
**Air cargo — Certified lower deck
containers — Design and testing**

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

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Container sizes and identification	3
4 Requirements	3
4.1 General	3
4.2 Airworthiness approval	4
4.3 Materials	4
4.4 Construction	4
4.5 Performance	7
4.6 Design loads	8
4.7 Environment	8
5 Testing	9
5.1 Ultimate load tests	9
5.2 Operation tests	9
6 Markings	11
7 Customs/security sealing	12
8 Manufacturer's instructions	13
9 Quality control	13
9.1 Design and production	13
9.2 Operations	14
Bibliography	21

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.

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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.

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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 F²⁾

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 F³⁾

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 F⁵⁾

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](http://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 letters⁷⁾:

- 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·m²/m (3 800 lbf·in²/in) width/length of core. It shall have a minimum area load capacity of 10 kPa (209 lb/ft²). 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

build-up and break-down. In the interest of ergonomic conditions improvement, it is recommended to also consider such an opening for other contours covered by this International Standard.

4.4.3.2 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 lbf) 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.

4.4.3.3 Door latch and restraint hardware design shall preclude damage to the shell or door during stowage and installation/removal of the door.

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

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

4.4.3.4 The door shall be stowable on top of the container. 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).

4.4.3.5 It shall be possible to lock (to discourage entry) and to seal the door so as to give visual indications of unauthorized entry. See [Clause 7](#) hereafter.

4.4.4 Shelves (optional)

Shelves may be fitted into non-rectangular containers that have extended contours with an overhang. In such units, the shelves are usually located at the junction of the outboard side panel and the sloping panel. In some instances, the shelf is hinged at the outboard edge so that it can be lowered to lie on the sloping panel.

Alternatively, full-width shelves may be fitted at half the unit height.

4.4.5 Cargo restraint

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

- near the base (not required if equivalent provisions are available at the base); and
- at half height, except for size K units, which shall have securing points at or near the base only.

Each of these points shall be capable of withstanding an omni-directional load of 2 225 daN (5 000 lbf) near or at the base, and 890 daN (2 000 lbf) at half height for L size units only.

These points shall comply with ISO 7166.

4.4.6 Pressure equalization

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

4.4.6.1 Normal flight conditions

For normal flight conditions, a minimum venting area of 5 cm² per m³ (0,02 in² per cu ft) of container internal volume shall be provided in accordance with ISO 11242, if the door seal venting area does not allow for sufficient air circulation between the interior and the exterior of the container. This venting area shall be adequately protected from cargo load shift to ensure that the minimum area is maintained during all normal flight conditions.

4.4.6.2 Rapid decompression

For rapid decompression in the event of an aircraft emergency, the container shall, in accordance with ISO 11242, provide a minimum venting area of 100 cm² per m³ (0,45 in² per cu ft) 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/in²), if the door seal venting area does not allow for sufficient air circulation between the interior and the exterior of the container to fulfil this venting requirement.

This opening area shall be adequately protected from cargo load shift to ensure its proper functioning in the event of an emergency. If the specific design requires a “blowout” device to achieve the required vent area, the “blowout” device must remain attached to the container after activation.

4.5 Performance

4.5.1 Base indentation

4.5.1.1 Local indentation of the container base panel

The maximum indentation (permanent set) at any location of the base panel when subjected to a 890 daN (2000 lbf) force by a steel roller 51 mm (2 in) long of 25,4 mm (1 in) diameter (see Figure 8) shall not exceed 0,25 mm (0,01 in), and when subjected to a 400 daN (900 lbf) force by a steel ball of 25,4 mm (1 in) diameter shall not exceed 0,5 mm (0,02 in). See Figure 1.

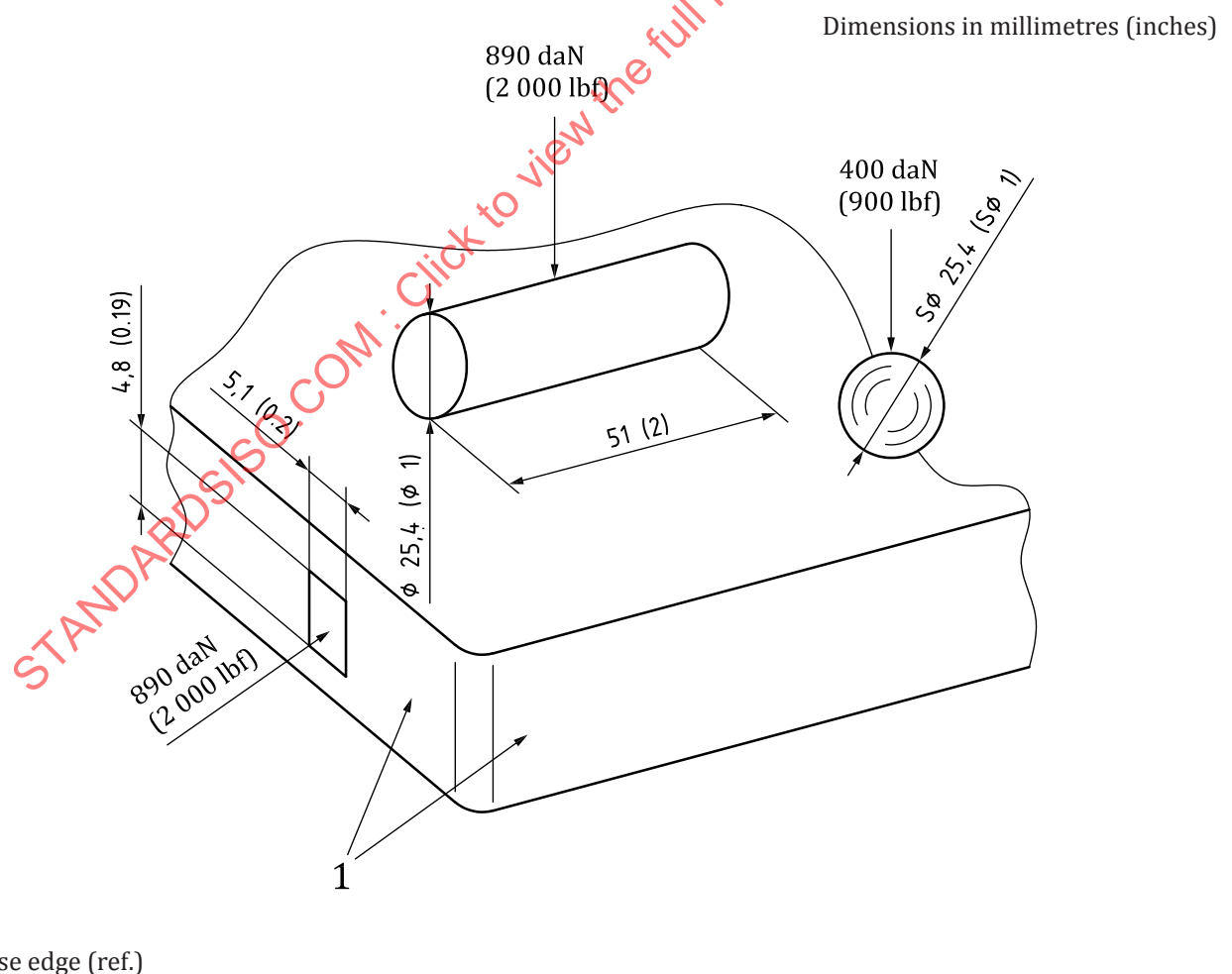


Figure 1 — Local indentation loading

4.5.1.2 Indentation along the periphery of the base edge

The maximum indentation at any location along the periphery of the base edge shall not exceed 0,13 mm (0,005 in) when subjected to a 890 daN (2 000 lbf) force applied parallel to the base over an area 5 mm (0,2 in) long by 5 mm (0,2 in) wide. See [Figure 1](#).

4.5.2 Traversing between levels

The container assembly loaded to its maximum gross mass shall be capable of traversing from one item of conveyor equipment to another when there is a height difference of 150 mm (6 in) between the two levels, with no detrimental permanent deformation (see [5.2.3](#)).

4.6 Design loads

4.6.1 The container shall satisfy the design and performance (ultimate load testing) criteria specified in ISO 21100, appropriate to the base size and configuration of the container, for type 2 units.

4.6.2 The container shall be designed and used to unitize and restrain its contents at maximum operational gross mass specified in [Table 1](#).

NOTE The maximum allowable gross mass of a container on any given aircraft position is the lowest of the values obtained dividing the certification ultimate loads (as per ISO 21100 or, for units approved prior to 2012, ISO 8097) by the flight load factors in the relevant direction of restraint (as stated by the aircraft type's approved Weight and Balance Manual). The result may vary according to aircraft type and position.

Because this value is aircraft type dependent, airlines through IATA have agreed, principally for interlining purposes, to define for each ULD size a maximum operational gross mass independent from the aircraft type, which is often higher or sometimes lower than the maximum allowable one on a specific aircraft type.

Table 1 — Maximum operational gross mass

Unit Type	Base dimensions		Maximum operational gross mass	
	mm × mm	in × in	kg	lb
AKC	1 534 × 1 562	60,4 × 61,5	1 588	3 500
AKE	1 534 × 1 562	60,4 × 61,5	1 588	3 500
AKG	1 534 × 1 562	60,4 × 61,5	1 588 ^a	3 500 ^a
AKH	1 534 × 1 562	60,4 × 61,5	1 588 ^a	3 500 ^a
ALF	1 534 × 3 175	60,4 × 125	3 175	7 000
ALP	1 534 × 3 175	60,4 × 125	3 175	7 000
ALU	1 534 × 3 175	60,4 × 125	3 175	7 000

^a In reference to ISO 21100, containers can be certified to 1 588 kg (3 500 lb) maximum allowable (1,5 g load factor in all directions). Containers certified before 2012 in reference to ISO 8097 were only tested and approved under 1,08 g side load factor, therefore limited on most aircraft types to an operational gross mass of 1 134 kg (2 500 lb).

4.7 Environment

4.7.1 The container shall be designed and built using materials which will provide maximum serviceability and protection of contents under the intended environmental conditions, as follows.

4.7.2 The structural and operational integrity of the container shall be maintained at temperatures from –40 °C to 60 °C (–40 °F to 140 °F), 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.

4.7.3 All components of the container shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion or other causes where the type of material used requires such protection.

4.7.4 Where non-metallic components are used for the container's structure or components, they shall be assessed for potential strength deterioration due to weathering or other environmental factors, including U.V. and chemicals (e.g. kerosene, solvents, lubricants, aircraft hydraulic fluid, glycol-based de-icing or anti-icing fluid), temperature variations, humidity or fungus exposure, likely to be encountered in the course of worldwide air cargo operations, taking into account the information of ISO/TR 8647. The manufacturer shall inform the purchaser about expected performance degradation and any identified chemical incompatibility.

NOTE For textile materials, the information provided in ISO/TR 8647 can also be found in SAE AIR 1490[9].

4.7.5 Where materials deterioration testing is performed, the requirements of the EUROCAE ED-14G standard shall be taken into account, and materials be accordingly subject to an environment qualification form identifying the performed tests.

NOTE RTCA DO-160G[16] is equivalent to EUROCAE ED-14G and may alternately be used.

4.7.6 Particular design attention shall be given to preventing the entry of water through door-to-container assembly interface areas, and at panel joints (see 5.2.6).

4.7.7 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. In addition, 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 8.1).

5 Testing

5.1 Ultimate load tests

5.1.1 Airworthiness approval tests shall be conducted using the maximum ultimate loads and centre of gravity deviations shown in ISO 21100 for the container configuration (UC), with the container being restrained in accordance with the indicated testing restraint condition(s) (RC). Analysis or numeric simulation, if used, shall use the same assumptions.

5.1.2 The method(s) used for testing any container configuration shall ensure conformity with the testing conditions and ultimate load parameters specified for that configuration in ISO 21100. Analysis or numeric simulation, if used, shall provide an equivalent assurance of conformity. A test and/or analysis report shall be established to record the details of the method(s) used and shall substantiate the results obtained.

5.1.3 Under ultimate load, the tested container or parts thereof may exhibit damage or permanent deformation, but shall not rupture to the extent of discharging its contents. Analysis or numeric simulation, if used, shall be based on yield stress values for the materials concerned and shall confirm that the analysed container would not deform or rupture to the extent its contents would be discharged under the test conditions.

5.2 Operation tests

The tests specified in 5.2.1 to 5.2.6 hereafter shall be conducted to demonstrate the ability of the container to withstand without excessive deflection or detrimental permanent deformation the maximum operational loads that may be experienced during handling and transportation. They do not substitute the in-flight ultimate load performance tests required for container airworthiness approval (certification) in accordance with ISO 21100, as per 5.1 above.

Tests and/or analysis or numeric simulation shall be conducted as necessary to show compliance with this International Standard.

5.2.1 Test No. 1: Horizontal load test

5.2.1.1 Procedure

Secure the container under test to the aircraft restraint system or a system equivalent to the applicable testing restraint configuration in ISO 21100.

Apply horizontally to one side of the container a test load equal to the maximum gross weight, less tare. Simultaneously apply an equal test load downwards to the top surface of the base.

Repeat the test with the test load applied to the side adjacent to the side previously tested. Should their structure not be identical, test the opposite sides in the same manner.

5.2.1.2 Requirements

The deflection of the intersection of the top and side panel in relation to the base shall not exceed 38 mm (1,5 in) out of the maximum allowable contour, and the door(s) shall not be released.

Upon completion of the test, the container shall show neither detrimental permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

5.2.2 Test No. 2: Upward load test

5.2.2.1 Procedure

Secure the container under test to the aircraft restraint system or a system equivalent to the applicable testing restraint configuration in ISO 21100. Apply upwards to the container a test load equal to its maximum operational gross weight, less tare.

5.2.2.2 Requirements

Upon completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

5.2.3 Test No. 3: Bridging and cresting

5.2.3.1 Procedure

Traverse the container, loaded to its maximum gross mass with a central centre of gravity position, on a roller system compatible with the minimum requirements of ISO 4116, and make it pass across a stepped junction with another similar roller system, with the height difference at the junction not less than 150 mm (6 in).

At the balance (cresting) point on the edge of the higher platform, hold the container in this position for a minimum of 5 s. Then allow the rear end of the container to drop from the higher platform onto the lower roller platform. Carry out the test 20 times.

5.2.3.2 Requirements

Upon completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied. The doors shall open and close with no prevalent binding, and the locks shall engage and disengage with ease.

5.2.4 Test No. 4: Cyclic test

5.2.4.1 Procedure

Uniformly load the container to its maximum gross mass with the centre of gravity at not less than half the unit height and make it traverse 100 times over a bed of 25,4 mm (1 in) diameter steel balls spaced on a 180 mm (7 in) matrix in accordance with ISO 4116. The forward and aft base edges shall impact against fixed steel stops 64 mm (2,5 in) wide at a velocity of 0,3 m/s (1 ft/s).

For size K units, the stops shall be spaced at 527 mm (20,75 in) with the first stop 603 mm (23,75 in) from the inboard face of the base edge.

For size L units, the stops shall be located symmetrically at 1 257 mm (49,5 in) and 2 311 mm (91 in) apart either side of the unit centreline of the 3 175 mm (125 in) edge.

The distance traversed during each cycle shall be at least 3 100 mm (122 in).

5.2.4.2 Requirements

Upon completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied. The doors shall open and close with no prevalent binding, and the locks shall engage and disengage with ease.

5.2.5 Test No. 5: Racking test

5.2.5.1 Procedure

Load the container to its maximum gross mass. Restrain it against sideways movement at the base of the inboard edge. Apply a horizontal force along the top edge of the outboard panel, sufficient to raise the outboard edge of the base from the floor or conveyor plane.

5.2.5.2 Requirements

Upon completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

5.2.6 Test No. 6: Water tightness test

5.2.6.1 Procedure

Apply a stream of water to all joints and seams of the container from a nozzle of 12,7 mm (0,5 in) inside diameter at a pressure of about 1 bar ⁸⁾ [corresponding to a head of about 10 m (33 ft) of water] on the upstream side of the nozzle. Hold the nozzle at a distance of 1,5 m (5 ft) from the corner under test, and move the stream at a speed of 100 mm/s (4 in/s).

Procedures involving the use of several nozzles are acceptable providing that each joint or seam is subjected to a water loading no less than that which would be given by a single nozzle.

6 Markings

6.1 All containers complying with this International Standard shall be marked as shown below, in such a manner that good readability is ensured during all phases of handling. The lettering of MGW and tare weight shall be not less than 25 mm (1 in) high.

8) 1 bar = 100 kPa

MGW:	kg	lb
Tare weight:	kg	lb
Internal volume:	m ³	ft ³

The tare weight shall be the nominal (production average) weight of the container to the nearest kilogram and even number of pounds, and the internal volume shall be shown to the nearest 1/10 m³ and cubic foot.

6.2 The following additional manufacturer's markings shall be indicated on the container's data plate. The positioning of such markings is optional but shall be in an area clearly visible after the article is loaded with cargo or other contents, and the letter size shall not be less than 6 mm (0,25 in) high.

Manufacturer:
.....
(Name, address and country)
Part number:
.....
Serial number:
.....
Burn rate:
.....
Certification:
.....

The burning rate shown, in mm (in) per minute, shall be the one determined for the container's primary material under 4.3.2 above. The certification data shall include the TSO number and ISO 21100 classification identifier, or (where applicable) alternate basis of certification (e.g. STC) with any applicable limitations.

6.3 For handling purposes, the container's identification code (see 3.2) shall be prominently marked at the top centre of at least two opposite sides, preferably three, of the container, in contrasting colour characters at least 100 mm (4 in) high, in such a manner that good readability is ensured during all phases of handling.

NOTE See IATA Standard Specification 40/0[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, website www.iata.org.

7 Customs/security sealing

The container shall be designed, constructed and equipped in such a manner that:

- a) customs/security seals can be applied to all container doors;
- b) no goods can be removed from, or introduced into, the sealed container without leaving obvious traces of tampering or breaking the customs or security seal;
- c) customs and security seals can be simply and effectively affixed;
- d) the container contains no concealed space where goods may be hidden; and

- e) all spaces capable of holding goods are readily accessible for customs or security inspection.

8 Manufacturer's instructions

8.1 The manufacturer shall deliver to the purchaser together with the first batch of containers a set of written instructions including at least:

- a) certificate of compliance with the requirements of the present International Standard;
- b) Authority approval (TSO Authorization, Letter of Design Approval (LODA), or equivalent);
- c) appropriate instructions to the operators (see [8.2](#));
- d) recycling instructions (see [4.7.7](#)).

The tests record file shall be provided to the approval Authority, and should be made available to the purchaser on request.

Document (a) shall be renewed at each subsequent delivery.

8.2 Instructions to the operators under [8.1](#) c) should include at least:

- a) intended conditions of use, and any exclusions there from if applicable,
- b) environmental assessment, health and safety precautions, known chemical incompatibilities,
- c) appropriate aircraft installation instructions,
- d) operational use recommendations referring to recognized applicable industry standards,
- e) continuing airworthiness inspection requirements and Authority approved serviceability limits (maximum allowable damage),
- f) Authority approved repair instructions with parts and materials procurement information (Component Maintenance Manual and Illustrated Parts List).

9 Quality control

9.1 Design and production

9.1.1 The manufacturer shall ensure design, testing, production and first article inspection of the container are performed within the framework of a quality control program meeting the requirements for airworthiness approval by Civil Aviation Authorities (see CCAR / EASA / 14 CFR Part 21).

9.1.2 Industry experience further demonstrates the essential character of continuous quality control in obtaining safe and dependable products beyond certification and production approval process requirements defined by CCAR / EASA / 14 CFR Part 21. The operational performance requirements of the present International Standard are not covered by the airworthiness quality control process.

9.1.3 Quality control programs meeting the detailed requirements, as appropriate for aircraft containers, of national standards AS 9100 and AS 9102, EN 9100 and EN 9102, or JIS Q9100 and SJAC 9102 (see Bibliography) may be considered an acceptable means of complying with the requirements for airworthiness approval, and are recommended for the broader purpose of comprehensive quality control of all aspects, airworthiness and operational performance, of the design, testing, production and inspection of the containers covered by the present International Standard.

9.2 Operations

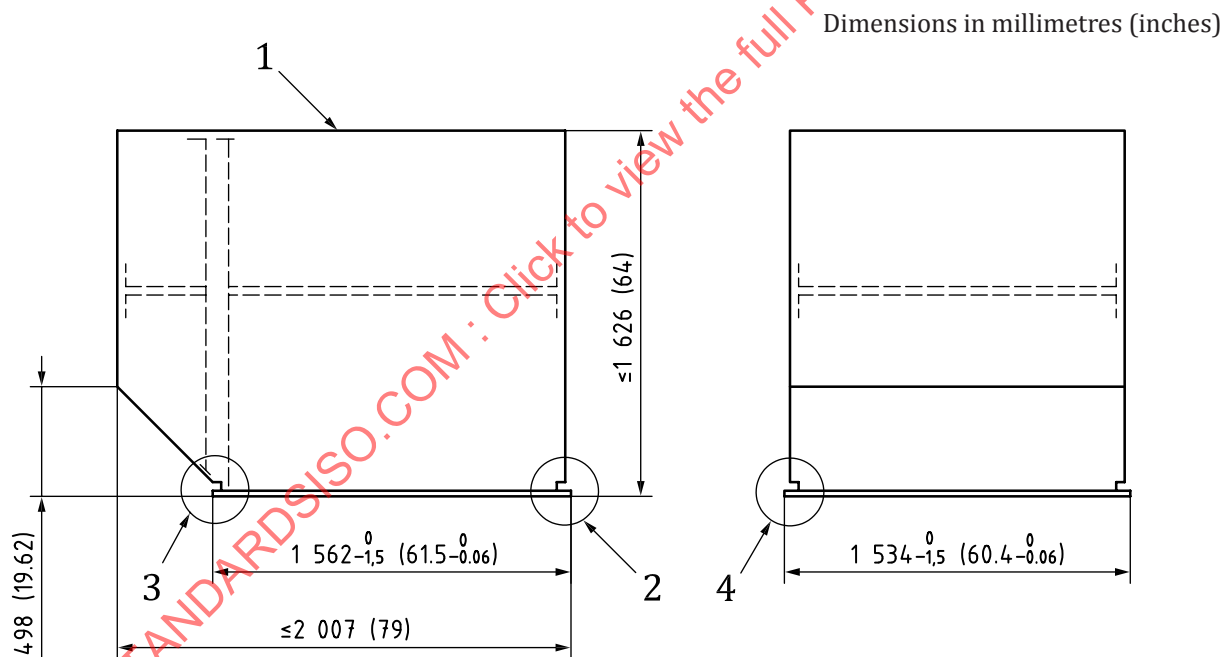
9.2.1 As regards containers operations, installation and in-service inspection processes shall be monitored and their quality and effectiveness be regularly assessed by an independent organization in the framework of the air carrier's internal evaluation and quality control program (see CCAR-121, 14 CFR Part 121 and AC 120-59, EU-OPS 1.035 and its AMC and IEM).

9.2.2 Accordingly, each container build-up site, including when it is located at a sub-contractor's premises, should be subject to inspection, investigation or audit from the air carrier's quality control department.

9.2.3 It is also recommended airport handling agencies facilities performing installation of containers on board an air carrier's aircraft maintain their own continuous quality control program meeting the requirements of ISO 9001 (see [4] in Bibliography), or an equivalent pertinent industry standard.

9.2.4 In addition, it is recommended any significant incident, in flight or on the ground at aircraft loading or offloading, resulting from or related to improper performance, installation or inspection of (a) container(s) be reported and subject to carrier's quality control department investigation, in order to be analysed and corrective action to be taken to avoid its reoccurrence.

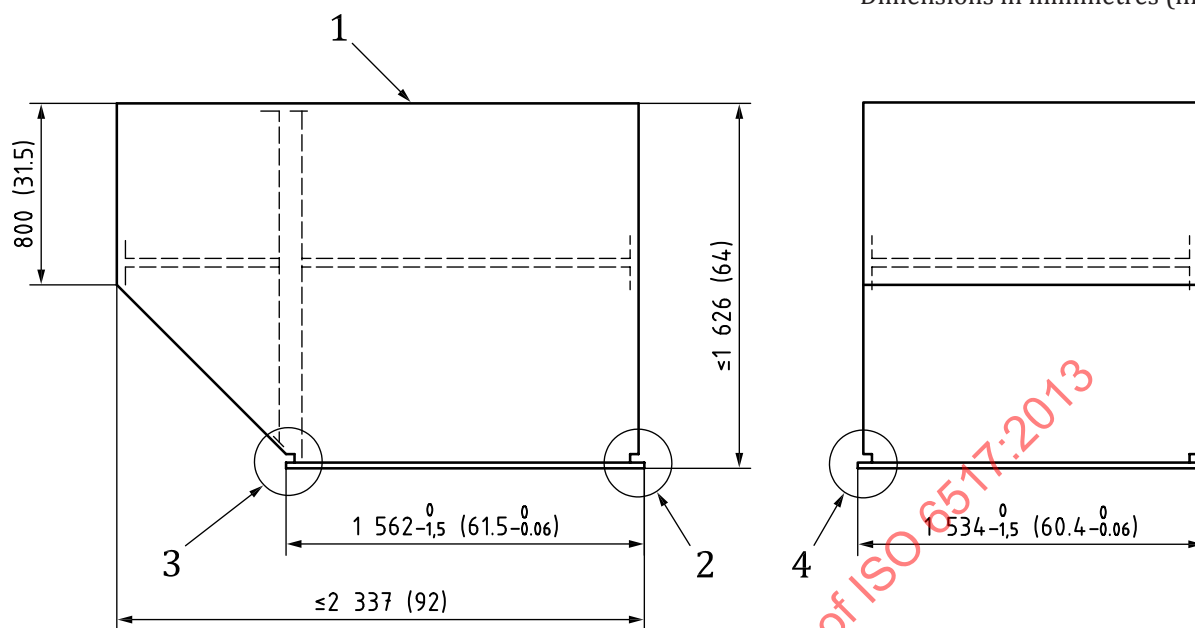
9.2.5 Any occurrence of damage to an aircraft due to an improperly designed, maintained or operated container shall be immediately reported to the air carrier's quality control department to be investigated as a flight safety occurrence. The container involved shall be kept aside for the investigation, and shall not be returned to service prior to being inspected by qualified personnel and found within serviceability limits.



Fork-liftable units shall be identified as AKN.

Figure 2 — AKE container

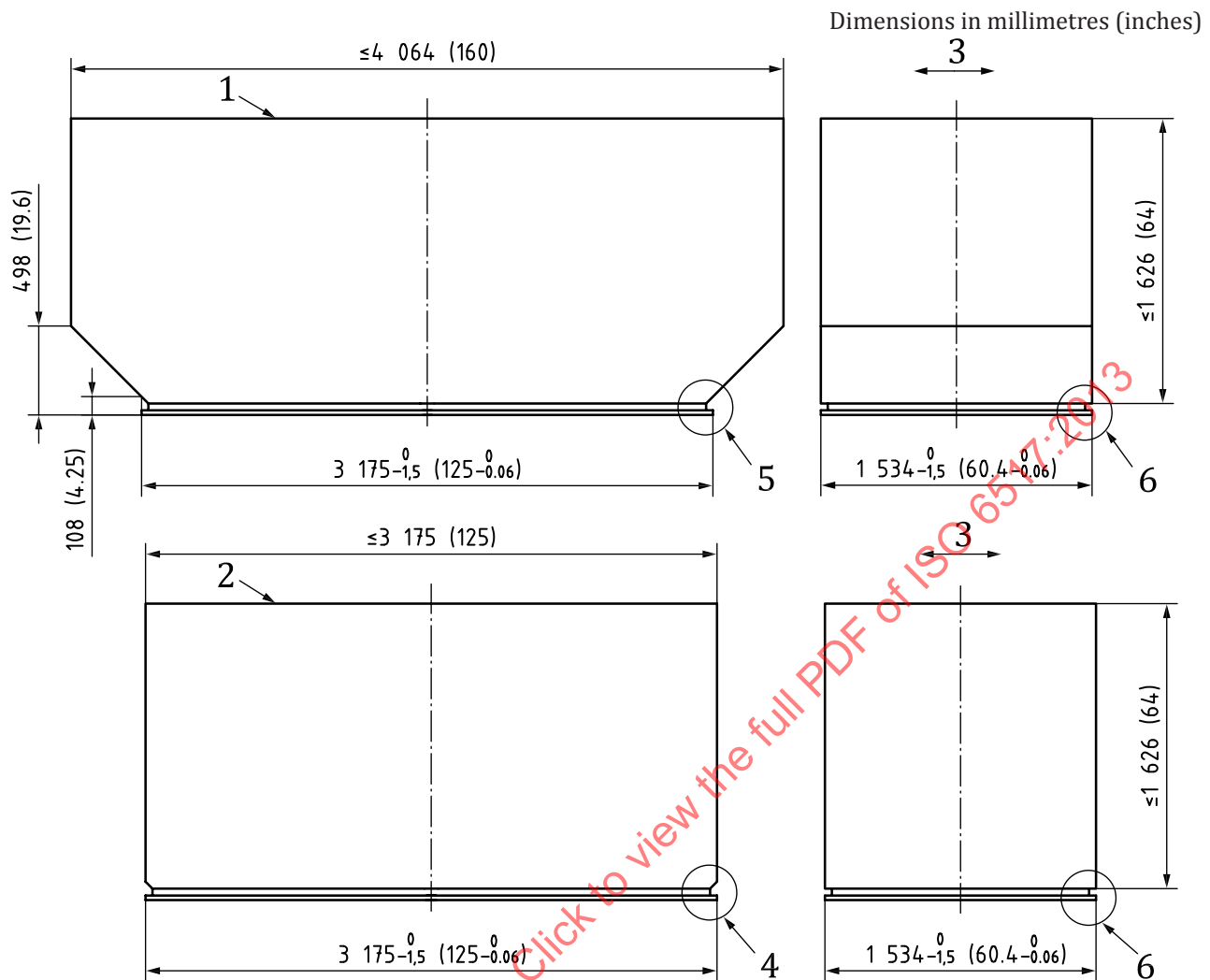
Dimensions in millimetres (inches)

**Key**

- 1 contour C
- 2 see detail A in [Figure 7](#)
- 3 see detail B in [Figure 7](#)
- 4 see detail C in [Figure 7](#)

NOTE Tolerances on base dimensions are for reference only.

Figure 3 — AKC container



Key

- 1 contour F
- 2 contour P
- 3 forward/aft direction
- 4 see detail A in [Figure 8](#)
- 5 see detail B in [Figure 8](#)
- 6 see detail C in [Figure 8](#)

All 3 175 mm \times 1 534 mm (125 in \times 60,4 in) bases shall have a corner radius of 50,8 mm (2 in) in the plan view.

NOTE Tolerances on base dimensions are for reference only.

Figure 4 — ALF (top) and ALP (bottom) containers