AEROSPACE STANDARD

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Superseding AS1825B

Methodology of Calculating Aircraft Cargo Volumes

RATIONALE

The SAE AGE-2A committee determined that the technology/practice defined in this standard has reached a level of maturity such that it is unlikely to change in the foreseeable future; therefore, it does not require regular 5-year reviews by the committee and it is appropriate for it to be stabilized.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE AGE-2A Cargo Handling Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

The scope of this SAE Aerospace Standard (AS) shall cover the methodology of defining and determining the "internal volumes" of both the main deck and lower deck aircraft cargo compartments. The minimum required clearance between the compartment envelope and the unit load devices (ULDs) shall also be stated in order to provide the maximum ULD external contour and the methodology to define the ULD internal volumes.

1.1 Purpose:

The purpose of this document is to establish a uniform methodology for defining and determining the usable internal volume of aircraft cargo compartments and usable external envelope for ULDs which can be accommodated within these compartments. This will provide the aircraft industry with a set of standard terminology which when specified, can be utilized by the airlines when comparing similar type aircraft.

The minimum essential criteria are defined by the key word "shall." Recommended criteria are identified by the key word "should" and while not mandatory, are considered to be of primary importance.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AIR4899
AS36100

2.2 NAS Standards:

Available from Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.

NAS 3610 Cargo Unit Load Devices - Specification for

2.3 IATA Publications:

Available from International Air Transport Association, IATA Building, 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.

IATA ULD Technical Manual Specification 50/0

3. COMPARTMENT INTERNAL VOLUMES:

3.1 Main Deck Compartment:

The main deck compartment internal volume may be calculated and listed as maximum usable volume, provided that bulk cargo is "compartment restrained," i.e., the floor, ceiling, sidewalls, bulkheads, nets, and supporting structure are capable of withstanding the bulk cargo restraint loads associated with all flight and ground load conditions with applicable load factors, included 9 g forward emergency landing condition. If bulk cargo is not "compartment restrained," then Type I and II ULDs per NAS 3610 may be utilized and the internal volume value shall be followed by an asterisk (*) denoting that the usable volume shall be derived from cumulative ULD volumes as defined per Section 4. The following criteria shall apply to define the main deck compartment envelope limits.

3.1.1 Length: The usable compartment length shall be that length of the main deck floor which is designed to support bulk cargo stacked over the entire floor area. If a forward barrier net is required, then only that portion of the usable floor length aft of the barrier net station shall be utilized. See Figure 1.

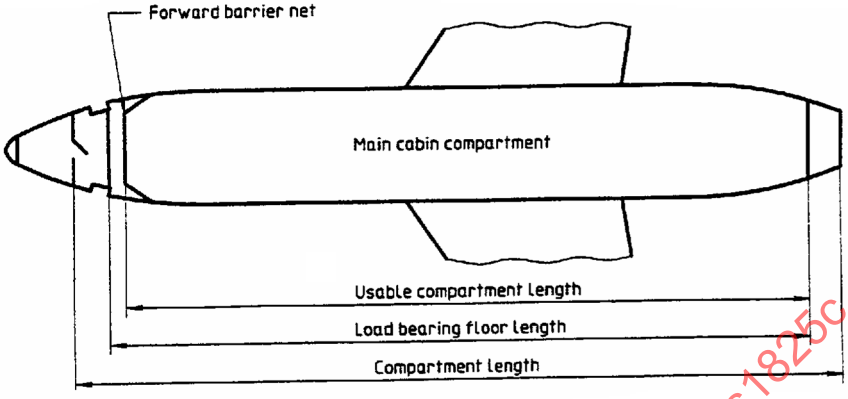


FIGURE 1 - Main Deck Compartment Usable Length

3.1.2 Height: The usable compartment height shall be the minimum height between floor or the top of the conveyor rollers and ceiling structure or lining under which cargo must pass during loading/ unloading procedures. This will take into account midcabin drop ceilings. Local protrusions at either end of the compartment under which cargo may be stowed but not passed beyond shall be accounted for in calculating the internal volume but shall not govern the compartment height. In no case shall the compartment height exceed the main deck loading doorway height. See Figure 2.

NOTE: This may be also visualized per 4.2; refer to last sentence.

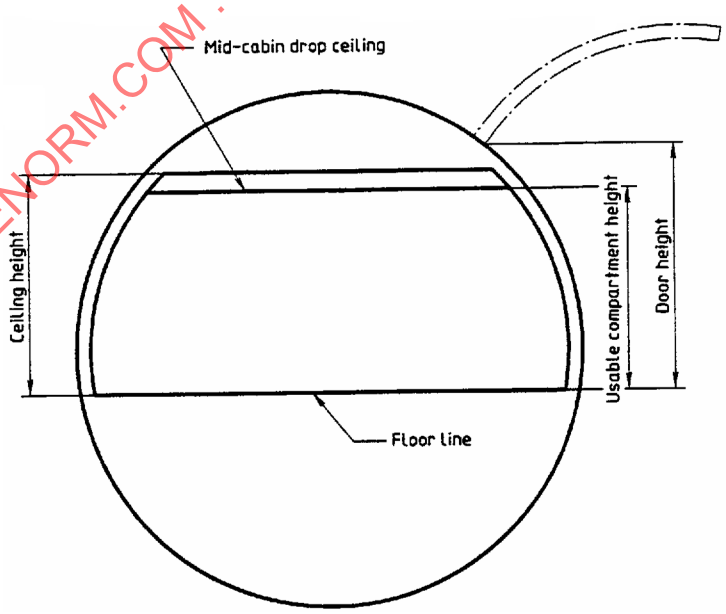


FIGURE 2 - Main Deck Compartment Usable Height

3.1.3 Width: The usable compartment width shall be the actual cross-sectional width of the compartment, provided that the sidewall liner is capable of withstanding the bulk cargo restraint loads. If the sidewall liner is not capable of withstanding this load, then only the width inboard of a lateral restraint device shall be utilized. See Figure 3.

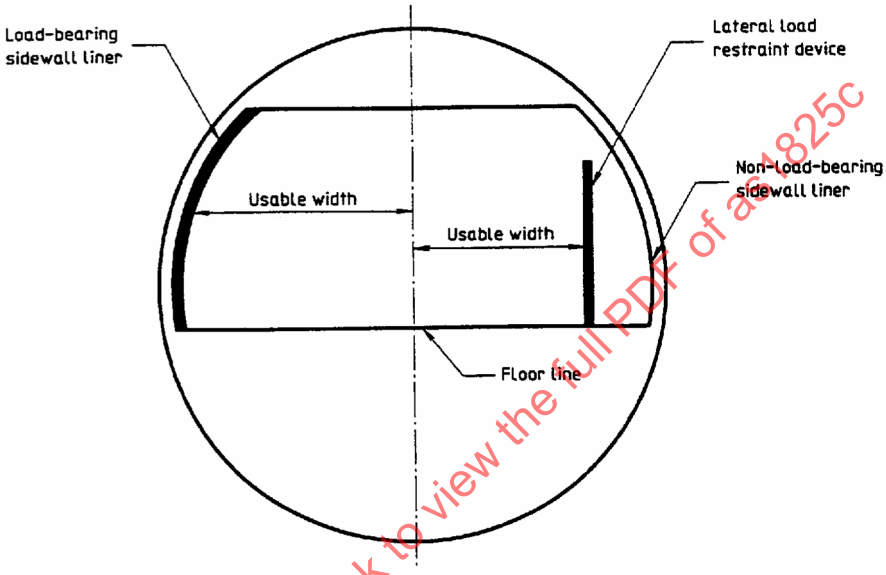


FIGURE 3 - Main Deck Compartment Usable Width

3.2 Lower Deck Compartments:

The lower deck compartment internal volumes shall be calculated and listed as maximum usable volumes, provided that bulk cargo is "compartment restrained," i.e., the floor, ceiling, sidewalls, bulkheads, nets, and supporting structure are capable of withstanding the bulk cargo restraint loads associated with all flight and ground load conditions with applicable load factors. If bulk cargo is not "compartment restrained," then Type I and II ULDs per NAS 3610 may be utilized and the internal volume value shall be followed by an asterisk (*) denoting that the usable volume shall be derived from cumulative ULD volumes as defined per Section 4. The following criteria shall apply to define the lower deck compartment envelope limits.

3.2.1 Length: The usable compartment length shall be that length of the lower deck floor which is designed to support bulk cargo stacked over the entire floor area. This requires that the end bulkheads be designed to withstand bulk cargo restraint loads. See Figure 4.

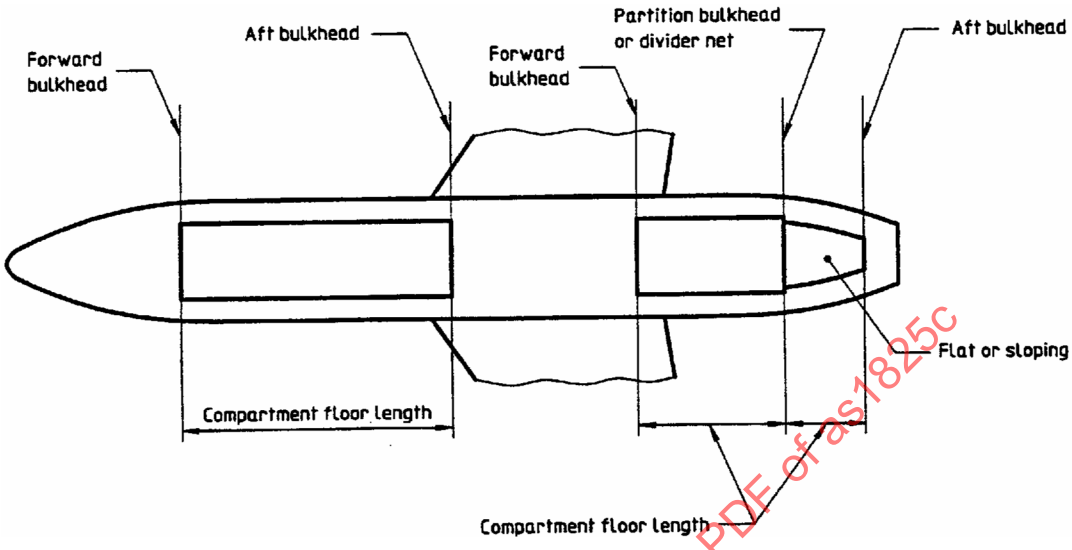


FIGURE 4 - Lower Deck Compartment Usable Length

3.2.2 Height: The usable compartment height shall be the actual height between floor and ceiling surfaces, provided that both are capable of withstanding bulk cargo restraint loads. The height that a cargo loading system protrudes above the floor surface need not be discounted, provided that the system is easily removed, retracted, or inverted when bulk cargo is being transported. The cargo doorway height, if less than the internal compartment height, must be considered when establishing the usable height to define the maximum ULD envelope, but it need not be the controlling factor to establish the usable compartment height to define the internal bulk cargo compartment volume. See Figure 5.

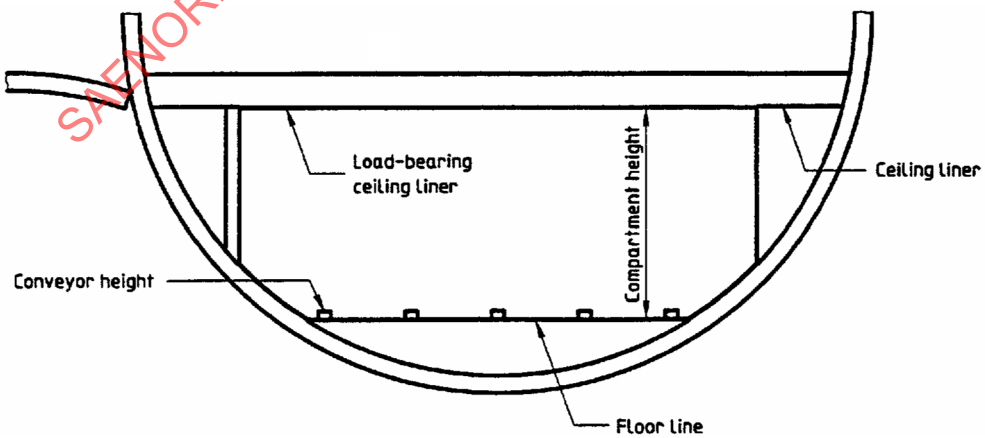


FIGURE 5 - Lower Deck Compartment Usable Height

3.2.3 Width: The usable compartment width shall be the actual cross-sectional width, provided that the sidewall liners (vertical and sloping) are capable of withstanding bulk cargo restraint loads. See Figure 6.

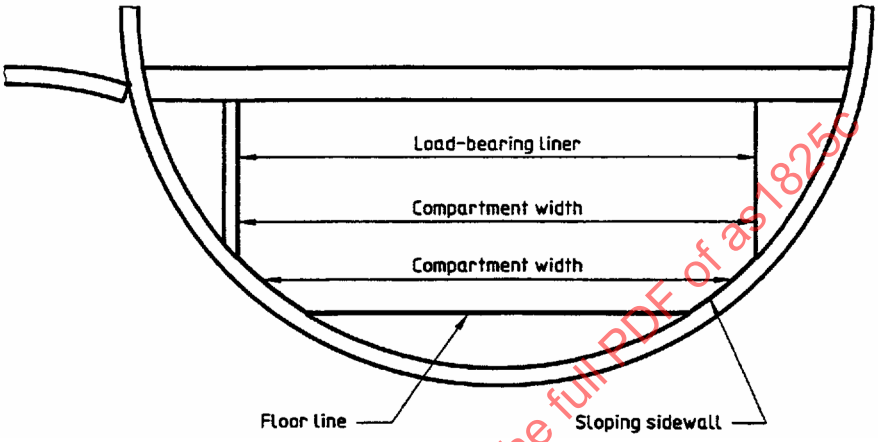


FIGURE 6 - Lower Deck Compartment Usable Width

3.2.4 Doorway Protection: The volume lost due to installation of doorway barriers shall be accounted for in determining the internal volume by assuming planes between floor, ceiling, and sidewall which encompasses all of the barrier tiedown/attach points.

4. ULD ENVELOPES:

The ULDs which can be accommodated within the cargo compartment to assist in transporting cargo can be separated into the following types:

Type I is a ULD which when restrained by a Class I restraint system per NAS 3610, the ULD and its contents are restrained for all flight and ground loads factors including the 9 g forward emergency landing condition. This type of a ULD is referred to as a certified ULD but may be utilized as a noncertified ULD.

Type II is a ULD designed for usage in a Class II restraint system per NAS 3610 and may restrain and contain its internal contents for nominal flight and ground loads factors but not necessarily the 9 g forward emergency landing condition. This type of a ULD is also referred to as a certified ULD but may be utilized as a noncertified ULD.

Cargo may be carried in ULDs which are not restrained by an aircraft restraint system (i.e., without consideration of NAS 3610 Class I or II), but rather by the cargo compartment enclosure. These ULDs are referred to as noncertified. They may, however, be base plate restrained in addition if so required.

4. (Continued):

The allowable clearance between aircraft interior and various types of ULDs are shown in Figure 7 and shall be based upon the minimum cross-section of the aircraft through which or in which the ULD will traverse or be stowed.

4.1 Container Envelope:

Containers are rigid ULDs, including both structural and nonstructural igloo assemblies with controlled contour shapes. The structural container and nonstructural container/igloo shall allow 50.8 mm (2 in) of clearance to the minimum aircraft envelope, except for the vertical clearance to the ceiling to be minimum 25.4 mm (1 in). See Figure 7.

4.1.1 Container Volumes: The internal volume of containers shall be listed as usable volumes and shall be calculated by taking 93.5% of the external envelope volume. This will account for the floor, ceiling, sidewalls, internal stiffeners, longerons, and supports. The 93.5% is not applicable to forkliftable containers.

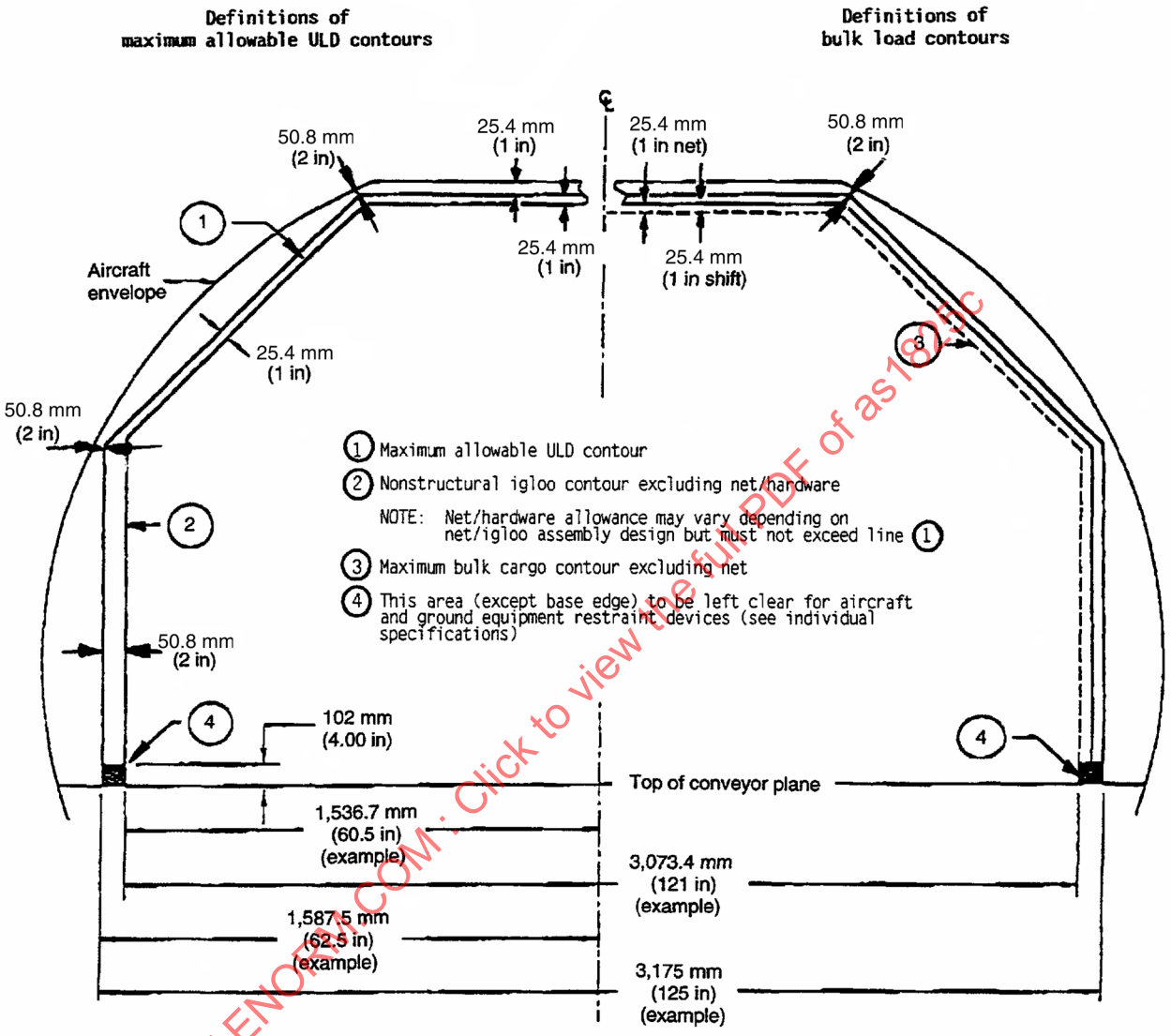
4.2 Pallets Load Envelope:

A cargo pallet is a flat ULD, having no side or end walls, on which cargo is stacked and utilizes over-throw nets to secure the stacked cargo load. The palletized cargo contour shall allow 50.8 mm (2 in) of clearance to the minimum aircraft envelope, except in areas where it is necessary to allow a greater clearance to protect critical aircraft components in order to account for irregular shaped loads and load shifting which may occur. The 50.8 mm (2 in) of clearance to the minimum aircraft envelope does not apply to the net/hardware, but in no case shall the net/hardware be within 50.8 mm (2 in) of the aircraft envelope, except for the vertical clearance to the ceiling under consideration of shift to be minimum 25.4 mm (1 in). The palletized cargo shall also have a 50.8 mm (2 in) setback from the outer edge of the pallet on all sides to permit attachment of net hardware to the pallet. See Figure 7.

A 152 mm (6 in) horizontal clearance shall be provided for cargo in line with any aircraft structure, unless that structure is designed to withstand bulk cargo restraint loads. See Figure 8.

NOTE: Dimensions have been rounded to the nearest millimeter; clearances are minimum except stated otherwise.

4.2.1 Palletized Volume: The volume of a palletized ULD shall be calculated and listed as usable volume, utilizing the following guidelines. Pallet thickness shall be assumed as 19 mm (0.75 in) for commercial pallets and 57 mm (2.25 in) for military pallets, unless otherwise specified. The palletized cargo shall have a 50.8 mm (2 in) setback from the outer edges of the pallet. The height shall be controlled by the 50.8 mm (2 in) clearance dimension, to the minimum aircraft envelope through which the palletized ULD must pass during the loading/unloading cycle. See Figure 7. A 152 mm (6 in) longitudinal clearance shall be provided for any change in contour shape due to overhead or sidewall protrusions in line with the ULD stowed position. See Figure 8.



The aircraft envelope is the minimum contour available for the ULD to pass.

Note (1): This contour/envelope definition has been agreed to be in line with this one of the IATA Standard Specification 50/0 in the IATA ULD Technical Manual 8th Edition, effective October 1, 1992: which is for IATA a contractual requirement for interchanging purposes.

Note (2): The maximum allowable ULD contour applies to structural aircraft containers, inclusive any protrusions. Existing containers are built with a recess inside of this contour; for reference volume calculation purposes, this should not be taken into account, except where required per individual specification (e.g., LD3 container forward and aft sides, 12.7 mm (0.50 in) recess required, see 4.1.1).

Note (4): This dimension (previously 152 mm (6 in)) has been agreed to be in line with the above IATA Standard Specification; Individual Specifications require i.e., for the LD3 54 mm (2.12 in), the containers with IATA Contour AAU/AAF/AMU/AMF 108 mm (4.25 in) as dimension for this area to be left clear.

FIGURE 7 - Maximum Allowable Unit Load Device Contour