BS ISO 4118:2016

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Air cargo — Non-certified lower deck containers — Design and testing

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National foreword

This British Standard is the UK implementation of ISO 4118:2016. It supersedes BS ISO 4118:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ACE/57, Air cargo and ground support equipment.

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INTERNATIONAL STANDARD

ISO 4118

Fourth edition
2016-07-01

Air cargo — Non-certified lower deck containers — Design and testing

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

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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 (see 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 (see www.iso.org/patents).

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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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO 4118:2005), of which it constitutes a complete technical revision.

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Introduction

The basic functions of air cargo containers are

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

b) the restraint in accordance with aircraft Weight and Balance Manual requirements of their contents against accelerations encountered in flight.

This revision introduces containers flight conditions testing in order to provide means to substantiate their ability to withstand maximum flight loads so that neither the container nor its contents can become a hazard or damage the aircraft structure.

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 practical 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, except for container base plan-view dimensions, whose exact values are those expressed in inches.

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INTERNATIONAL STANDARD ISO 4118:2016(E)

Air cargo — Non-certified lower deck containers — Design and testing

1 Scope

This International Standard covers the design, performance and testing requirements for lower deck containers for use in main line aircraft which do not require airworthiness approval/certification when loaded under the conditions of compartment restraint and/or where applicable according to the aircraft type's approved Weight and Balance Manual, ISO 8097 or ISO 21100 equivalent base plate restraint for these containers.

Aircraft Weight and Balance Manuals require non-certified containers be constructed then loaded in such a manner that neither the container nor its contents can become a hazard or damage the aircraft structure under flight conditions. Compliance with the present International Standard is one means of demonstrating compliance with these requirements.

Most sizes of containers covered by this International Standard (base sizes K, L, P and Q) cannot physically be loaded and latched on aircraft main deck cargo systems. Base size A and M containers can, but are not allowed on aircraft main decks, which in general do not accept non-certified units. Accordingly, all containers covered by this International Standard are intended to be used/installed exclusively in aircraft lower deck compartments

NOTE 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. See introduction where it is deemed necessary to use exact values.

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, *Air cargo equipment — Ground equipment requirements for compatibility with aircraft unit load devices*

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

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

ISO 10254, *Air cargo and ground equipment — Vocabulary*

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

ISO 21100, *Air cargo unit load devices — Performance requirements and test parameters*

CAAC CCAR-25, *Airworthiness Standards –Transport Category Airplanes, paragraph 25.855, Cargo or baggage compartments*[1)]

U.S. Code of Federal Regulations 14 CFR Part 25, *Airworthiness Standards: Transport category airplanes, paragraph 25.855, Cargo or baggage compartments*[2)]

1) The Civil Aviation Administration of China (CAAC) CCAR-25 constitutes the Chinese government transport aircraft airworthiness Regulations.

2) 14 CFR Part 25 constitutes the U.S.A. Government transport aircraft airworthiness Regulations, and can be obtained from: US Government Printing Office, Mail Stop SSOP, Washington DC 20402-9328, U.S.A. or its web site at www.gpoaccess.gov.from: US Government Printing Office, Mail Stop SSOP, Washington DC 204[illegible]

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European Aviation Safety Agency CS-25, *Certification Specifications for Large Aeroplanes, paragraph 25.855, Cargo or baggage compartments*[3)]

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

3 Terms and definitions

For the purposes of this document, the definitions in ISO 10254 and the following apply.

3.1
aircraft container
completely enclosed unit load device which interfaces directly with the aircraft cargo handling and restraint system and alone performs all the functions of a unit load device

3.2
certification
approval
approval by an airworthiness authority that a component or item of equipment meets the required performance for aircraft installation

3.3
non-certified container
container exclusively for the lower deck of wide-body aircraft, which is not subject to airworthiness approval (certification), but may be carried under conditions specified by the aircraft's Weight and Balance Manual

3.4
Weight and Balance Manual
W&BM
manual published for each aircraft type by its manufacturer, which is approved by the airworthiness authority as part of the aircraft type's certification and defines the set of limits not to be exceeded by the operating carrier when loading

4 Dimensions and ratings

4.1 Containers complying with this International Standard are identified by a type code composed of three letters:[5)]

a) the first letter **D** denoting a non-certified aircraft container;

b) the second letter **A**, **K**, **L**, **M**, **P** or **Q** denoting the base size as defined in ISO 21100;

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

website at www.gpoaccess.gov.

3) EASA CS-25 constitutes the European Governments transport aircraft airworthiness Regulations and can be obtained from: European Aviation Safety Agency (EASA), Postfach 101253, D-50452 Cologne, Germany, or its web site at www.easa.europa.eu.

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

5) 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, web site at www.iata.org.

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The identification code shall be prominently marked on two opposite sides of the container (see Clause 8).

EXAMPLE

A non-certified aircraft container (D) of base size 3 175 mm x 1 534 mm (125 in x 60,4 in) (size L) and of nominal overall width 3 175 mm (125 in) (rectangular contour P) shall be designated as **DLP**.

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 (References [5] and [6]) for any code changes.

4.2 External contours, dimensions, and ratings of applicable containers are shown in **Table 1**.

Table 1 — Ratings and contour dimensions of non-certified containers

Name of containers and nominal dimensions in mm (in)	Rating (Maximum operational gross mass) kg (lb)[a]	Contour and external dimensions	IATA Identification Code (IATA 40/1)[b]
Half-width contoured container, 2 337 mm (92 in) wide, with base dimensions 1 534 mm × 1 562 mm (60,4 in × 61,5 in)	1 588 kg (3 500 lb)	Annex A	DKC
Half-width contoured container, 2 007 mm (79 in) wide, with base dimensions 1 534 mm × 1 562 mm (60,4 in × 61,5 in)	1 588 kg (3 500 lb)	Annex B	DKE/DKN
Half-width rectangular container, 1 562 mm (61,5 in) wide, with base dimensions 1 534 mm × 1 562 mm (60,4 in × 61,5 in)	1 588 kg (3 500 lb)	Annex C	DKP
Full-width contoured container, 4 064 mm (160 in) wide, with base dimensions 1 534 mm × 3 175 mm (60,4 in × 125 in)	3 175 kg (7 000 lb)	Annex D	DLF
Full-width rectangular container, 3 175 mm (125 in) wide, with base dimensions 1 534 mm × 3 175 mm (60,4 in × 125 in)	3 175 kg (7 000 lb)	Annex E	DLP
Half-width contoured container, 1 562 mm (61,5 in) wide, with base dimensions 1 534 mm × 1 194 mm (60,4 in × 47 in)	1 225 kg (2 700 lb)	Annex F	DPE/DPN
Full-width contoured container, 3 175 mm (125 in) wide, with base dimensions 1 534 mm × 2 438 mm (60,4 in × 96 in)	2 449 kg (5 400 lb)	Annex G	DQF
Full-width rectangular container, 2 438 mm (96 in) wide, with base dimensions 1 534 mm × 2 438 mm (60,4 in × 96 in)	2 449 kg (5 400 lb)	Annex H	DQP
Full-width contoured container, 4 064 mm (160 in) wide, with base dimensions 2 235 mm × 3 175 mm (88 in × 125 in)	4 627 kg (10 200 lb)	Annex I	DAF
Full-width contoured container, 4 064 mm (160 in) wide, with base dimensions 2 438 mm × 3 175 mm (96 in × 125 in)	5 103 kg (11 250 lb)	Annex J	DMF
Low-height, full-width contoured container, 2 438 mm (96 in) wide, with base dimensions 1 534 mm × 1 562 mm (60,4 in × 61,5 in)	1 588 kg (3 500 lb)[c]	Annex K	DKH
Low-height, half-width contoured container, 2 007 mm (79 in) wide, with base dimensions 1 534 mm × 1 562 mm (60,4 in × 61,5 in)	1 588 kg (3 500 lb)[c]	Annex L	DKG

[a] Actual maximum gross mass shall comply with the aircraft's Weight and Balance Manual.

[b] Carriage of non-certified containers in any cargo compartment must be allowed by the aircraft type's Weight and Balance Manual.

[c] Limited to 1 134 kg (2 500 lb) on the main aircraft types concerned.

NOTE The maximum gross mass allowable for a non-certified container on any given position of an aircraft is determined by the aircraft type or sub-type's Authority-approved Weight and Balance Manual. Because this value is aircraft type dependent, airlines through IATA have agreed, principally for interlining purposes, to define for each ULD size a container maximum operational gross mass independent from the aircraft type, as shown in Table 1, which is often higher or sometimes lower than the maximum allowable one on a given aircraft type.

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5 Design requirements

5.1 General

5.1.1 Non-certified lower-deck containers shall meet the requirements of this International Standard and, in accordance with airworthiness Authority-approved aircraft Weight and Balance Manuals, be constructed then loaded in such a manner that neither the container nor its contents can become a hazard or damage the aircraft structure under flight conditions.

5.1.2 The container shall consist of a complete enclosure (base, top, four sides) with door.

5.1.3 The structure shall be designed to provide the maximum usable internal volume available within the limits of structural design and the space required for latching, including door(s).

5.1.4 Provisions shall be made for closing and sealing the container to meet customs clearance and security requirements (see Clause 9).

5.1.5 The tare weight of the container shall be kept to a minimum, consistent with the requirements and within the limits of sound design practice.

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 should be pursued.

5.1.6 If required (see 5.7), means of fork-lifting the container shall be provided in accordance with the appropriate annexes.

5.1.7 Robustness, reliability and maintainability shall be major factors in the design, commensurate with planned service life.

5.1.8 The materials used shall be fire resistant, in accordance with the regulatory requirements of CS-25, CCAR-25, JAS Part 3 or 14 CFR Part 25 Appendix F Part I § (a)(2)(iv) and (a)(1)(v), i.e. may not have a burn rate greater than 100 mm (4 in) per minute when tested horizontally as specified in Part I § (b)(5).

5.1.9 During material selection, preference shall be given to recyclable materials and materials that minimize overall environmental impact, as well as carbon dioxide production, where this does not compromise container performance and weight. The container's components and materials should be selected in order to allow identified recycling methods when out of use. Instructions for recycling should be provided by the manufacturer (see 10.1).

5.1.10 No surfaces or edges shall present sharp or rough edges potentially injurious to personnel or cargo.

5.1.11 Insofar as atmospheric conditions may affect the performance of the container or any part thereof, it should be taken into account that during transportation, these conditions range from −40 °C (−40 °F) to 60 °C (140 °F) in temperature, with relative humidity from 20 % to 85 %. These are the mean temperature and humidity figures worldwide without taking into account extremes in temperature such as those experienced in arctic, sub-polar, or desert regions. This, however, is not a test requirement.

5.1.12 Component parts shall be replaceable by interchange with new or repaired ones. Panel assemblies should be replaceable by interchange with new or repaired ones.

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5.2 Base

5.2.1 The base shall be smooth and free from rough or sharp edges which may be hazardous to personnel, cargo, aeroplane, ramp, and terminal handling equipment. The base shall be structurally attached to, and an integral part of, the container assembly. The construction shall be designed for strength and durability to withstand harsh treatment during its service life. It shall have a high resistance to impact and wear. Where attachment of the container body to the base is required, this should be accomplished by the use of normal hand tools.

5.2.2 Care shall be exercised in the design and construction of the base to ensure that flatness of the lower surface and edge members can be maintained in service and it is of adequate strength to minimize bowing and to provide for the ease of conveyance

5.2.3 The base's outer dimensions and tolerances shall be as defined for the relevant size in ISO 21100. All base edges, corners, and restraint space shall have dimensions as shown in Figure 1 for sizes K, P and Q, or Figure 2 for sizes A, L and M, and Table 4. The recess over the base edge shall be maintained continuously all around the base periphery. The required minimum clearance shall be provided under the sloped (overhanging) panel on the outboard side(s).

5.2.4 The base design shall provide for support and ease of movement at the equally distributed rating on minimum conveyor systems as defined in ISO 4116. Its stiffness shall aim at not exceeding a maximum area load of 10 kPa (209 lbf/ft^2) on the underlying conveying system. The minimum core stiffness of the base shall be

— 77 N.m^2/m (680 lbf.in^2/in) width/length of core for sizes K, P or Q,

— 330 N.m^2/m (2 900 lbf.in^2/in) width/length of core for all other sizes.

5.2.5 Where optional forklift capability is provided, the minimum forklift entry size should be 100 mm (4 in) high by 300 mm (12 in) wide, with chamfered protected edges.

5.2.6 Where provided, there shall be forklift entries at least on the two long sides, although three-way entry is preferred on K-size and P-size units.

5.2.7 On size L and size Q units, the distance between the inner edges of the optional forklift entries shall be not less than 815 mm (32 in), and on size K and size P units not less than 355 mm (14 in).

5.2.8 The optional base forklift tine entry and separation should be designed so that the base panel of the unit imparts no more than 10 kPa (209 lbf/ft^2) to the supporting conveyor systems.

5.3 Body

5.3.1 It is essential that the container's integrity be maintained throughout its transportation because the container interfaces directly with the aircraft system. Imposed loads shall be sustained by the base and the body. The materials and methods of construction shall, therefore, be adequate for this task.

5.3.2 The sides, roof, and door(s) shall be of a minimum weight commensurate with maximum stability during both ground handling and air transportation.

5.3.3 Access for loading is generally required on one or both longer sides, although positions may vary to suit individual requirements.

5.3.4 The roof shall be flush, such that any protrusions do not cause damage in contact with the aircraft's cargo compartment ceiling. The top of the container shall be self-draining and designed for easy snow removal.

5.3.5 There shall be no intrusions between the base edges, as defined in Figures 1 and 2 base details typical for all edges, and the container body within a depth of 28 mm (1,12 in) from the base edges.

5.3.6 In addition to those on the door (see 5.4.4), 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

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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.

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

5.3.8 The container's body shall not contain rough or sharp edges potentially dangerous to personnel, cargo, airplane or terminal handling equipment. Any gussets in the door opening shall be of minimum size, consistent with the strength and/or deflection requirements.

5.3.9 The minimum height dimension of the container is 1 600 mm (63 in) for standard height (contours C, E, F, N or P) containers and 1 118 mm (44 in) for low-height (contours G or H) containers.

5.4 Doors

5.4.1 Doors shall be designed to avoid finger-pinching hazards and be of sufficient strength to contain the load during air and ground transportation. 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 sizes A, L, M and Q), and no more than 15 s for half-width units (base sizes K and P).

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.

The door shall be stowable on top of the unit. 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 knots).

5.4.2 The door(s) shall have a minimum number of securing devices to sustain the handling loads at maximum gross mass without unlocking. These devices are required to positively secure the door(s) in the closed position. They should be so located that they cannot damage, or become damaged by, an adjacent container. No tools shall be required to operate the door(s) or the securing devices.

5.4.3 In general, containers have only one door situated on a long side of the unit. In some cases, for operational reasons, size K or P 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 4 and Annexes K and L), the door design shall provide a horizontal opening over half the depth of the roof panel in order to allow a person standing in the opening for container build-up and break-down. In the interest of ergonomic conditions improvement, it is recommended to also consider such an opening for all other contours covered by this International Standard.

5.4.4 Handles, straps or hand holds shall be provided on each door for handling the door and for manual movement of the container by one person. These devices shall be able to withstand a 445 daN (1 000 lbf) pull in any direction. They shall provide 150 mm (6 in) wide by 75 mm (3 in) deep space for gripping with a gloved hand. They shall be designed not to exceed the maximum outer contour, and so they can cause no damage to adjacent units.

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5.5 Internal tie-down

Provision shall be made for internal restraint of the load, such as tie-down rings and/or tie-down track in accordance with ISO 7166 around the base edges, including at least the corners. Each fitting shall be capable of supporting a 2 225 daN (5 000 lbf) load in any direction, using an ISO 9788 double stud tie-down fitting in the case of track conforming to ISO 7166.

5.6 Placard holders

5.6.1 One or more placard holders to accept destination placards of standard size A5 [210 mm × 148 mm (8 1/4 in × 5 7/8 in)] shall be provided adjacent to the door(s). The upper edge of the holder shall not be more than 1 020 mm (40 in) from the bottom of the base.

5.6.2 It is suggested that the placard holder should have the alternative capability of being used as a board for chalk or grease pencil markings.

5.7 Design options

The following may be added as design options required by a purchaser:

a) knock-down capability (knock-down and reassembly shall be carried out after Clause 7 tests);

b) components and sub-assemblies interchangeability;

c) internal shelf capability (see ISO 6517, 4.4.4);

d) fork-lifting capability (see 5.1.6 for applicable requirements);

e) fork-lifting and stacking capability (see 5.1.7);

f) customs and security sealing (see Clause 9).

6 Flight conditions performance and testing

6.1 Pressure equalization and rapid decompression

6.1.1 For a normal flight condition, a minimum venting area of 5 cm^2/m^{-3} (0,02 in^2/ft^3) of container internal volume shall be provided in accordance with ISO 11242, if the door seals venting area is not sufficient.

6.1.2 For rapid decompression in the event of an aircraft emergency, the container shall, in accordance with ISO 11242, provide a minimum decompression venting area of 100 cm^2/m^3 (0,45 in^2/ft^3) of container internal volume to become open in a duration of less than 0,2 s when submitted to a maximum pressure differential from inside of 14 kPa (2,0 lb/in^2) if the door seals area is not sufficient to fulfil this venting requirement

If the specific design requires a “blowout” device to achieve the required venting area, the “blowout” device shall remain attached to the container after activation.

6.1.3 These venting areas shall be adequately protected from cargo load shift to ensure that the minimum area is maintained during all normal flight conditions and during emergency operations. Refer to ISO 11242 for the pressure equalization requirements.

6.2 Flight loads

6.2.1 In order to demonstrate, as required by the aircraft Weight and Balance Manuals, that neither the container nor its contents can become a hazard or damage the aircraft structure under flight conditions, the container shall be submitted to tests under the maximum loads to be encountered in flight, per Table 2.

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