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Air cargo — Main deck containers — Design and testing

Fret aérien — Conteneurs de pont principal — Conception et essais

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Foreword

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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 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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

This second edition cancels and replaces the first edition (ISO 10327:1995), which has been technically revised.

Introduction

The basic functions of main deck air cargo containers are

a) the unitization of cargo 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 air transport 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 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 — Main 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 main or upper deck cargo compartments of main line civil transport aircraft, capable of being used by either airlines or shippers and requiring an 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 Though nothing technically prevents their being used for baggage, main deck containers are generally used only for carriage of freight.

1.2 This International Standard does not cover the performance requirements and ultimate load testing parameters for airworthiness authorities approval (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 the performance and certification testing requirements of these International Standards.

1.3 This International Standard does not cover containers with an overall height of 1 625 mm (64 in) or less, that can be loaded on the lower deck compartments of main line civil transport aircraft, which are specified in ISO 6517, nor air-surface main deck containers, which are specified in ISO 4128 and ISO 8323.

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 4128:1985, *Aircraft — Air mode modular containers*

ISO 4171:1993, *Air cargo equipment — Interline pallets*

ISO 6517:1992, *Air cargo equipment — Base-restrained certified containers exclusively for the lower deck of high-capacity aircraft*

ISO 7137:1995, *Aircraft — Environmental conditions and test procedures for airborne equipment*

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*

ISO 8323:1985, *Freight containers — Air/surface (intermodal) general purpose containers — Specification and tests*

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

ISO/PAS 21100:2011, *Air cargo unit load devices — Performance requirements and test parameters*

CAAC CCAR-21, *Certification Procedures for Products and Parts*[1)]

CAAC CCAR-25, *Airworthiness Standards —Transport Category Airplanes*[1)]

CAAC CCAR-121, *Air Carriers Certification and Operations system*[1)]

CAAC Chinese Technical Standard Order CTSO C90d — *Cargo pallets, nets and containers*[1)]

EASA Part 21, *Certification of aircraft and related products, parts and appliances, and of design and production organisations* (Commission Regulation (EU) No. 748/2012)[2)]

EASA CS-25, *Certification Specifications for Large Aeroplanes*[2)]

EASA, *(European Aviation Safety Agency) EU-OPS 1035 — Quality system*[2)]

EASA, *European Technical Standard Order ETSO C90d — Cargo pallets, nets and containers (Unit Load Devices)*[2)]

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

U.S. Code of Federal Regulations Title 14 CFR Part 21, *Certification Procedures for Products and Parts*[4)]

U.S. Code of Federal Regulations Title 14 Part 25, *Airworthiness Standards: Transport Category Airplanes*[4)]

U.S. Code of Federal Regulations Title 14 CFR Part 121, *Air carriers certification and operation*[4)]

U.S. Federal Aviation Administration Advisory Circular AC 120-59, *Air carriers internal evaluation programs*[4)]

U.S. FAA Technical Standard Order TSO C90d, *Cargo Pallets, Nets and Containers*[4)]

EUROCAE ED-14G, *Environmental conditions and test procedures for airborne equipment*[5)]

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

2) The listed EASA documents constitute the European 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 web site at www.easa.europa.eu.int.

3) 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.

4) 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/ecfr.

5) 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 This International Standard specifies the basic requirements for design and operational testing of containers that have the nominal base sizes shown in Table 1.

Table 1 — Sizes

Size code of base in accordance with ISO/PAS 21100	Container base size	
	mm	in
A	2 235 × 3 175	88 × 125
B	2 235 × 2 743	88 × 108
M	2 438 × 3 175	96 × 125

3.2 Maximum container contours shall be determined in accordance with ISO 10046 for the aircraft type(s) where they are intended to be carried. The resulting overall maximum dimensions are shown in Figures 4 to 6 for some of the mostly used container contours able to fit several aircraft types. Many other contours are allowed and present a large variety to adapt to specific aircraft types or aircraft configurations. The maximum contours given for examples only in Figures 4 to 6 are:

— contour A: overall height 2 438 mm (96 in), width 2 337 mm (92 in) (see Figure 4);

— contour D: overall height 2 997 mm (118 in), width 2 438 mm (96 in) (see Figure 5);

— contour Y: overall height 2 083 mm (82 in), width 3 175 mm (125 in) (see Figure 6).

Base size A and M containers with an overall height of 1 625 mm (64 in) or less of contours F, K, P, or U can be loaded on the lower deck and, regardless of their certification status, shall comply with the relevant requirements of ISO 6517 in addition to those of the present International Standard.

3.3 Container types complying with this International Standard are identified according to their ISO/PAS 21100 configuration by a type code composed of three letters[6)]:

a) the first letter A denoting a certified aircraft container complying with the performance requirements of ISO/PAS 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/PAS 21100;

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

The identification code shall be prominently marked on two opposite sides of the container (see Clause 6).

EXAMPLE A certified aircraft container (A) of base size 3 175 mm × 2 438 mm (125 in × 96 in) (size M) and of overall height 2 438 mm (96 in) (contour A) shall be designated as AMA.

NOTE The containers 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 (see Reference [6] and Reference [7]) for any code changes.

6) The type code is, by industry consensus, under custody of and assigned by International Air Transport Association (IATA), ULD Registrar, 800 Place Victoria, P.O. Box 113, Montréal, Québec H4Z 1M1, Canada, web site www.iata.org. See IATA Standard Specification 40/1 (Reference [6] in Bibliography).

4 Requirements

4.1 General

4.1.1 The container shall consist of a complete structural enclosure meeting ISO/PAS 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 8.2).

4.1.3 The container 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/PAS 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 containers use is that their weight results in additional fuel burn by aircraft. Therefore, apart from economic advantages, reducing containers weight as much as possible to still meet performance objectives is a highly effective environmental contribution and shall be pursued.

4.2 Airworthiness approval

4.2.1 The mostly used method for this purpose is applying for a TSO/CTSO/ETSO/JTSO C90d Technical Standard Order authorization in reference to ISO/PAS 21100 (containers certified prior to 2012 were approved under TSO C90c in reference to ISO 8097). In special instances, other approval methods can 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).

4.3.2 All container and components 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 is 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. In accordance with TSO requirements, the measured burn rate shall be marked on the container (see 6.1).

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 corner radius shall be 51 mm (2 in). The base shall not contain rough or sharp edges potentially dangerous to personnel, cargo, airplane, 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 an integral part of, the container assembly. The base shall be removable with hand tools and shall be interchangeable.

The base shall comply with the performance criteria specified in ISO 4171.

4.4.1.2 The base shall comply with the indentation performance requirements of 4.5.1 and 4.5.2, and 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 percent (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. The recess over the base edge shall be maintained continuous all around the base periphery.

4.4.1.4 The minimum core stiffness of the base shall be 429 N·m^2/m (3 800 lbf.in^2/in) width/length of core. Its stiffness shall aim at not exceeding a maximum area load of 10 kPa (209 lb/ft^2) on the underlying conveying system.

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 Figure 7). 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 where in the door opening, shall be the minimum consistent with structural requirements.

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

4.4.2.3 To facilitate repair and assembly, component parts shall be readily removable with hand tools and shall be replaceable by interchange with new or repaired ones.

4.4.2.4 In addition to those on the door (see 4.4.3.3), two non-protruding handles or straps shall be located on each side panel for manual handling 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 minimum capacity of 445 daN (1 000 lbf) pull in any direction.

4.4.2.5 The contour shall conform with the maximum allowable ULD contour. All dimensions shown are external maximum dimensions and provide minimum acceptable airplane clearance (see 3.2 and Figures 4 to 6). Any deviation or tolerance shall be to the low side to prevent reduction of clearance.

NOTE The maximum allowable ULD contours are shown in the IATA ULD Regulations Standard Specification 50/0, Appendix E (see Reference [7]).

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

4.4.2.1 Cargo restraint

Securing points shall be provided around the interior walls, spaced approximately 500 mm (approximately 20 in) apart, at the following points:

— near the base (not required if equivalent provisions are available at the base);

— at approximately half height.

Each of these points shall be capable of reacting an omni-directional load of 2 225 daN (5 000 Ibf) near or at the base, and 890 daN (2 000 Ibf) at half height. These points shall comply with ISO 7166.

4.4.3 Door

4.4.3.1 The door should be designed to make a maximum possible internal cross-section available for loading and shall ensure no interference of the door, latches, and/or hardware occurs with ground equipment in accordance with ISO 4116 (stops and guides 102 mm (4 in) high).

4.4.3.2 It shall be possible for one person to open or close the door and any associated net or hardware in no more than one minute.

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.

4.4.3.3 Handles, straps, or hand-holds shall be provided on each door for handling the door and for manual movement of the container. These devices shall be able to withstand a 450 daN (1 000 Ibf) pull in any direction, and shall provide 150 mm (6 in) wide by 75 mm (3 in) deep space for gripping with a gloved hand. These devices shall be designed not to exceed the maximum outer contour, and to cause no damage to adjacent units.

4.4.3.4 Door latch and restraint hardware design shall preclude damage to container body or door during door stowage and installation/removal with no special attention.

The door latching and installation mechanisms shall be designed to allow door installation and removal while the container is sitting on uneven surfaces varying by as much as 13 mm (0,5 in) over the length of the base.

No tools shall be required to open and close the doors or latches.

4.4.3.5 Unless the door is entirely removable, means of retention in the open position shall be provided, which shall be able to maintain the door in the open and stowed position in wind and blast up to a minimum of 110 km/h (60 kn).

4.4.3.6 It shall be possible to lock (discourage entry) and seal the door, so as to give visual indication of unauthorized entry. See Clause 7 hereafter.

4.4.3.7 Particular design attention should be given to prevention of water intrusion through door-to-container assembly interface areas.

4.4.4 Pressure equalization

The container design shall comply with the specifications of ISO 11242, as follows.

