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SAE The Engineering Resource For Advancing Mobility

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AEROSPACE STANDARD

AS 1825

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Revised

METHODOLOGY OF CALCULATING AIRCRAFT CARGO VOLUMES

1. PURPOSE: The purpose of this Aerospace Standard is to establish a uniform methodology for defining and determining the usable internal volume of aircraft cargo compartments, and usable external envelope for Unit Load Devices (ULD's) 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. SCOPE: The scope of this Aerospace Standard 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 (ULD's) shall also be stated in order to provide the maximum ULD external contour and the methodology to define the ULD internal volumes. The methodology of defining and determining "maximum package sizes charts" for the cargo compartments shall also be included.

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 9g forward emergency landing condition. If bulk cargo is not "Compartment Restrained", then type I and II unit load devices (ULD's) 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 4.0. 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 A.

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. See Figure H. This will take into account mid-cabin 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 B.

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 C.

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 unit load devices 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 4.0. 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 are designed to withstand bulk cargo restraint loads. See Figure D.

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 restraints loads. The height that a cargo loading system protrudes above the floor surface need not be discounted, provided that the system is easily removed 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 E.

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 F.

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. UNIT LOAD DEVICES ENVELOPES: The unit load devices (ULD's) 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 9g forward emergency landing condition. This type of a ULD is referred to as a certified ULD but may be utilized as a non-certified 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 9g forward emergency landing condition. This type of a ULD is also referred to as a certified ULD but may be utilized as a non-certified ULD.

Cargo may be carried in ULD's 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 ULD's are referred to as non-certified.

The allowable clearance between aircraft interior and various types of ULD's are shown in Figure G 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 unit load devices, including both structural and non-structural igloo assemblies, with controlled contour shapes. The structural container and non-structural container/igloo shall allow two inches (50.8 mm) of clearance to the minimum aircraft envelope, per Figure G.

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 two inches (50.8 mm) 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 two inches (50.8 mm) of clearance does not apply to the net/hardware, but in no case shall the net/hardware be within two inches (50.8 mm) of the aircraft envelope. The palletized cargo shall also have a two inch (50.8 mm) setback from the outer edge of the pallet on all sides to permit attachment of net hardware to the pallet. See Figure G. A six inch (15.2 cm) longitudinal 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 H.

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 0.75 inch (19.1 mm) for commercial pallets and 2.25 inches (57.2 mm) for military pallets, unless otherwise specified. The palletized cargo shall have a two inch (50.8 mm) setback from the outer edges of the pallet. The height shall be controlled by the two inch (50.8 mm) clearance dimension, to the minimum aircraft envelope through which the palletized ULD must pass during the loading/unloading cycle. See Figure G. A six inch (15.2 cm) 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 H.

5. PACKAGE SIZE CHART: Package size charts or graphs should be determined for each cargo compartment to define the maximum size rectangular shaped package which can be accommodated. The compartment length, width, height, door size, and location are all influencing factors. The package size chart shall define the maximum package length in terms of package height and width and should be similar to the example shown in Figure J. The height and width shall be in increments, not exceeding ten inches (25.4 cm), and the length shall be determined for packages in full contact with the compartment floor or conveyor system during loading/unloading operation and storage. A linear interpolation shall be permitted on any of the three dimensions or combination of any two dimensions. The charts shall be based upon a two inch (50.8 mm) minimum clearance between package and compartment interior envelope at all critical areas, such as door jambs, sidewall, ceiling and bulkhead. Tilting, twisting, bending, and/or rotating packages through the door opening will allow additional lengths in most cases, but these should be determined for each special situation depending on allowable conditions and should not be included in the package size charts.

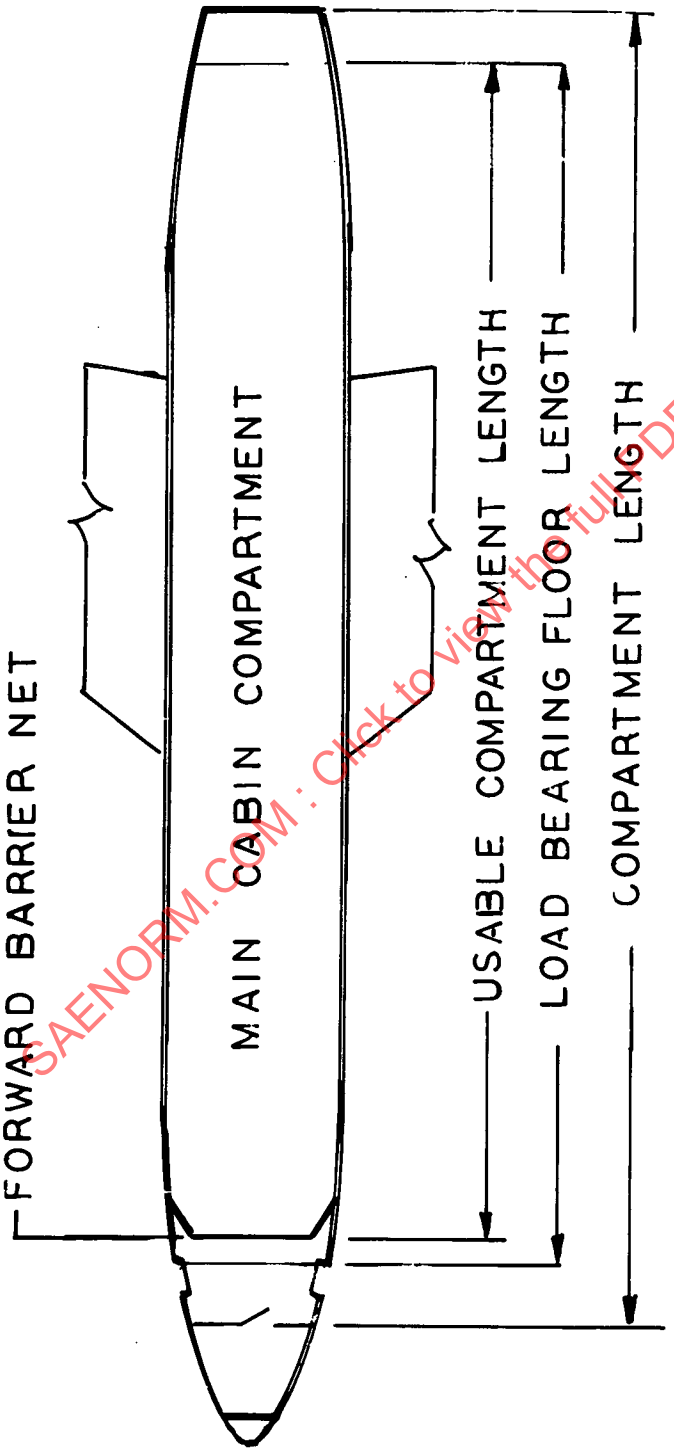

FIGURE A.

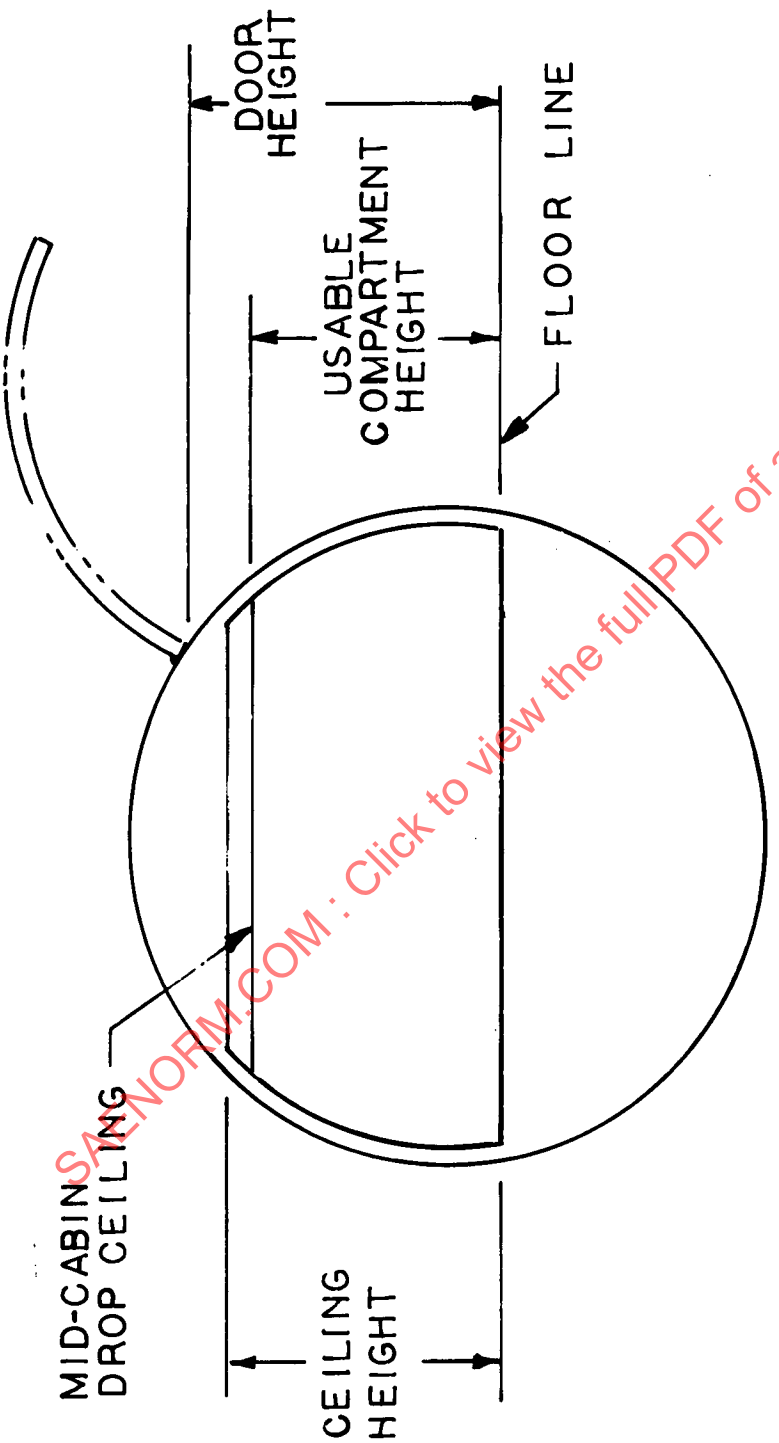

FIGURE B.

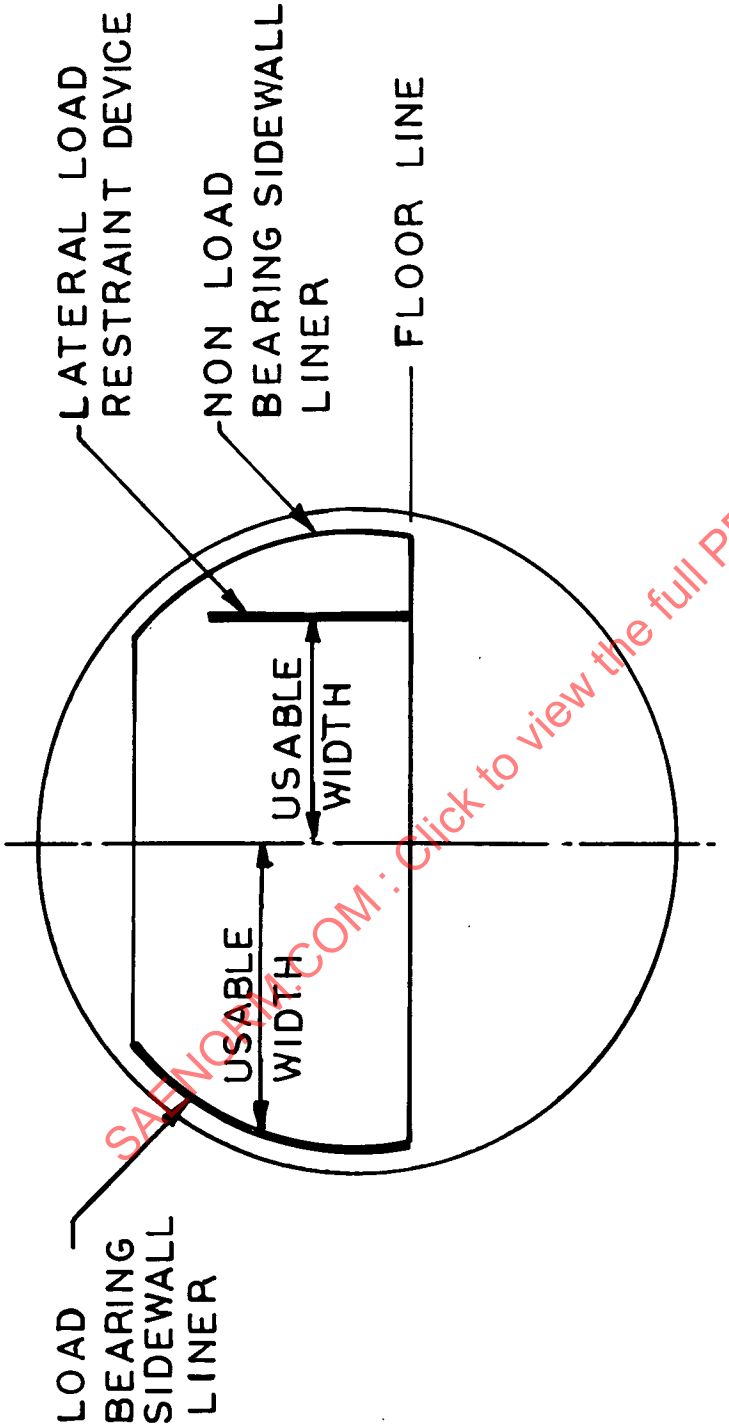

FIGURE C.

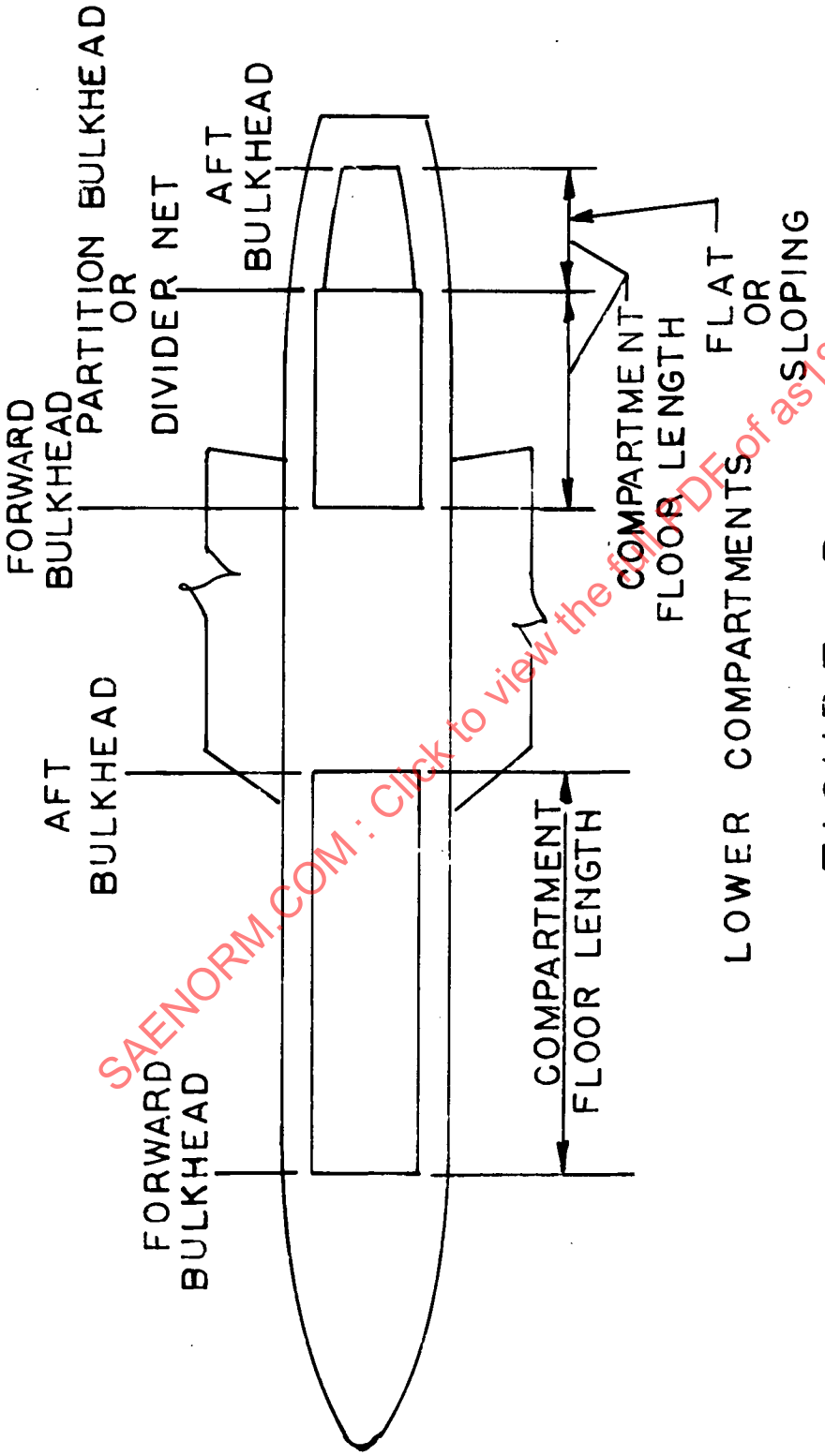

FIGURE D.

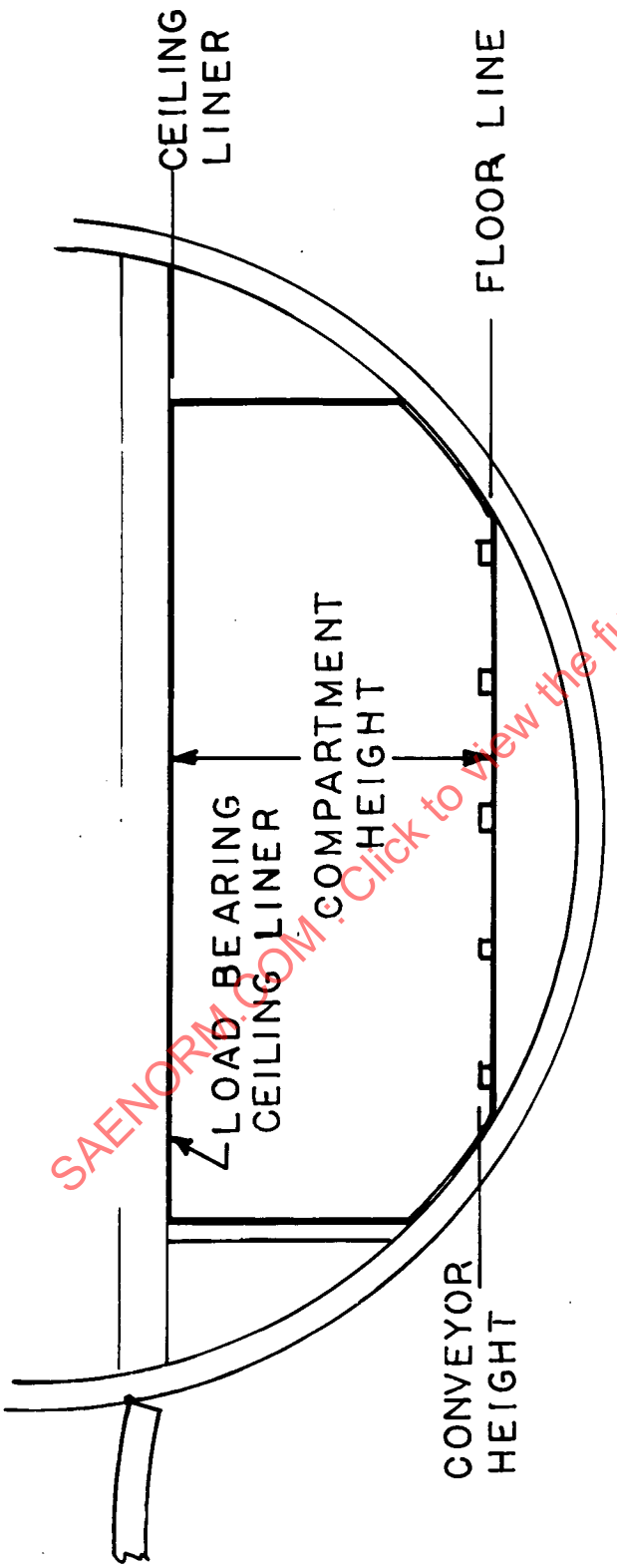

FIGURE E. LOWER COMPARTMENT

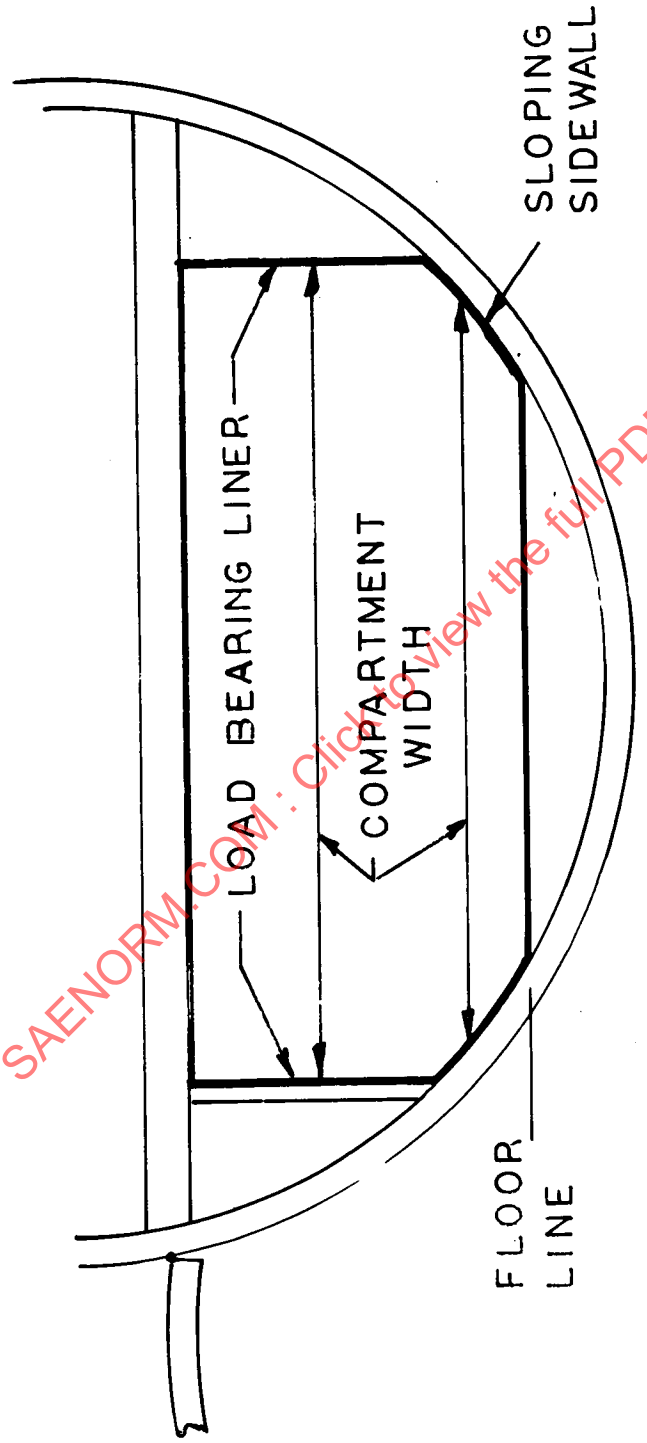

FIGURE F. LOWER COMPARTMENT