — *Airworthiness Standards: Transport Category Airplanes* ("14 CFR Part 25"), paragraph 25.855, *Cargo or baggage compartments*, and Appendix F[5)]

U.S. Code of Federal Regulations Title 14 CFR Part 121 — *Air carriers certification and operation*[5)]

U.S. Federal Aviation Administration Advisory Circular AC 120-59 — *Air carriers internal evaluation programs*[5)]

U.S. Federal Aviation Administration Technical Standard Order TSO C90d — *Cargo Pallets, Nets and Containers*[5)]

EUROCAE ED-14G, *Environmental conditions and test procedures for airborne equipment*[6)]

NOTE 3 Also see informative references in Bibliography.

3) The listed EASA documents constitute the European governments transport aircraft airworthiness approval Regulations, and can be obtained from the European Aviation Safety Agency (EASA), Otto Platz 1, Postfach 101253, D-50452 Cologne, Germany, or its website at www.easa.europa.eu.int.

4) Japanese Airworthiness Standard Part 3 (ISBN 4-89279-661-1) constitutes the Japanese government transport aircraft airworthiness approval Regulations, and can be obtained from the Civil Aviation Bureau (CAB) of the Ministry of Land, Infrastructure and Transport, Tokyo, Japan, or its website at www.mlit.go.jp/en.

5) The listed FAA documents constitute the U.S.A. government transport aircraft airworthiness approval Regulations, and can be obtained from the U.S. Government Printing Office, Mail Stop SSOP, Washington DC 20402-9328, or its website at www.gpoaccess.gov.

6) EUROCAE ED-14G can be obtained from the European Organisation for Civil Aviation Equipment, 102 rue Etienne Dolet, 92240 Malakoff, France, or its website at www.eurocae.eu.

3 Container sizes and identification

3.1 The overall maximum dimensions of the containers are shown in Figures 2 to 6.

They embrace two base sizes:

— Size **K**: 1 562 mm × 1 534 mm (61,5 in × 60,4 in),

— Size **L**: 3 175 mm × 1 534 mm (125 in × 60,4 in).

and seven contours (see 3.2 NOTE):

— Contour **C**: nominal overall width 2 337 mm (92 in) (see Figure 3),

— Contour **E**: nominal overall width 2 007 mm (79 in) (see Figure 2),

— Contour **F**: nominal overall width 4 064 mm (160 in) (see Figure 4),

— Contour **G**: nominal overall width 2 007 mm (79 in) (see Figure 6),

— Contour **H**: nominal overall width 2 438 mm (96 in) (see Figure 6),

— Contour **P**: nominal overall width 3 175 mm (125 in) (see Figure 4),

— Contour **U**: nominal overall width 4 724 mm (186 in) (see Figure 5).

3.2 Container types complying with this International Standard are identified according to their ISO 21100 configuration by a type code composed of three letters[7)]:

a) the first letter **A** denoting a certified aircraft container complying with the performance requirements of ISO 21100 type 2 or, for units approved prior to 2012, ISO 8097 type II;

b) the second letter denoting the base size in accordance with ISO 21100;

c) the third letter denoting the contour determined in accordance with ISO 10046 (see NOTE 3).

The identification code shall be prominently marked on two opposite sides of the container (see 6.3).

EXAMPLE A certified aircraft container (A) of base size 3 175 mm × 1 534 mm (125 in × 60,4 in) (size L) and of nominal overall width 3 175 mm (125 in) (contour P) shall be designated as follows: **ALP**.

NOTE The container type code's third (contour) digit is subject to change to accommodate evolving airline needs. Check the latest yearly edition of IATA Unit Load Devices Regulations Standard Specifications 40/1 and 50/0 Appendix E (references[6] and[7] in Bibliography) for any code changes.

4 Requirements

4.1 General

4.1.1 The container shall consist of a complete structural enclosure meeting ISO 21100 type 2 or ISO 8097 type II performance requirements, and all the requirements of the present clause.

4.1.2 The container manufacturer shall provide the user instructions for the maintenance and repair of the container necessary to maintain its continuing airworthiness qualification (see 9.1).

7) The type code is, by industry consensus, under custody of and assigned by the International Air Transport Association (IATA), ULD Registrar, 800 Place Victoria, P.O. Box 113, Montréal, Québec H4Z 1M1, Canada, website www.iata.org.

4.1.3 The manufacturer shall provide the user instructions for installation, operation and servicing of the container (see 8.2), which shall comply with load distribution and centre of gravity conditions of ISO 21100 and refer to methods to achieve the centre of gravity location control requirements.

4.1.4 The design, materials and construction of the container shall be of aircraft quality. Maintainability and reparability shall be a factor in the design to ensure the minimum need for maintenance, and shall ensure that such maintenance and repair can be accomplished with ease and at minimum cost.

4.1.5 The structure shall be designed to make the maximum internal cross-section available for loading cargo, within the limits of structural design and the space required for latching.

4.1.6 The materials and design shall be selected to provide for an empty (tare) weight as low as possible, consistent with maintainability objectives (see 4.1.4).

NOTE A direct environmental impact of container use is that their weight results in additional fuel burn by aircraft. Therefore, apart from economic advantages, reducing container weight as much as possible to still meet performance objectives is a highly effective environmental contribution and must be pursued.

4.2 Airworthiness approval

4.2.1 The container manufacturer shall apply to the appropriate airworthiness authority to obtain approval (certification) for use of the container in aircraft whose cargo compartments require the use of base-restrained certified containers (see also 4.2.2).

4.2.2 The mostly used method for this purpose is applying for a TSO/CTSO/ETSO/JTSO C90d Technical Standard Order authorization in reference to ISO 21100 (containers certified prior to 2012 were approved under TSO C90c in reference to ISO 8097). In special instances, other approval methods may be used. Airworthiness approval procedures and requirements shall in any event be in accordance with CCAR/EASA/14 CFR Part 21 Regulations.

4.3 Materials

4.3.1 The materials and processes selected shall provide for maximum service life by giving consideration to the extremely hard usage to which the container will be subjected. All metal parts shall be suitably protected against corrosion. All non-metallic liquid absorbent materials shall be sealed or treated to prevent liquid absorption. Materials shall be fire resistant per 4.3.2 and shall withstand environmental degradation (see 4.7).

4.3.2 All container and component materials shall meet the requirements of CS-25, CCAR-25, JAS Part 3 or 14 CFR Part 25 Appendix F, Part I, paragraphs (a)(1)(v) and (a)(2)(iv), i.e. shall not have a burn rate greater than 100 mm (4 in) per minute when flame tested horizontally in accordance with Appendix F, Part I paragraphs (b)(5), (b)(2), (b)(3) and (b)(8). The test specified therein shall be performed on each material and results recorded.

4.4 Construction

4.4.1 Base

4.4.1.1 The base shall be enclosed on all four sides by an aluminium extrusion. The corner's integrity with its edges shall be a prime concern. The base shall not contain rough or sharp edges potentially dangerous to personnel, cargo, aircraft or terminal handling equipment. The construction of the base shall be designed for strength and durability to withstand harsh treatment in service. The base shall be structurally attached to, and be an integral part of, the container assembly. The base shall be removable with hand tools and shall be interchangeable.

4.4.1.2 The base shall comply with the indentation performance requirements of 4.5.1. The minimum core stiffness shall be 429 $N \cdot m^2/m$ (3 800 $lbf \cdot in^2/in$) width/length of core. It shall have a minimum area load capacity of 10 kPa (209 lb/ft^2). This load shall be applicable to any area representing at least 10 %

of the total base area, and the base shall not exhibit any significant deformation of this area while the container is supported by the aircraft restraint system.

4.4.1.3 The base edges shall conform with the dimensional requirements shown in Figure 7 for size K and Figure 8 for size L. The recess over the base edge shall be maintained continuous all around the base periphery. The required minimum clearance shall be provided under the sloped (overhanging) panel on the outboard side(s).

4.4.1.4 Where optional fork-lift capability is provided, the minimum aperture size shall be 100 mm (4 in) high by 300 mm (12 in) wide, with chamfered protected edges.

4.4.1.5 Where provided, there shall be fork-lift pockets at least on the two long sides, although three-way entry is preferred on size K units.

4.4.1.6 On size L units, the distance between the inner edges of the optional fork-lift pockets shall be not less than 815 mm (32 in), and on size K units not less than 355 mm (14 in).

4.4.2 Body

4.4.2.1 The container's body shall not contain rough or sharp edges potentially dangerous to personnel, cargo, airplane or terminal handling equipment. Any attachments between the base and the panels shall be designed to have a minimum intrusion into the door area, and none in the continuous recess all around the base periphery (see Figures 7 and 8). Gussets are allowed at the junctions of panels and base or top to allow the transfer of bending moments. The size of all gussets, particularly in the door opening, shall be the minimum consistent with structural requirements.

The top of the container shall be self-draining. The top surface shall be designed to be easily cleared of snow.

To facilitate repair and assembly, component parts shall be readily removable with hand tools and shall be interchangeable.

4.4.2.2 In addition to those on the door (see 4.4.3.2), two non-protruding handles or straps shall be located on each side panel for manual movement of the container by one person. Each handle shall provide 150 mm (6 in) wide by 75 mm (3 in) deep space for gripping with a gloved hand, and shall have a local attachment strength of 450 daN (1 000 lbf) in any direction.

4.4.2.3 One or more placard holders shall be fitted to the body to accommodate a destination placard of standard size A5 [210 mm × 148 mm (8 1/4 in × 5 7/8 in)].

4.4.3 Doors

4.4.3.1 The door opening should be designed to make the maximum possible cross-section available for loading. It shall be possible for one person to open or close the door and any associated net or hardware in no more than 1 min for full-width units (base size L), and no more than 15 s for half-width units (base size K).

It shall be possible to open any type of door without exceeding a height of 2,5 m (98 in), measured from the underside of the base. The door shall be capable of being opened with a 102 mm (4 in) high obstacle adjacent to the base.

Where hinges are used, the design shall not allow fingers to be trapped.

In general, containers have only one door situated on a long side of the unit. In some cases, for operational reasons, size K units may have a door on each long side.

Doors are generally rectangular, but may vary to suit the container contour, the choice of structural shape, or to provide enhanced or full-width door opening.

On contour G and H containers (see Clause 3 and Figure 6), the door design shall provide a horizontal opening over half the depth of the roof panel in order to allow a man standing in the opening for container