SAE Aerospace
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AEROSPACE STANDARD

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Superseding AS832E

Air/Surface (Intermodal) General Purpose Containers

RATIONALE

In terms of relevance to the AGE 2A sub-committee, the air cargo aspects are better covered in AS4041A. The requirement for this document is thought to be very limited.

The above two points indicate that the document should be made "non concurrent".

NONCURRENT NOTICE

This specification has been declared "NONCURRENT" as of February 2008. It is recommended, therefore, that this document not be specified for new designs.

Each of these "NONCURRENT" documents is available from SAE.

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1. SCOPE:

This SAE Aerospace Standard (AS) establishes the basic requirements for the specification and testing of air surface (intermodal) 8 ft x 8 ft (2.44 m x 2.44 m) cross-section containers.

The basic requirements for the air/surface (intermodal) container are presented in Sections 3 to 6 while the detailed design requirements are in Appendix A. Appendix B describes the sections of other standards that apply to air/surface containers. Appendix C describes uniformity of test apparatus and methods. These appendices shall be referred to for important supplemental requirements and procedures for this document.

AS4041 presents the requirements for air mode general purpose containers.

Requirements for containers to be transported by rotary-wing aircraft are excluded from this document.

NOTE: The essential basic and detail criteria are identified by use of the key word "shall." Recommended basic and detail criteria are identified by use of the key word "should," and while not mandatory, are considered to be of primary importance in providing serviceable, economical, and practical air/surface containers.

1.1 Field of Application:

These containers are suitable for international exchange and for conveyance by road, rail, and sea as well as by freighter versions of high capacity fixed-wing aircraft, including interchange between these modes of transport.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this specification 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 specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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

ARP1334 Ground Equipment Requirements for Compatibility with Aircraft Unit Load Devices

ARP1372 Minimum Requirements for Air Cargo Unit Load Device Ground Handling and Transport Systems

AS4041 Air Mode General Purpose Containers

2.1.2 NAS Standards: Available from Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.

NAS 3610 Cargo Unit Load Devices, Specification for

2.1.3 FAR Publications: Available from FAA, 800 Independence Avenue, SW, Washington, DC 20591.

Federal Aviation Regulation (FAR) Part 25, United States Department of Transportation

2.1.4 ANSI Publications: Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 668 Series 1 Freight Containers - Classification, External Dimensions and Ratings
ISO 1161 Series 1 Freight Containers, Corner Fittings Specification
ISO 1496/1 Series 1 Freight Containers, Specification and Testing - Part 1: General Cargo Containers for General Purposes
ISO 3874 Series 1 Freight Containers, Handling & Securing
ISO 6346 Freight Containers, Coding and Identification and Marking
ISO 8323 Freight Containers, Air/Surface (Intermodal) General Purpose Containers, Specification and Tests

2.1.5 IATA Publications: Available from IATA, IATA Building, 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.

IATA Standard Specification Number 40/0	Marking of Unit Load Devices
IATA Standard Specification Number 40/2	Marking of Air/Surface (Intermodal) Containers
IATA Standard Specification Number 50/0	Condition Requirements for Interlining of ULD's
IATA Standard Specification Number 50/6	Air/Surface (Intermodal) Container

2.2 Definitions:

2.2.1 AIR/SURFACE (INTERMODAL) CONTAINER: An article of transport equipment having an internal volume of 1 m_3 (35 ft_3) or more, fitted with top and bottom corner fittings, with restraint provisions compatible with an aircraft restraint system, and an entirely flush base bottom to allow handling on rollerized cargo handling systems.

2.2.2 TERMINOLOGY: The term "weight" is used throughout this document instead of the correct technical term "mass" in order to conform to current commercial usage.

2.2.3 SYMBOLS AND MARKINGS: The coding, identification, and marking of these containers shall be in accordance with Appendix B.3. To denote the container as an air/surface (intermodal) container, the symbol illustrated in Figure 1 shall be located at the top left-hand corner of the end walls and sidewalls and, as appropriate, on the roof, complying with the requirements of ISO 6346, IATA 40/0, and IATA 40/2 (see Appendix B.3).

NOTE: If any other markings are used on the container, they shall in no way interfere with the location of the marks required by ISO 6346, IATA 40/0, and 40/2.

3. GENERAL REQUIREMENTS:

NOTE: Applicable portions of IATA 50/0 should be referred to for general requirements not detailed in this document.

3.1 Airworthiness:

Airworthiness requirements laid down by Federal Aviation Regulation Part 25 shall be recognized for container design features such as ultimate loads (see 5.2.1), rapid decompression (see 5.3.2), fire protection, and markings.

For this purpose, NAS 3610 shall be applied.

3.2 Tare Weight:

Taking into consideration the unique aircraft requirements, container design should utilize the combination of design and material that results in as low a tare weight as possible.

3.3 Customs Sealing:

Since air/surface (intermodal) containers are expected to travel on international routes under customs control, container design shall meet the appropriate requirements of the following international conventions:

a. UN/IMO (International Maritime Organization): Customs convention on containers, Geneva, 1972-12-02.

b. UN/ECE (Economic Commission for Europe): Customs convention on the international transport of goods under cover of TIR carnets (TIR Convention), Geneva, 1975-11-14.

The requirements affecting container design appear in annex 4 of the convention quoted in a), and in annex 2 of the convention quoted in b), which are regulations on technical conditions applicable to containers that may be accepted for international transport under customs seal.

The main considerations for container design appear in A.5 of Appendix A.

In accordance with annex 5 of the convention quoted in a), and with annex 3 of the convention quoted in b), an approval certificate should be issued by competent national authority, and an approval plate, as specified (minimum dimensions 200 mm x 100 mm (8 in x 4 in)), should be affixed accordingly in the vicinity of the lower edge of the container door.

4. DIMENSIONS AND RATINGS:

4.1 External Dimensions:

The overall external dimensions and tolerances of the containers, covered by this document, are those established for series 1A, 1B, 1C, and 1D freight containers in ISO 668 (see Appendix B.1). No part of the container shall project beyond these specified overall external dimensions.

4.2 Minimum Internal Dimension:

Internal dimensions of containers shall be as large as possible, but at least equal to the values shown in Table 1.

The dimensions apply when measured at a temperature of 20 °C (68 °F). Measurements taken at other temperatures shall be adjusted accordingly.

When a corner fitting projects into the internal space, as specified by Table 1, the part of the corner fitting extending into the container shall not be considered as a factor in reducing the size of the container.

TABLE 1 - Minimum Internal Dimensions

Freight Container Designation	Minimum Height mm	Minimum Height in	Minimum Width mm	Minimum Width in	Minimum Length mm	Minimum Length ft	Minimum Length in
1A	2197	7 ft 2-1/2 in	2330	91-3/4	11 998	39	4-3/8
1B	2197	7 ft 2-1/2 in	2330	91-3/4	8 931	29	3-5/8
1C	2197	7 ft 2-1/2 in	2330	91-3/4	5 867	19	3
1D	2197	7 ft 2-1/2 in	2330	91-3/4	2 802	9	2-5/16

4.2.1 Door Opening: The container shall be designed to make the maximum possible internal cross-section available for loading.

Each container shall be provided with a door opening at least at one end.

Door openings shall be as large as possible, but not less than:

a. Minimum door height: 2134 mm (84 in)
b. Minimum door width: 2286 mm (90 in)

4.3 Ratings:

For the ratings of containers suitable for air and surface transport, the following definitions apply.

4.3.1 Maximum Gross Weight: The maximum allowable combined weight of the container and its cargo:

a. R_a: Maximum gross weight of an air/surface container
b. R_s: Maximum gross weight of a surface container (stacking only)

4.3.2 Tare Weight, T: The weight of the empty container, including its normal complement of loading restraint devices.

4.4 Maximum Gross Weight, R_a, and Distributed Load for Air/Surface (Intermodal) Containers:

The container shall not be used, in any transport system, at gross weight in excess of those given in Table 2a.

However, a uniformly distributed load up to 6759 kg (14 900 lb) may be placed in any 3 m (10 ft) linear length for 1A, 1B, and 1C containers.

TABLE 2a - Maximum Gross Weight of Container, R_a

Air/Surface Intermodal Container Designation	Maximum Gross Weight, R_a kg	Maximum Gross Weight, R_a lb
1A	20 412	45 000
1B	15 876	35 000
1C	11 340	25 000
1D	5 670	12 500

4.5 Center of Gravity:

Cargo placement shall limit the center of gravity to within the envelope indicated below:

a. ±10% of the external width, measured from the geometric center

b. ±5% of the external length, measured from the geometric center

c. Between a height of 356 mm (14 in) to 1219 mm (48 in), measured from the bottom of the base

To obtain the above asymmetric conditions, cargo density is assumed to vary linearly.

5. TECHNICAL REQUIREMENTS - BASIC:

(For supplementary detailed design requirements see Appendix A.)

5.1 General:

All containers shall be weatherproof.

Containers, when loaded to maximum gross weight, shall be capable of fulfilling the operating requirements specified in 5.1.1 to 5.1.4.

5.1.1 Stacking: Air/surface (intermodal) containers shall be capable of being stacked in position as follows (see Table 3):

a. Terminal storage: beneath two general cargo containers of the same size loaded to their ratings, as specified in ISO 668 - 2 R_s

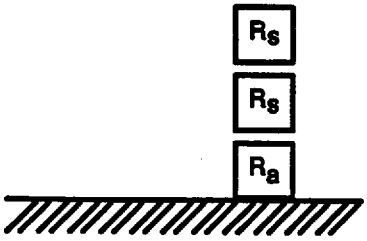
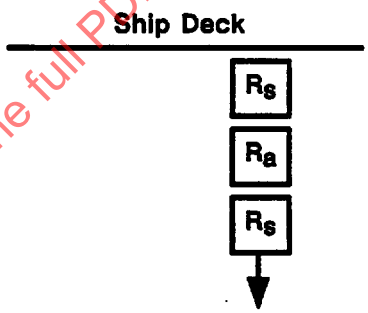
b. Ship transport, below deck only: beneath one general cargo container of the same size loaded to its rating, as specified in ISO 668 - R_s

For stacking, the maximum gross weight, R_s, for surface mode (intermodal) general cargo containers shall not exceed the values given in Table 2b.

TABLE 2b - Maximum Gross Weight of Container, R_S

Surface Container Designation	Maximum Gross Weight, R_S kg	Maximum Gross Weight, R_S lb
1A	30 480	67 200
1B	25 400	56 000
1C	24 000	52 900
1D	10 160	22 400

TABLE 3 - Stacking

Terminal Storage	Ship Transport, Below Decks Only
	

5.1.2 Lifting from Top Corner Fittings: Series 1A, 1B, and 1C containers shall be capable of being lifted, from the four top corner fittings (see Appendix B.2), with the lifting force applied vertically. The 1D container shall be capable of being lifted, from the four top corner fittings, with the lifting forces applied at any angle between the vertical and 60° to the horizontal (see 6.3 - Test No. 2).

5.1.3 Lifting from Bottom Corner Fitting: Series 1A, 1B, 1C, and 1D containers shall be capable of being lifted, from the bottom corner fittings (see Figure 10), by means of lifting devices exerting force on the bottom corner fittings only and attached to a single transverse central spreader beam above the container (see 6.4 - Test No. 3).

5.1.4 Ground Handling:

5.1.4.1 Vertical Movements: The ground handling equipment shall subject the container to certain loads that shall be taken into account by the designer. The lifting and lowering of containers onto supports is assumed to produce a dynamic load. The combined effect of this dynamic load, the varying center of gravity of load within the container, and gravity is assumed to produce an equivalent vertical load not greater than 2.0 R_a (see 6.2 - Test No. 1, 6.3 - Test No. 2, 6.4 - Test No. 3).

Due to the flat bottom configurations, for terminal storage compatible ISO interlayer fittings or other separator means may be attached to the applicable corner fittings.

For stacking in ship cells (that is, the top two tiers), interlayer fittings shall be attached to each of the four bottom corner fittings (see ISO 3874).

5.1.4.2 Horizontal Movements: The design of the container shall take into account the longitudinal external restraint conditions that may be experienced during transportation by rail, so that the container shall be capable of withstanding a horizontal acceleration of 2 g through the base, while being supported and restrained only at the four bottom corner fittings (see 6.5 - Test No. 4).

The design of the container shall also take into account the maximum operational forward forces that may be experienced during surface transportation, so that the container shall be capable of withstanding a horizontal acceleration of 0.4 g through the end walls or doors (see 6.6.2 - Test No. 5.1).

Account shall also be taken, in the design of the container, of the maximum operational side forces that may be experienced during surface transportation, so that the container shall be capable of withstanding a horizontal acceleration of 0.6 g through the sidewalls (see 6.7.2 - Test No. 6.1).

5.1.4.3 Bridging and Cresting: The container shall be capable of negotiating a crest or bridge, when being moved along a rollerized conveyor system, without suffering permanent deformation or damage (see 6.12 - Test No. 11).

5.1.4.4 Roof Strength (Walking Loads): The container roof shall be capable of withstanding a uniformly distributed weight of not less than 300 kg (660 lb), over an area of 600 mm x 300 mm (24 in x 12 in), applied vertically downwards (see 6.8.2 - Test No. 7.1).

5.1.4.5 Deck Lashing: No requirements for deck lashing are laid down, as air/surface containers shall be carried below deck only (top two positions) for ship transport.

5.1.4.6 Base Restraint on Roller Bed Vehicles: Slots to be used for ground transport restraint on roller bed vehicles, not equipped with twist lock fittings, shall be provided, as shown in Figure 7. The inner face of each outward slot (or block) shall be capable of restraining, laterally, 33% of the maximum gross weight (R_a).

The container lower edge member shall be capable of restraining an upward load of 20% of the maximum gross weight (R_a) in the slot area. These loads shall be applied simultaneously (see 6.13 - Test No. 12).

5.1.4.7 Grappler Arms: No optional provision shall be made for handling containers by means of grappler arms or similar devices.

5.1.4.8 Loading by Trucks or Similar Devices: The container floor shall withstand the concentrated dynamic loads imposed while being loaded by powered industrial trucks or similar devices (see 6.9 - Test No. 8).

5.1.4.9 Ground Transport Equipment: The applicable portions of ARP1372 shall be considered for handling of the container.

5.2 Aircraft Restraint Loads:

5.2.1 Ultimate Loads: Air containers differ from their surface counterparts in that they play an integral part in the aircraft restraint system and are, therefore, subjected to additional design complexity, imposed by aircraft certification requirements.

The container shall be designed to bear the ultimate loads given in NAS 3610 (see Appendix B.4), while being supported on a roller system, in accordance with 5.4.6, base restrained, in accordance with 5.2.2 and 5.2.3, and with the center of gravity of the cargo located at any point in the envelope, specified in 4.5.

Under these loads, the container may exhibit permanent deformation, but shall not deform to the extent of discharging cargo.

5.2.2 Base Restraint Loads: Side loads shall be exerted on the container base. Upward, forward, and aft loads shall be exerted by a fitting, as shown in Figure 4, and inserted into the restraint slots, shown in Figures 2 and 3. The design shall allow the forward and aft loads to be exerted on the following number of load-bearing slots:

a. 1A (40 ft) container: 11 slots
b. 1B (30 ft) container: 8 slots
c. 1C (20 ft) container: 5 slots
d. 1D (10 ft) container: 2 slots

The ultimate forward and aft loads for each slot shall be 8340 daN (18 750 lb), imparted by a restraint latch, as shown in Figure 4, acting on the abutment face. For forward and aft loads, the load-bearing slots shall be considered effective either on one or both sides of the container.

5.2.2 (Continued):

The container shall be designed to be restrained for vertical loads exerted by 50 to 60% of the total number of slots, equally distributed on each side. The upward load shall be exerted by a minimum fitting, as shown in Figure 4, inserted in the side restraint slots (see 6.6.3, 6.6.4, 6.7.3, 6.7.4, 6.8.3, and 6.8.4).

5.2.3 Base Restraint Loads - 1D Containers: In addition to the requirements of 5.2.2, end restraint slots shall be designed to restrain a 1D container against ultimate forward, aft, and vertical upward loads, when used in conjunction with restraint fittings, located as shown in Figure 5, and in the configuration illustrated in Figure 6. The container end slot dimensions and location are shown in Figure 7.

5.3 Container Assembly:

5.3.1 Container body construction shall be rugged and weatherproof.

5.3.2 Pressure Equalization Requirements:

5.3.2.1 Normal Flight Conditions: The container shall have a built-in vent area to allow normal (low airflow) pressure equalization. This vent area shall be a minimum of 5 cm_2/m_3 (0.02 in_2/ft_3) of container internal volume and shall be located so that it cannot be blocked or partially blocked by cargo or cargo shift.

The container door seals may fulfill part or all of this vent requirement if they are sufficiently flexible to deflect in either direction (in and out) under a pressure differential of between 3.5 and 7.0 kPa (0.5 to 1.0 psi).

5.3.2.2 Emergency (Rapid Decompression) Conditions: The container shall be designed to ensure high flow pressure equalization in the event of a rapid decompression without creating a hazard to the cargo compartment or the aircraft structure. A minimum vent area of 100 CM^2/M^3 (0.45 in^2/ft^3) of container internal volume shall be provided unless the container door seals and door frames deform sufficiently under rapid decompression conditions to fulfill this requirement. If the container design incorporates a blow-out panel or equivalent device to meet this requirement, then such a device shall fully open in less than 0.2 s when subjected to a maximum pressure differential, from the inside, of 14 kPa (2.0 psi). The "blowout"' device shall remain attached to the container after activation.

All vent areas shall be located and/or designed to avoid becoming blocked or partially blocked by cargo or cargo shift.

5.3.2.2 (Continued):

NOTE: Full-scale tests have indicated that typical aircraft containers design and construction meet the previous requirement since, when submitted to the rapid decompression condition, the panel joints and noticeably the door frames immediately deform to the extent of creating sufficient space for the high airflow required, without breaking or projecting parts which could become a hazard to the surrounding structure (see ISO 11242).

However, it remains necessary, in compliance with clause 3.8 of ISO 8097 (NAS 3610), to verify this requirement by analysis or testing when designing any new type of container, particularly if the new design is intended to be built in a stronger manner than is current industry practice.

5.3.3 The container body shall incorporate fittings at its top four corners in accordance with Appendix B.2. The protrusion of the upper faces of the top corner fittings shall be kept to a minimum of 6 mm (1/4 in) above the roof of the container.

The bottom four corners shall incorporate fittings in accordance with Figure 10.

Dimensions and tolerances between corner fittings shall be in accordance with Appendix B.1.

5.4 Container Base:

5.4.1 The container shall have a smooth bottom below which there shall be no protrusions. The lower surface of the edge members and the bottom corner fittings shall be flush with the bottom surface of the base (see Figure 9).

5.4.2 Along the length of the container, the bottom surface shall be flat to within 3 mm (0.125 in). This shall allow for a waviness factor, crest to crest, at a minimum pitch of 915 mm (36 in).

5.4.3 The base edge shall have restraint slots that conform to Figures 2 and 3. End slots shall be provided in accordance with Figure 7. The vertical surface of the base edge between the restraint slots shall be smooth and continuous in order to provide a suitable interface for the automatic aircraft restraint latches. The lower profile of the edges shall be as shown in Figures 3 and 7.

5.4.4 Securing points shall be provided internally for the attachment of devices for the lashing of cargo, and these points shall be located on 600 mm (24 in) centers around the periphery of the base, excluding the door sill area. These points shall be "D" rings, or equivalent, each capable of withstanding a force of 1776 daN (4000 lb) in any direction.

5.4.5 So that the container conforms to the aircraft system deflected shape, the 1A and 1B container base, loaded to the rated maximum gross weight (see Table 2), shall be free to deflect ±92 mm (±3/8 in), without rigid restraint by the sidewalls. Base stiffness in the forward and aft direction in the plane of the base shall have a maximum value of 339 075 N.m^2/m (3 lbf-in^2/in x 10^6 lbf-in^2/in) or 824 000 Pa per 25 mm.

NOTE: These 1A and 1B container requirements relate to current aircraft and may be amended for future aircraft.

5.4.6 The base shall provide for support and ease of movement when loaded to the rated maximum gross weight on the following minimum conveyor systems:

a. Four rows of rollers, approximately equally spaced over a width of 1930 mm (76 in), as measured between the centers of rows. Each row shall be comprised of 38 mm (1.5 in) diameter parallel rollers, 76 mm (3 in) long, uncrowned, with an edge radius of 1.5 mm (0.06 in), spaced 254 mm (10 in) apart. The container shall travel perpendicular to the roller centerlines.

b. Swivel castors, with 25.4 mm (1 in) diameter wheels, shall have a contact length of 51 mm (2 in), located on a 305 mm x 305 mm (12 in x 12 in) grid pattern. The container shall travel in all directions across the grid.

c. Ball transfer units, with 25.4 mm (1 in) diameter balls, shall be located on a 127 mm x 127 mm (5 in x 5 in) grid pattern. The container shall travel in all directions across the grid.

(See 6.9.2 - Test No. 8.2.)

5.4.7 The base design shall allow for deflections of no more than the thickness of the interlayer adapter fittings for ground handling or more than the combined dimensions of the adapter and the proud location of the upper fittings of the surface container, on which it is stacked for ship-cell handling. For design purposes, the combined dimension is assumed to be 19 mm (0.75 in).

Accordingly, under dynamic conditions, or the static equivalent thereof, no part of the base shall deflect more than 19 mm (0.75 in). (See 6.2 - Test No. 1.)

5.5 Closures and Doors:

5.5.1 Any closure in the container which, if unsecured, could be hazardous during handling, shall be provided with an adequate securing system.

5.5.2 Doors should be capable of being securely fastened in the open and closed positions, while the container is being supported solely by the lower corner fittings or when it is on the minimum conveyor systems, as described in ARP1334.

5.5.3 The lower edge of the door and its attached hardware shall not encroach on the mandatory restraint slot areas as shown in Figure 7.

5.5.4 The door latches shall be designed to allow for the opening and shutting of the door when the container is on an uneven surface (varying up to 12 mm (0.5 in) over the width of the door opening).

5.5.5 Provision shall be made for a mechanical device to indicate that doors are positively locked.

5.5.6 Particular attention should be given to the prevention of water leaking through door-to-body interface areas (see 6.11 - Test No. 10).

5.5.7 Handles, straps, or handholds shall be provided on the door of the 1D container to assist in the manual movement of the container. These devices shall withstand a 450 daN (1000 lb) pull in any direction, and should provide an area equivalent to 152 mm (6 in) wide by 76 mm (3 in) deep for gripping with a gloved hand.

5.6 Forklift Pockets:

5.6.1 When forklift pockets are provided for handling 1C and 1D containers in the loaded or unloaded conditions, they shall comply with the dimensional requirements specified in Figure 8. The pockets shall pass completely through the base structure of the container so that lifting devices may be inserted from either side (see 6.10 - Test No. 9).

Pocket design shall take into account that forklift tines shall not extend the full width of the container. Backward tilt up to 10°, and a lift and load support equivalent to 1.25 R_a shall be imparted by the upper tunnel structure against the two tine blades, neither of which shall be more than 200 mm (8 in) wide or less than 1828 mm (72 in) in length. In selecting the material used for pocket faces and tunnels, consideration shall be given to the fact that tines are steel blades that shall be inserted at an angle ±3° with the centerline of the pocket.

6. TESTING:

6.1 General:

Air/surface (intermodal) containers, complying with the design requirements specified in Section 5, shall not be inferior to containers that have passed the tests specified in 6.2 to 6.13, inclusive. It is recommended that the test for weatherproofness (Test No. 10) shall be carried out last.

6.1 (Continued):

Unless otherwise stated, operational design loads shall be used in all tests. For substantiation of analytical data when required, tests, in selected cases, should be repeated under ultimate load conditions. If this becomes necessary, the container tested in this manner shall not be used in service until structural and design parameters have been completely restored. Where a test is not stipulated, the design requirements specified in Section 5 should be verified either by calculation or testing.

6.1.1 The symbol R_a denotes the maximum gross weight of the air/surface (intermodal) container (see Table 2a) and the symbol P denotes the maximum payload of the container under test, that is, the tare weight, T, subtracted from the maximum gross weight (see Equation 1):

$$R_a = P + T$$
$$P = R_a - T \qquad \text{(Eq. 1)}$$

The symbol R_s denotes the assumed maximum gross weight of the surface container (see Table 2b).

6.1.2 The test load placed in the container shall be uniformly distributed, unless otherwise specified. The maximum variations in the center of gravity, as specified in 4.5, shall be considered for Test Nos. 5.2, 5.3, 6.2, 6.3, 7.2, 7.3, 8.2, and 11.

6.1.3 The described test equipment and methods for testing are not intended to be restrictive; however, for uniformity of testing results, the apparatus and methods described in Appendix C should be used.

6.1.4 When restraint of movement is used on an aircraft system, the test system shall be in accordance with 5.4.6. Suitable latches and guide-rails shall be provided to guide the container along the conveyor and to secure it at its latch points. The test system shall be of sufficient length to permit cycling of the longest test container.

6.1.5 The diagrams in Figures 11a to 11f (Test Nos. 1 to 12) show the test loads and reaction forces applied to a 6 m (20 ft) container (drawn approximately to scale). Variations in the geometrical layout of the restraint means and test methods are stated beneath the diagram, where appropriate.

6.2 Test No. 1 - Stacking:

6.2.1 General: This test shall be carried out to prove the ability of an air/surface (intermodal) container, while on the ground, to support two fully loaded surface containers (2 R_s) of the same length.

This test also tests the ability of the air/surface (intermodal) container to support one fully loaded surface container (R_s), when placed in ship-cell structures.

6.2.2 Procedure: The container shall be placed on four level pads, one under each corner fitting. The pads shall be centered under the fittings and shall be basically of the same dimensions as the fittings. The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the uniformly distributed test load shall be equal to 1.8 R_a. For the purposes of the test, a uniform load shall be defined as 1.8 R_a - T.

The container shall have a test load applied vertically to each of the four top corner fittings simultaneously, in such a manner that the planes of the container remain horizontal throughout the test. The load shall be applied through a corner fitting, or a pad, not less than 25 mm (1 in) thick and of the same plan area as the corner fitting. Each pad shall be offset in the same direction by 25 mm (1 in) laterally and 38 mm (1.5 in) longitudinally.

The test load value on each corner fitting shall be determined from Table 4.

TABLE 4 - Corner Fitting Test Load

Container Designation	Test Load per Corner[1] daN	Test Load per Corner[1] lb
1A	16 169	36 350
1B	13 678	30 750
1C	11 187	25 150
1D	6 205	13 950

[1] The test load values allow for an assumed lifting device weight of 5000 kg (11 000 lb) when the container is lowered.

6.2.3 Requirement: Throughout the test, the maximum downward deflection of the base shall not exceed 19 mm (0.75 in).

On completion of the test, the container shall not show a permanent deformation nor abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.3 Test No. 2 - Lifting from the Four Top Corner Fittings:

6.3.1 General: This test shall be carried out to prove the ability of a container to withstand being lifted from its four top corner fittings, by means of lifting devices bearing on the top corner fittings.

6.3.2 Procedure: The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the uniformly distributed test load is equal to 2 R_a. It shall be carefully lifted from the four top corners in such a way that no significant acceleration or deceleration forces are applied. For the purposes of the test, a uniform load shall be defined as 2 R_a - T. No portion of the container shall touch the ground during the test.

6.3.2 (Continued):

For series 1A, 1B, and 1C containers, the lifting forces shall be applied vertically. For the 1D container, lifting shall be by means of slings, each leg being at an angle of 60° to the horizontal.

After lifting, the container shall be suspended for not less than 5 min and then lowered to the ground.

6.3.3 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.4 Test No. 3 - Lifting from the Four Bottom Corner Fittings:

6.4.1 General: This test shall be carried out to prove the ability of a container to withstand being lifted from its four bottom corner fittings, by means of lifting devices, bearing on the bottom corner fittings only, and attached to a single transverse central spreader beam above the container.

6.4.2 Procedure: The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the uniformly distributed test load is equal to 2 R_a. It shall be carefully lifted from the side apertures of all four bottom corner fittings in such a way that no significant acceleration or deceleration forces are applied. For the purposes of the test, a uniform load shall be defined as 2 R_a - T.

Lifting forces shall be applied at:

a. 30° to the horizontal for 1A containers

b. 37° to the horizontal for 1B containers

c. 45° to the horizontal for 1C containers

d. 60° to the horizontal for 1D containers

In each case, the line of action of the lifting force and the outer face of the corner fitting shall be no farther apart than 38 mm (1.5 in). The lifting shall be carried out in such a manner that the lifting devices bear only on the four bottom corner fittings.

The container shall be suspended for 5 min and then lowered to the ground.

6.4.3 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.5 Test No. 4 - Longitudinal Restraint:

6.5.1 General: This test shall be carried out to prove the ability of a container to withstand longitudinal external restraint under the dynamic conditions of railway operations, which implies acceleration equivalent to a load of 2 R_a exerted horizontally.

6.5.2 Procedure: The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the uniformly distributed test load is equal to R_a. It shall be secured longitudinally to rigid anchor points through the bottom apertures of the bottom corner fittings at one end of the container. For the purpose of the test, a uniform load shall be defined as R_a - T.

A load equivalent to a load of 2 R_a shall be applied horizontally to the container through the bottom apertures of the other bottom corner fittings, first toward and then away from the anchor points.

6.5.3 Requirements: While the container is subjected to the internal downward load of R_a and is supported by the bottom corner fittings, and after the removal of the horizontal loads, the doors and latches shall be checked for normal function.

On completion of the test, the container shall not show a permanent deformation nor abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.6 Test No. 5 - Strength of End Wall/Door:

6.6.1 General: These tests shall be carried out to prove the ability of the container end walls and door to withstand the maximum operational forward forces that may be experienced during surface or air transportation, while secured by means of the bottom corner fittings or the appropriate aircraft restraint system.

6.6.2 Test No. 5.1 - Surface Mode:

6.6.2.1 Procedure: The container shall be secured to rigid anchor points through the bottom apertures of the four bottom corner fittings. A test load of 0.4 (R_a - T) shall be applied horizontally to one end of the container.

The test shall be repeated at the opposite end of the container unless the ends are identical.

6.6.2.2 Requirements: On completion of the tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.6.3 Test No. 5.2 - Air Mode:

6.6.3.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent. The number of latches indicated in 5.2.2 shall be engaged on one side of the container and the latches adjusted by a suitable means, to ensure contact with the end of the side latch receptacle slot. The container shall have a test load of R_a - T applied horizontally to one end wall. A similar test load of R_a - T may be applied downwards, simultaneously, to the top surface of the container base.

The test shall be repeated at the opposite end of the container unless the ends are identical.

6.6.3.2 Requirements: On completion of the tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.6.4 Test No. 5.3 - Air Mode, 1D Container Only:

6.6.4.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent, using only restraints in the fore and aft end slots, in accordance with Figures 5 and 6.

The container shall have a test load of R_a - T applied horizontally to one end wall. A similar test load of R_a - T may be applied downward, simultaneously, to the top surface of the container base.

The test shall be repeated at the opposite end of the container unless the ends are identical.

6.6.4.2 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.7 Test No. 6 - Strength of Sidewalls:

6.7.1 General: These tests shall be carried out to prove the ability of the container sidewalls to withstand the maximum operational side forces that may be experienced during surface transportation or air transportation, while secured by means of the bottom corner fittings or the appropriate aircraft restraint system.

6.7.2 Test No. 6.1 - Surface Mode:

6.7.2.1 Procedure: The container shall be secured to rigid anchor points through the bottom apertures of the four bottom corner fittings. A test load of 0.6 (R_a - T) shall be applied horizontally to the sidewall of the container.

The test shall be repeated on the opposite sidewall unless the walls are identical.

6.7.2.2 Requirements: On completion of the tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.7.3 Test No. 6.2 - Air Mode:

6.7.3.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent. The number of latches indicated in 5.2.2, equally spaced on both container sides, shall be engaged in the side slots and the latches adjusted by suitable means, to ensure vertical restraint.

The container shall have a test load of R_a - T applied horizontally to one sidewall. A similar test load of R_a - T may be applied downward, simultaneously, to the top surface of the container base.

The test shall be repeated on the opposite sidewall unless the walls are identical.

6.7.3.2 Requirements: Throughout the tests, the maximum permitted lateral deflection of the container roof with respect to the container base, shall not exceed 38 mm (1.5 in).

On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.7.4 Test No. 6.3 - Air Mode, 1D Container Only:

6.7.4.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent, using only restraints in the fore and aft end slots, in accordance with Figures 5 and 6.

The container shall have a test load of R_a - T applied horizontally to one sidewall. A similar test load of R_a - T may be applied downward, simultaneously, to the top surface of the container base.

The test shall be repeated on the opposite sidewall unless the walls are identical.

6.7.4.2 Requirements: Throughout the tests, the maximum permitted lateral deflection of the container roof, with respect to the container base, shall not exceed 38 mm (1.5 in).

On completion of the tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.8 Test No. 7 - Roof Strength:

6.8.1 General: These tests shall be carried out to prove the ability of the container roof to withstand the force imposed by persons working on it, and the maximum operational load that may be experienced during air transportation.

6.8.2 Test No. 7.1 - Surface Mode:

6.8.2.1 Procedure: A load of 300 daN (660 lb) shall be uniformly distributed over an area of 600 mm x 300 mm (24 in x 12 in), located at the weakest area of the rigid container roof.

6.8.2.2 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.8.3 Test No. 7.2 - Air Mode:

6.8.3.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent. The container shall have a test load of R_a - T applied upward to the underside of the roof.

The total number of restraint latches shall be as given in Table 5 and the latches shall be equally distributed between both sides and equally spaced along the full length of the container.

TABLE 5 - Total Number of Restraint Latches

Air/Surface (Intermodal) Container Designation	Total Number of Restraint Latches
1A	24
1B	18
1C	12
1D	6

6.8.3 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.8.4 Test No. 7.3 - Air Mode, 1D Container Only:

6.8.4.1 Procedure: The container shall be secured to the aircraft restraint system, or its equivalent, using only restraints in the fore and aft end slots, in accordance with Figures 5 and 6. The container shall have a test load of R_a - T applied upward to the underside of the roof.

6.8.4.2 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.9 Test No. 8 - Floor Strength:

6.9.1 Test No. 8.1 - Surface Mode (Cyclic Loading):

6.9.1.1 General: This test shall be carried out to prove the ability of a container floor to withstand the concentrated dynamic loads imposed during cyclic loading operations; for example, by powered industrial trucks and similar devices.

6.9.1.2 Procedure: The test shall be carried out using a test vehicle equipped with tires, and loaded to an axle weight of 5460 kg (12 000 lb); that is, 2730 kg[1] (6000 lb) on each of two wheels. The vehicle shall be positioned so that all points of contact between each wheel and a flat continuous surface lie within a rectangular envelope measuring 185 mm (7-1/4 in) (in a direction parallel to the axle of the wheel) by 100 mm (4 in). Each wheel shall make physical contact over an area within this envelope of not more than 142 cm^2 (22 in^2). The wheel width shall be nominally 180 mm (7 in) and the wheel centers shall be nominally 760 mm (30 in).

The path of the test vehicle shall be patterned over the entire floor area of the container. One cycle is defined as the test vehicle entering the container, traveling its entire length along various paths and then leaving the container. This maneuver shall be repeated for 100 cycles. The test shall be made with the container resting on four level supports under four bottom corner fittings, to allow its base structure to be free to deflect.

The test shall be repeated with the container supported on unidirectional and multidirectional conveyor systems, as described in ARP1334.

[1]The values of 5460 kg and 2730 kg are in conformity with the requirements of the CSC (International Convention for Safe Containers, UN/IMO) floor strength test.

6.9.1.3 Requirements: On completion of the tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.9.2 Test No. 8.2 - Air Mode (Cyclic Endurance):

6.9.2.1 General: The test shall be carried out to prove the ability of the base structure to withstand the cyclic action of being moved along aircraft and ground mode conveyor systems.

6.9.2.2 Procedure: The container, loaded to R_a - T, shall be placed on a system consisting of one half rollers and one half swivel castors (but not ball units), as described in 5.4.6. The maximum vertical displacement of system parts should be less than 0.76 mm (0.03 in).

The container shall be moved along the system over a distance not less than the container length and back to the starting position. This traverse cycle shall be repeated for 100 cycles at a mean velocity not less than 18.3 m/min (60 ft/min).

The drawbar pull shall be measured periodically at test speed or at breakaway.

6.9.2.3 Requirements: During the test, the maximum drawbar pull shall not exceed 3% of the maximum gross weight at test speed or 5% of the maximum gross weight at breakaway. The variation of drawbar pull from the first to the last cycle shall not exceed 0.5% of the maximum gross weight.

After the test, with the container still loaded to its maximum gross weight and resting on the conveyor system, the doors shall be fully opened and closed for three complete cycles. The doors shall open and close without jamming and the door-locks shall engage and disengage with ease.

On completion of these tests, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.10 Test No. 9 - Lifting from Forklift Pockets (Where Fitted):

6.10.1 General: This test is applicable to 1C and 1D containers when fitted with forklift pockets.

6.10.2 Procedure: The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the uniformly distributed test load is equal to 1.25 R_a. It shall be supported on two horizontal bars, each 200 mm (8 in) wide, projecting 1828 mm ± 3 mm (72 in ± 0.125 in) into the forklift pockets, as measured from the outside face of the side of the container. The bars shall be centered within the pockets.

The container shall be supported for 5 min and then lowered to the ground.

6.10.3 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.11 Test No. 10 - Weatherproofness:

6.11.1 Procedure: A stream of water shall be applied on all exterior joints and seams of the container from a nozzle with a 12 mm (0.5 in) inside diameter, at a pressure of about 100 kPa (corresponding to head of about 10 m (33 ft) of water) on the upstream side of the nozzle. The nozzle shall be held at a distance of 1.5 m (5 ft) from the container, and the stream shall be directed at the container at a speed of 100 mm/s (4 in/s).

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

6.11.2 Requirements: On completion of the test, no water shall have leaked into the container.

6.12 Test No. 11 - Bridging and Cresting:

6.12.1 General: This test shall be carried out to prove the ability of the container to transfer from one type of handling equipment to another, when the level of the conveyor surfaces are not in the same plane. At the point where the container balances on the end of the higher surface, the entire load is supported by one row of rollers.

6.12.2 Procedure: The container, loaded to R_a - T, with the center of gravity at the maximum limits, shown in 4.5, shall be moved along a roller system compatible with the minimum requirements of ARP1334, and made to pass across a stepped junction with another similar roller system, with the height difference at the junction being not less than 150 mm (6 in).

The container shall be held at the balance (cresting) point on the edge of the higher platform for a minimum period of 5 s.

The rear end of the container shall then be allowed to drop from the higher platform to the lower platform.

6.12.3 Requirements: On completion of the test, the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

6.13 Test No. 12 - Base Restraint on Roller Bed Vehicles:

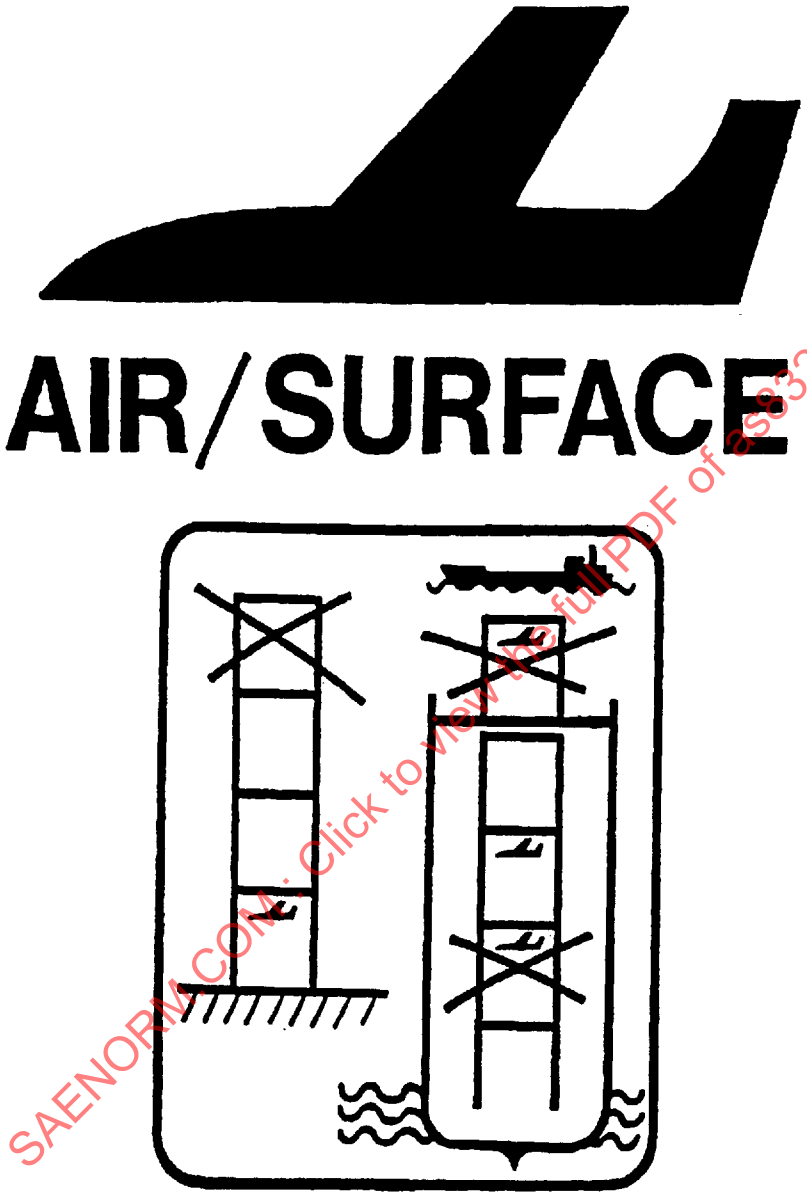
6.13.1 General: This test shall be carried out to prove the ability of the container to be transported on ground vehicles, incorporating roller beds, while being restrained by latches engaged in the container slots used for ground transport.

6.13.2 Procedure: The container shall be secured to a rigid base, using only latches, in accordance with Figure 6, engaged in the fore and aft ground transport end slots, as shown in Figure 7. The latches shall be adjusted by suitable means, to ensure restraint and contact with the inner face of each outward slot.

The container shall have a test load of 0.33 R_a applied horizontally, in an inward direction, to each inner face of one of the outward slots. Simultaneously, a test load of 0.20 R_a shall be applied vertically, in an upward direction, to the container lower edge member in the opposite slot area. The test loads shall be applied to both ends of the container. The test shall be repeated in the opposite slots unless the slots and base sides are identical.

6.13.3 Requirements: On completion of the test the container shall not show a permanent deformation or abnormality that will render it unsuitable for use, and its dimensional requirements that affect handling, securing, and interchange shall be satisfied.

PREPARED BY SAE SUBCOMMITTEE AGE-2A, CARGO HANDLING OF
COMMITTEE AGE-2, AIR CARGO AND AIRCRAFT GROUND EQUIPMENT AND SYSTEMS



The aircraft in the symbol shall be at least 130 mm (5 in) high and 360 mm (14 in) long. The stacking symbol shall be at least 280 mm (11 in) high and 260 mm (10 in) wide. The recommended proportions should be used. The capital letters shall be at least 80 mm (3 in) high

The colour of the symbol should be black. If the colour of the container is such that the symbol does not show clearly, a panel of a suitable colour, preferably white, should be provided as background.

FIGURE 1 - Symbol to Denote an Air/Surface (Intermodal) Container

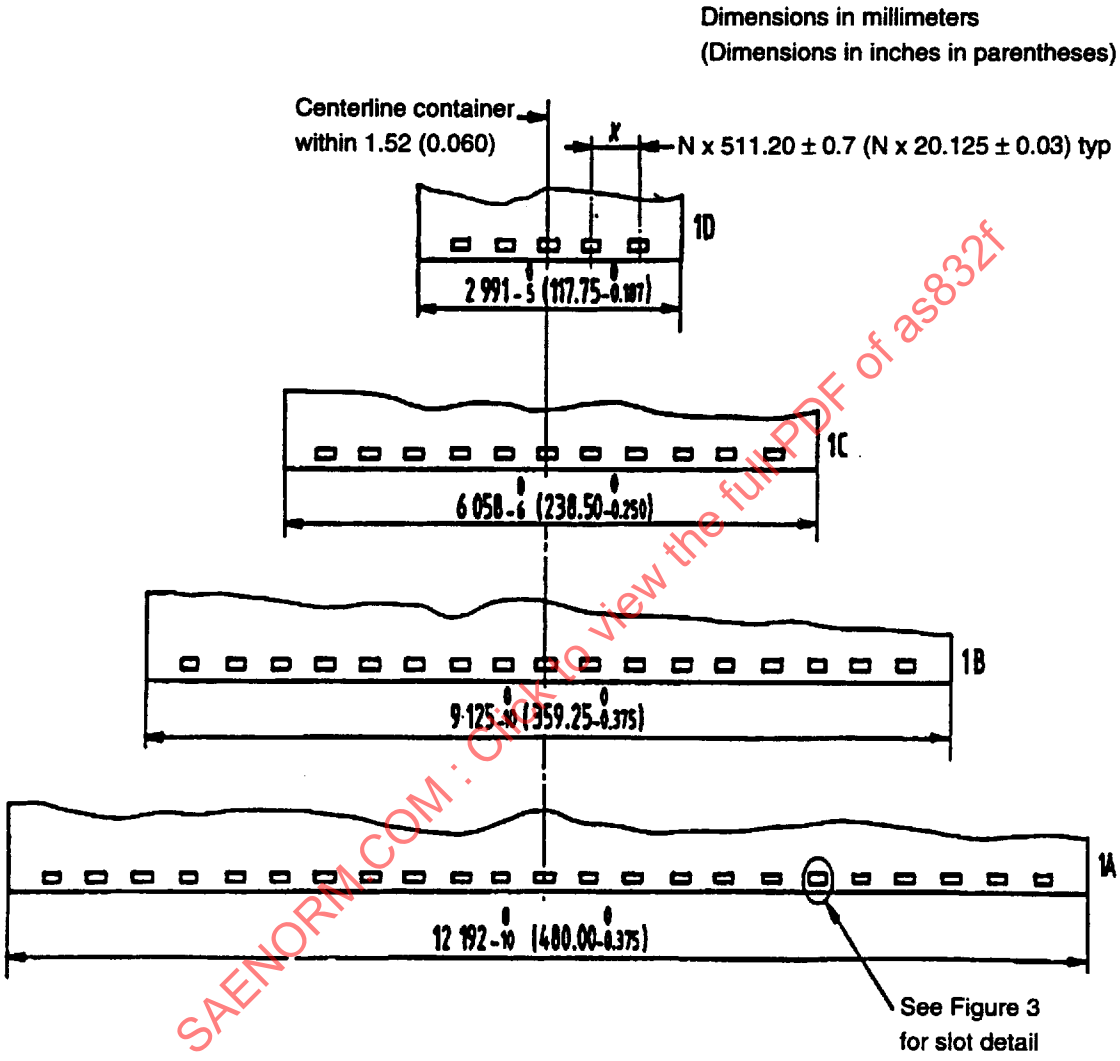


FIGURE 2 - Side Restraint Slots Location

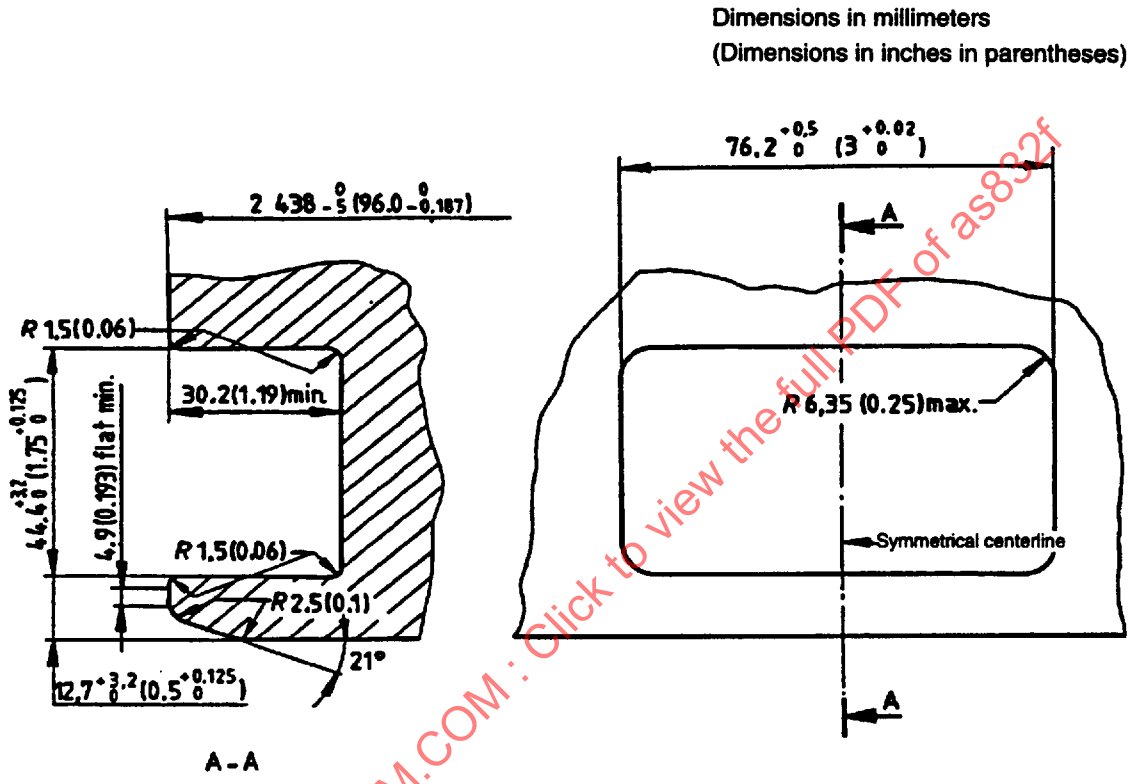
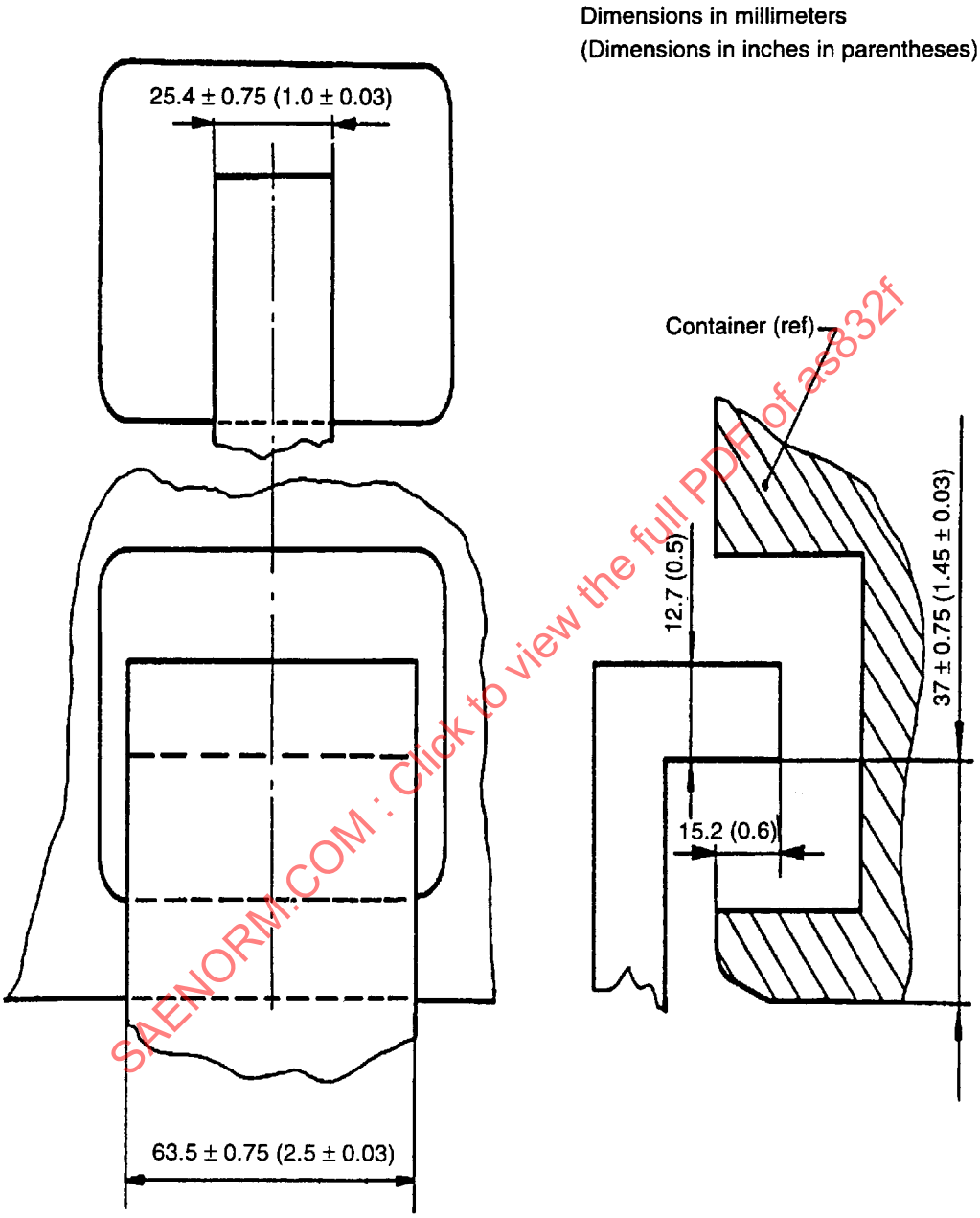


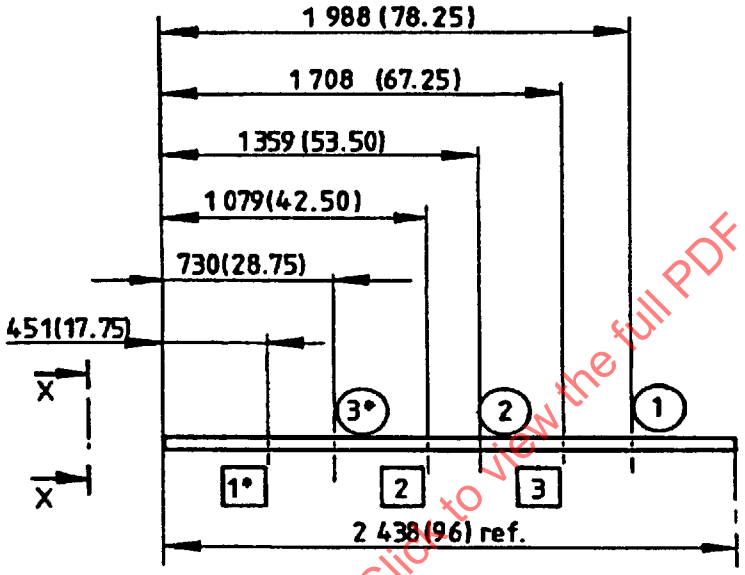
FIGURE 3 - Side Slot Detail



NOTE: Latches with the dimension of 25.4 (1.0) are for vetical restraint only.

FIGURE 4 - Latch Dimensions - Forward, Aft, Upward, and Side Loads

Dimensions in millimeters
(Dimensions in inches in parentheses)



* Set of three latch locations used depending on the orientation in the aircraft; each set is marked □ or ○

FIGURE 5 - End Restraint Locations

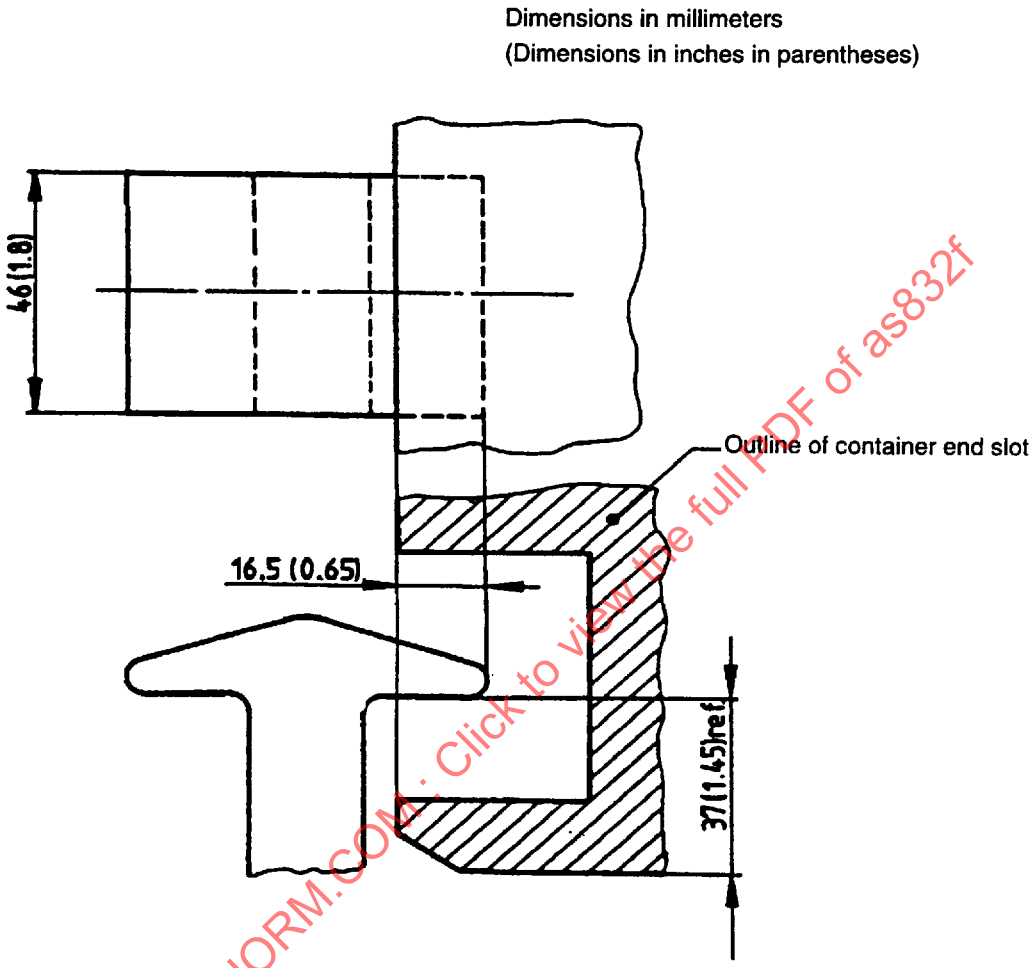


FIGURE 6 - End Latch Dimensions

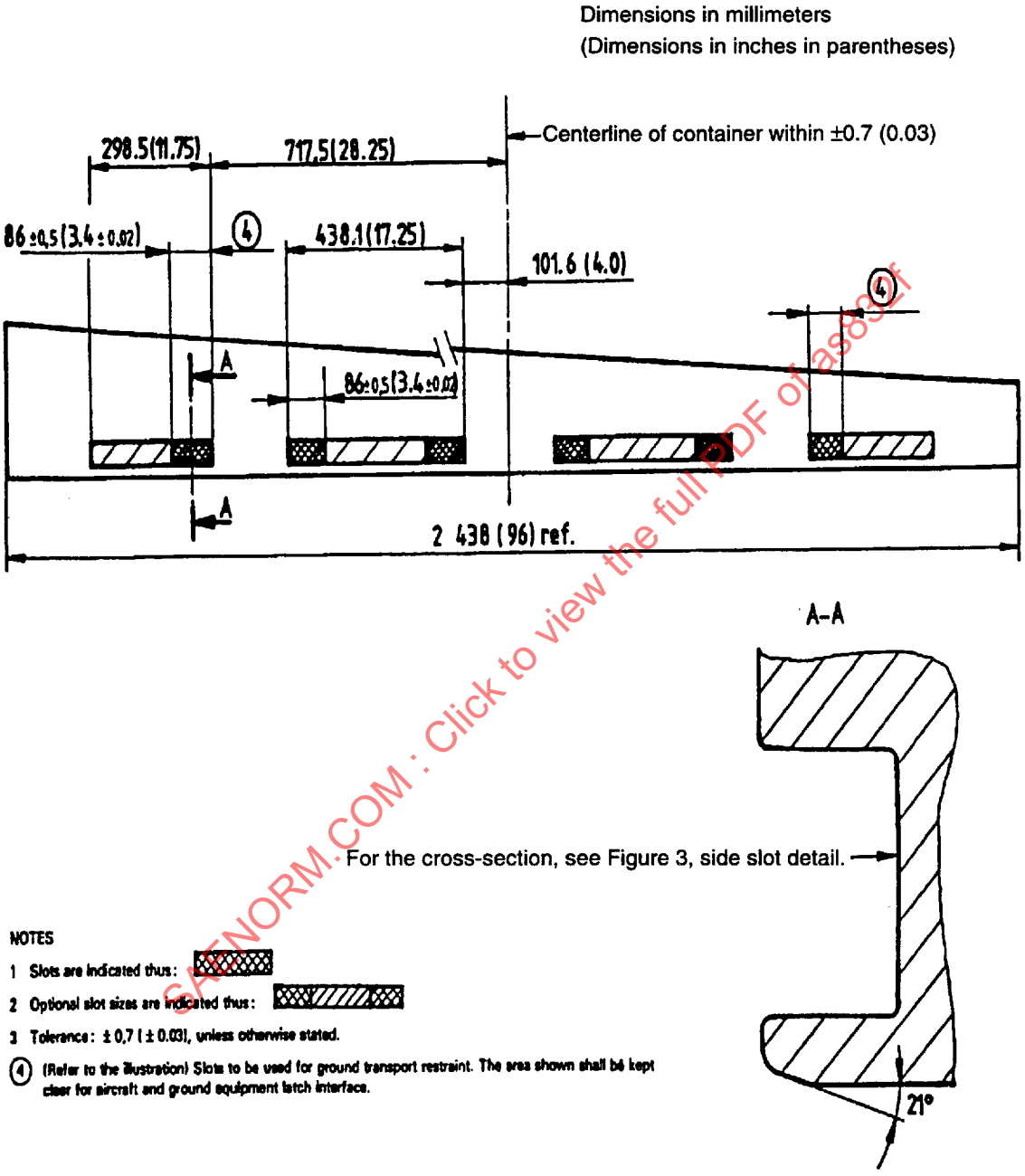


FIGURE 7 - End Slots

Dimensions in millimeters
(Dimensions in inches in parentheses)

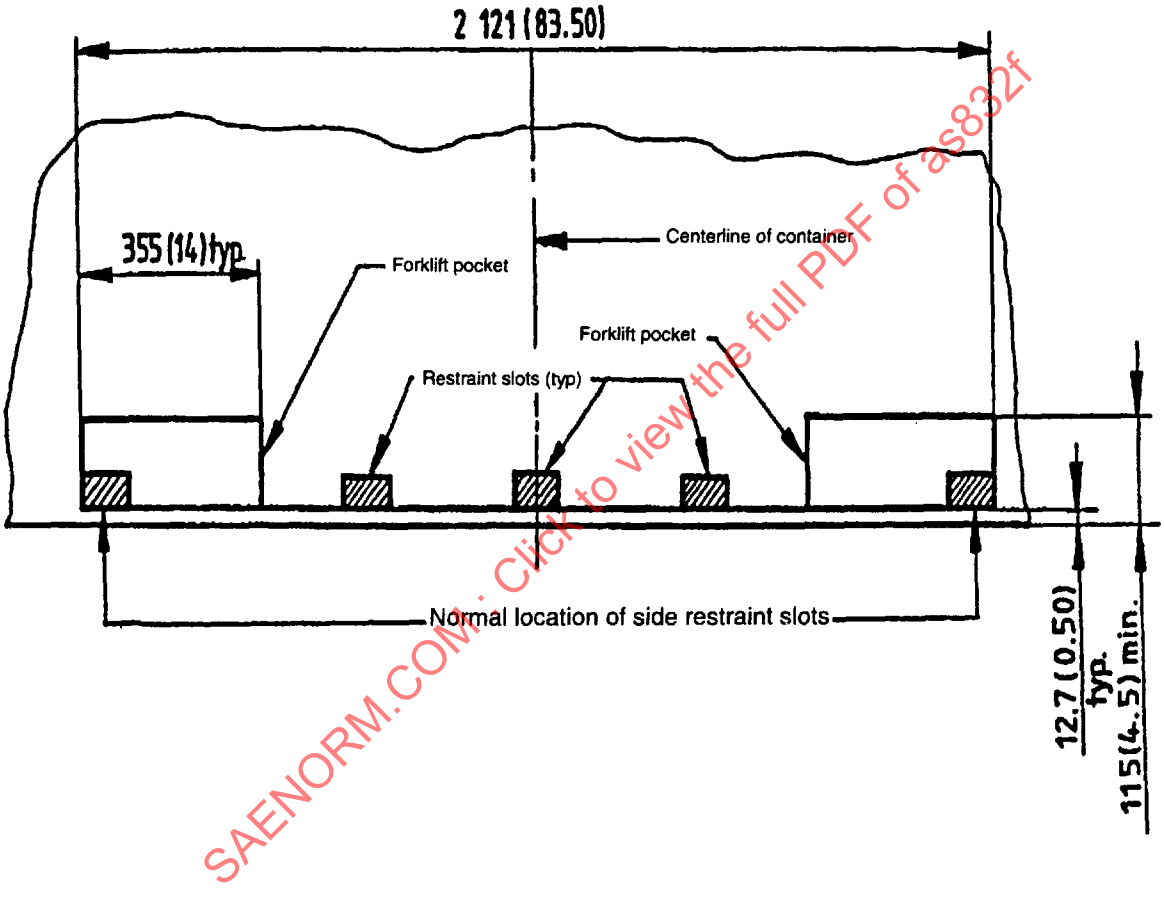


FIGURE 8 - Provisions for Handling 1C and 1D Containers by Means of Forklift Trucks

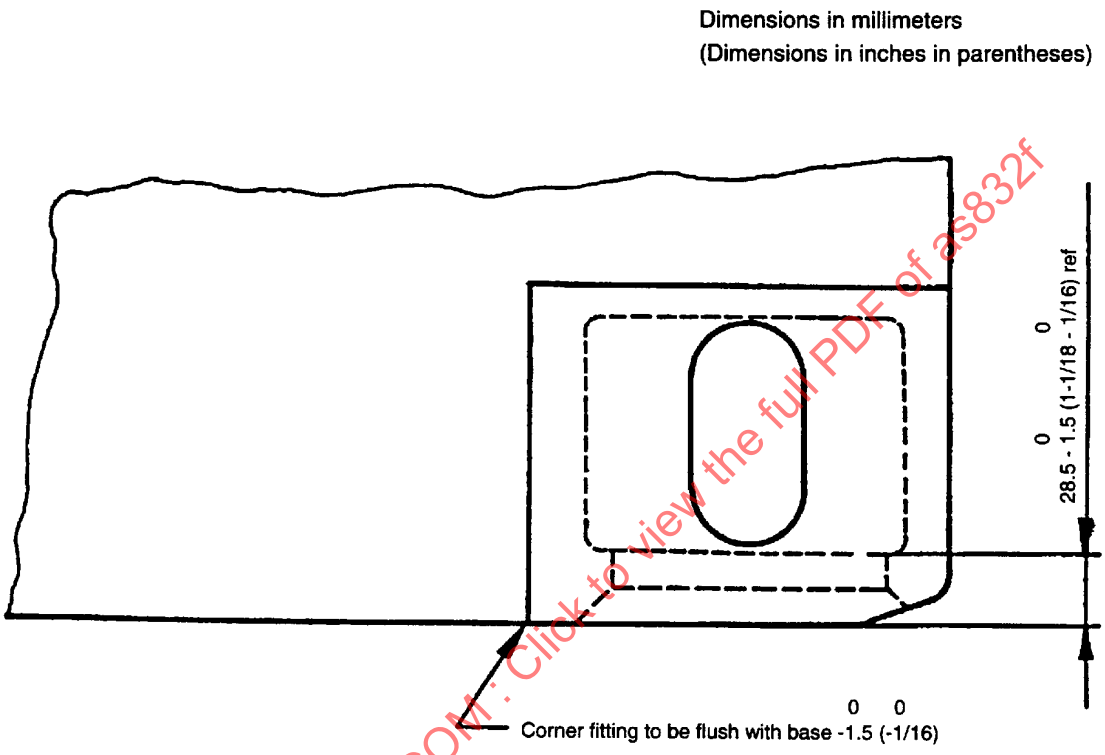
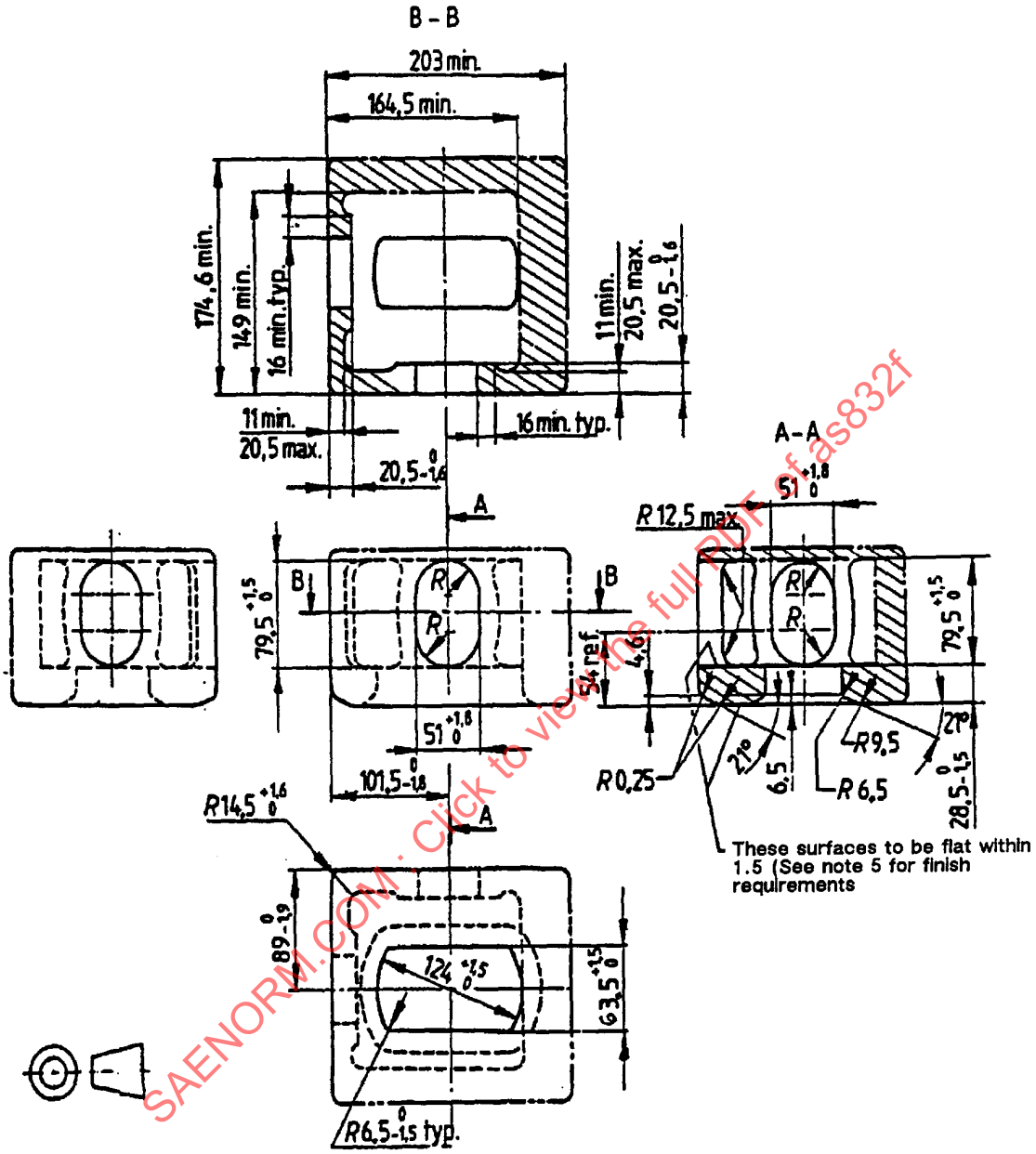


FIGURE 9 - Location of Bottom Corner Fitting



NOTES

1 Solid and broken lines (— and - - -) show surfaces and contours which shall be physically duplicated in the fitting.

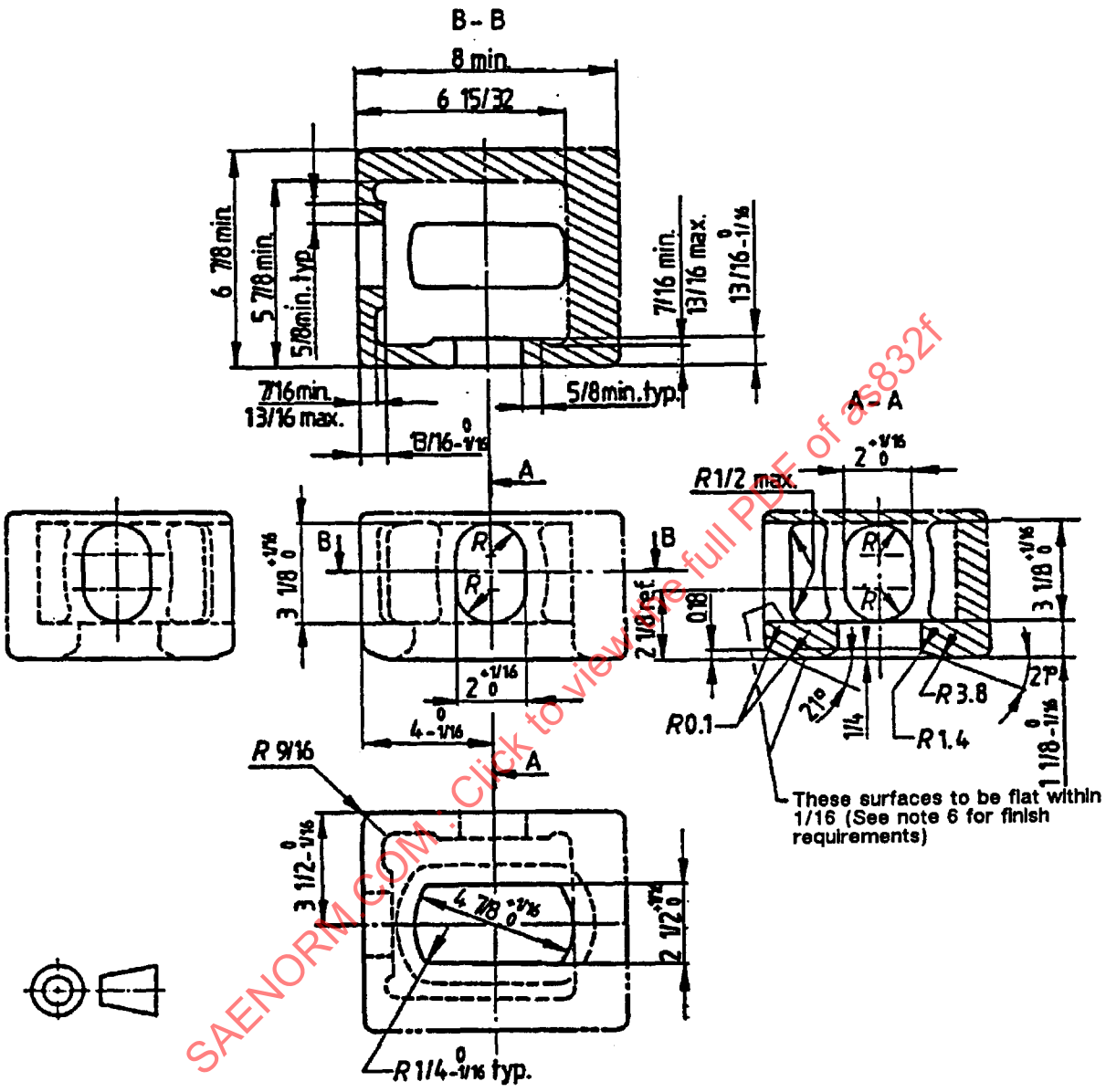
2 Phantom lines (— · —) show optional walls which may be used to develop a box shaped fitting.

3 Outside and inside corner radii, where sharp corners are shown, shall be 3 mm max., except as noted.

4 Four fittings are required per container, two as shown and mirror images.

5 Outside surfaces shall be a casting surface of C30 or better.

FIGURE 10a - Bottom Corner Fitting - Dimensions in Millimeters



NOTES

1 Solid and broken lines (— and - - -) show surfaces and contours which shall be physically duplicated in the fitting.

2 Phantom lines (— · —) show optional walls which may be used to develop a box-shaped fitting.

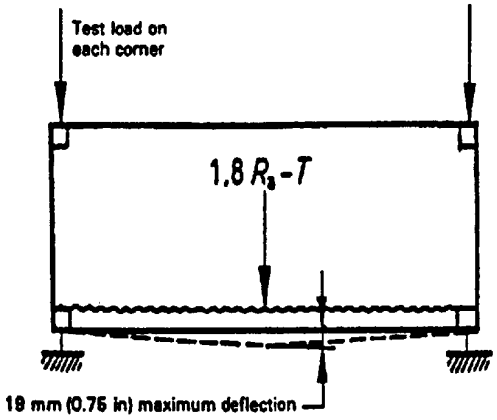
3 Outside and inside corner radii, where sharp corners are shown, shall be 1/8 in max., except as noted.

4 Four fittings are required per container, two as shown and two mirror images.

5 Outside surfaces shall be casting surface of C30 or better.

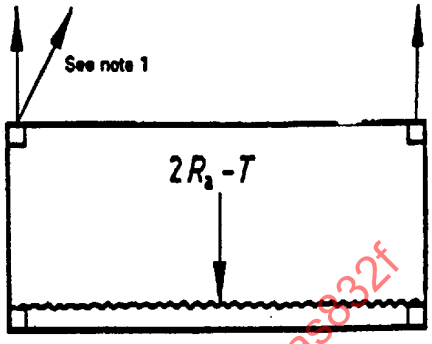
FIGURE 10b - Bottom Corner Fitting - Dimensions in Inches

Test No.1 – Stacking – Surface mode



NOTE - See 6.2.2 for limitations on offset line of application of externally applied forces.

Test No. 2 – Top lifting – Surface mode

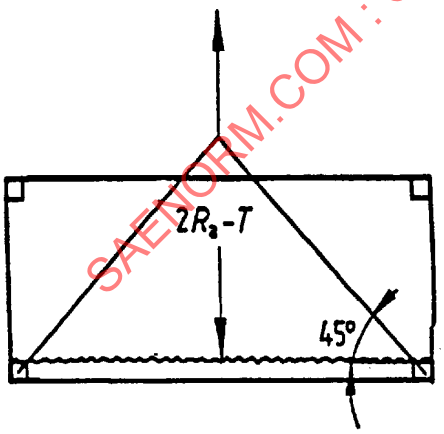


NOTES

1 Vertical lifting slings for all sizes of container, except for 3 m (10 ft) unit where the sling angle shall be 60° to the horizontal.

2 Suspend for 5 min.

Test No. 3 - Bottom lifting - Surface mode



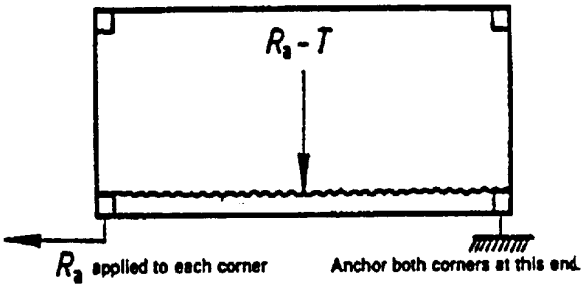
NOTES

1 See 6.4.2 for the sling angle of units other than 6 m (20 ft) length.

2 The line of action of the slinging force and the outer face of the corner fitting shall be no further apart than 38 mm (1.5 in).

3 Suspend for 5 min.

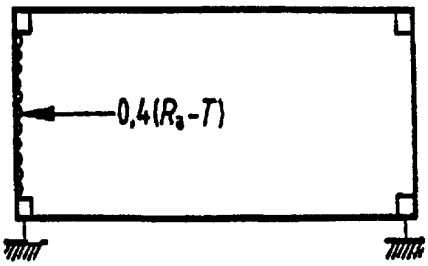
Test No. 4 - Longitudinal restraint - Surface mode



NOTE - Repeat test with horizontal forces, R_a applied in the opposite direction.

FIGURE 11a - Diagrammatic Representation of Test Nos. 1, 2, 3, and 4

Test No. 5.1 – Strength of end wall/door – Forward operational load – Surface mode

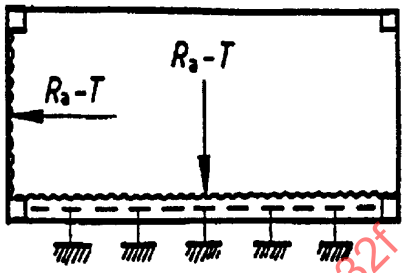


NOTES

1 Restrain through bottom apertures of bottom corner fittings.

2 Repeat test with the horizontal force, 0,4 (R_g - T), applied to the opposite end unless the ends are identical.

Test No. 5.2 – Strength of end wall/door – Forward operational load – Air mode



NOTES

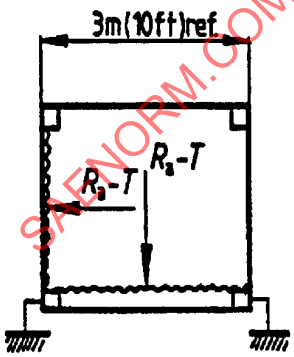
1 See 5.2.2 for minimum restraint requirements.

2 Horizontal lateral reaction forces are necessary at the base to prevent horizontal rotation of the unit.

3 R_g - T downwards is optional.

4 Repeat test with the horizontal force, R_g - T, applied to the opposite end unless the ends are identical.

Test No. 5.3 - Strength of end wall/door - Forward operational load - Air mode, 1D container only



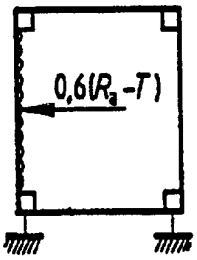
NOTES

1 Restraint at end slots only.

2 R_g - T downwards is optional.

3 Repeat test with the horizontal force R_g - T, Applied to the opposite end unless the ends are identical.

Test No. 6.1 - Strength of side walls - Side operational load - Surface mode



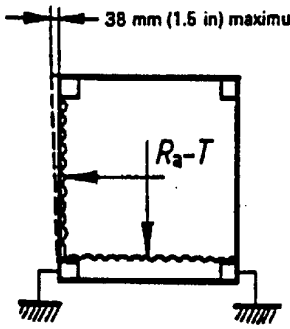
NOTES

1 Restrain through bottom apertures of bottom corner fittings.

2 Repeat test for the horizontal force, 0,6 (R_g - T), applied to the opposite side unless the sides are identical.

FIGURE 11b - Diagrammatic Representation of Test Nos. 5.1, 5.2, 5.3, and 6.1

Test No 6.2 – Strength of side walls – Side operational load – Air mode



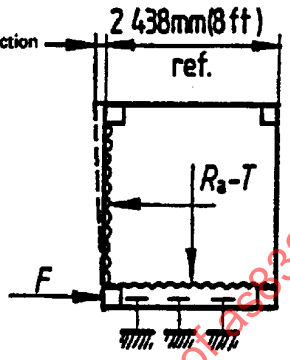
NOTES

1 See 5.2.2 for minimum restraint requirements.

2 R_a - T downwards is optional.

3 Repeat test with the horizontal force, R_a - T, applied to the opposite side unless the sides are identical.

Test No 6.3 – Strength of side walls – Side operational load – Air mode, 1D container only



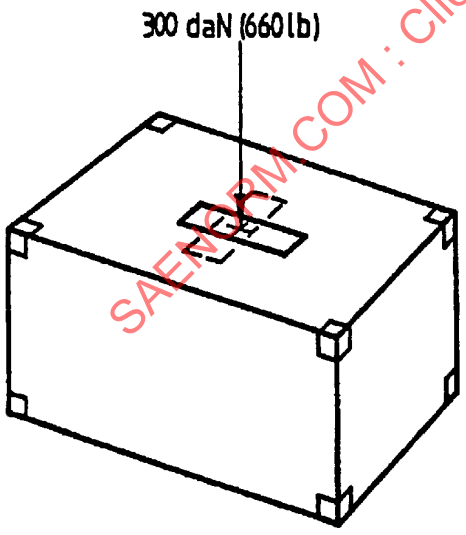
NOTES

1 Reaction force, F, at the base increases end slot restraint

2 R_a - T downwards is optional.

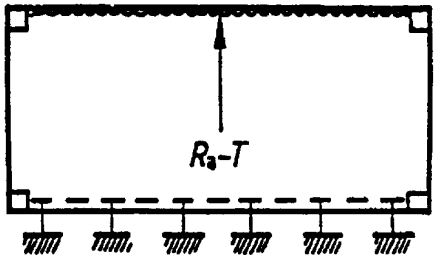
3 Repeat test with the horizontal force, R_a - T, applied to th opposite side unless the sides are identical.

Test No. 7.1 - Roof strength - Localized walking load - Surface mode



NOTE - The test load shall be applied over an area of 300 mm x 600 mm (12 in x 24 in) on the weakest part of the roof.

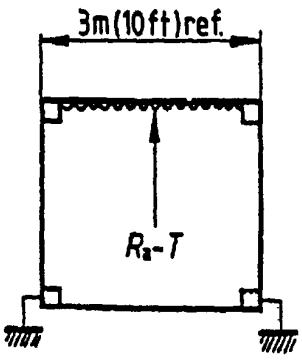
Test No. 7.2 - Roof strength - Upwards operational load - Air mode



NOTE - See 5.2.2 for minimum restraint requirements.

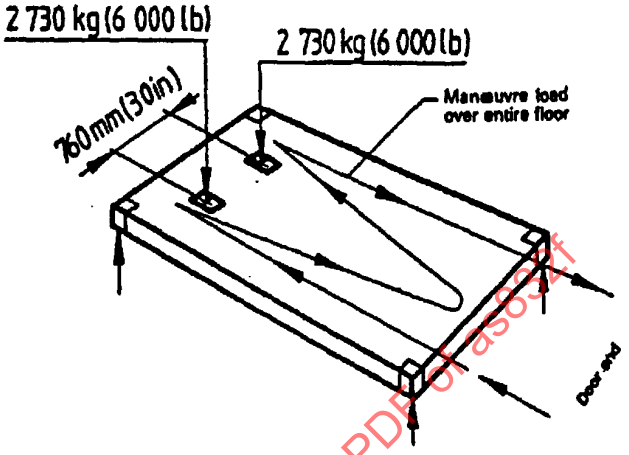
FIGURE 11c - Diagrammatic Representation of Test Nos. 6.2, 6.3, 7.1, and 7.2

Test No 7.3 – Roof strength – Upward operational load – Air mode, 1D container only



NOTE - Restraint at end slots only.

Test No 8.1 – Floor strength – Cyclic loading



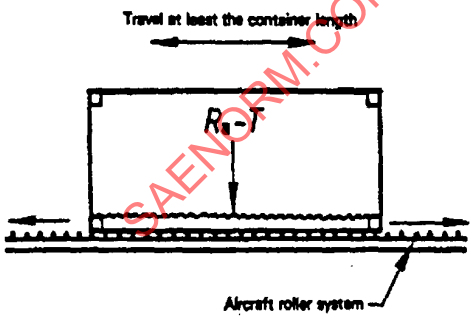
NOTES

1 The load shall be applied by two wheels, each 185 mm (7.25 in) wide, with 142 cm² (22 in²) maximum contact area with the container supported on its four corner fittings.

2 Manœuvre load for 100 cycles.

3 Repeat test with the container supported on the conveyor surface, in accordance with the minimum requirements of ARP 1334

Test No. 8.2 - Floor strength - Cyclic endurance

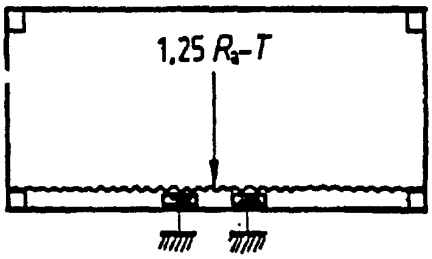


NOTES

1 Speed of travel 18,3 m/min (60 ft/min) for 100 cycles.

2 The draw-bar pull shall be measured periodically as specified in 6.9.2.2.

Test No. 9 - Lifting from fork-lift pockets (where applicable)



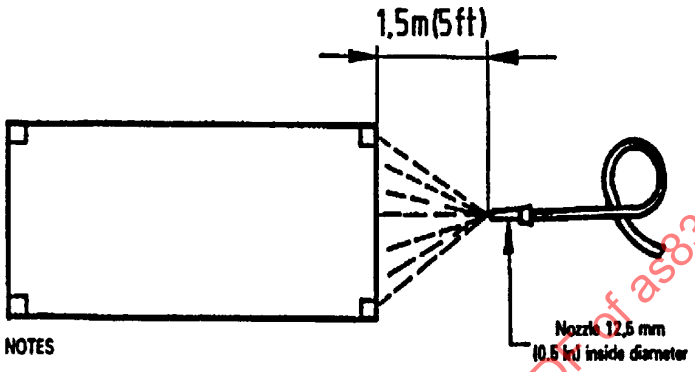
NOTES

1 Support beam shall be centrally located in fork-lift pockets.

2 Support beams shall be 200 mm (8 in) wide, projecting 1 828 + 3 mm (72 ± 0.125 in) into the pockets.

FIGURE 11d - Diagrammatic Representation of Test Nos. 7.3, 8.1, 8.2, and 9

Test No 10 – Weatherproofness

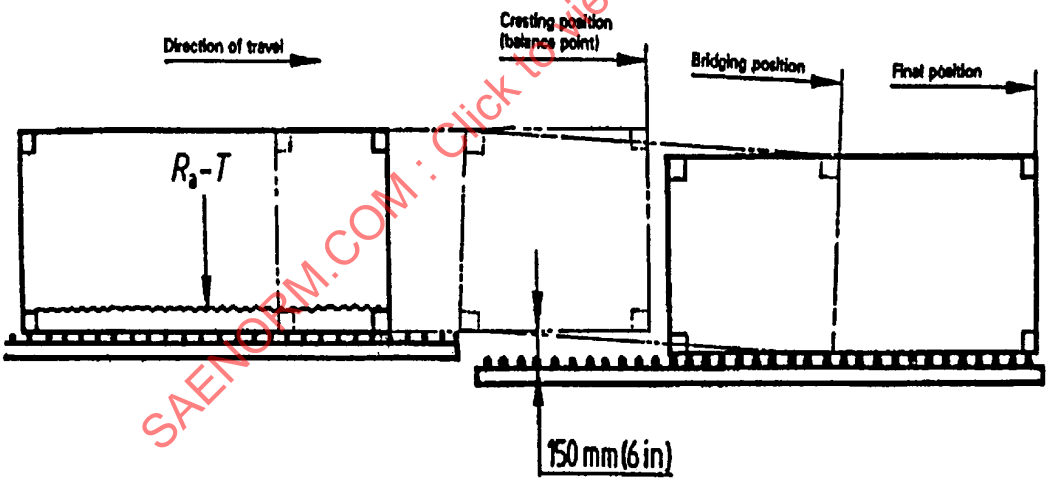


NOTES

1 Water pressure : 100 kPa.

2 Water velocity : 100 mm/s (4 in/s).

Test No. 11 - Bridging and cresting



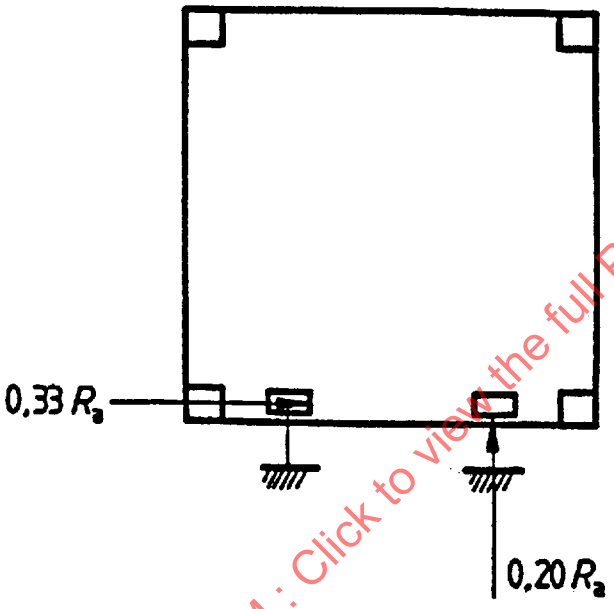
NOTES

1 Container shall be held in cresting position for 5 sec. minimum.

2 Container shall be allowed to drop from the bridging position onto the lower platform.

FIGURE 11e - Diagrammatic Representation of Test Nos. 10 and 11

Test No. 12 - Base restraint on roller bed vehicles - Surface mode



NOTES

1. **Restraint at ground transport end slots only (both ends).**
2. **Apply horizontal and vertical forces, R_a, at both ends of the base, simultaneously.**
3. **Repeat test in the opposite slots unless the slots and base sides are identical.**

FIGURE 11f - Diagrammatic Representation of Test No. 12

APPENDIX A
DETAILED DESIGN REQUIREMENTS

A.1 INTRODUCTION:

The following detailed design requirements are intended to supplement the basic design requirements laid down in 5.3, 5.4, and 5.5. They shall be carefully considered in order to provide serviceable, economical, and practical air/surface containers.

A.2 CONTAINER ASSEMBLY:

A.2.1 The container shall be equipped with devices allowing the air to flow in or out for normal pressure equalization. These devices shall be constructed so as to prevent access to the contents.

A.2.2 The structural and operational integrity of the container shall be maintained in a temperature environment from -54 to +71 °C (-65 to +160 °F).

A.2.3 Material used in the manufacture of the container shall be capable of withstanding the environmental conditions experienced in sea transport, including dock and lighter handling, warehousing, and over-the-road operations.

A.2.4 Container construction shall be free of recesses or voids in which cargo (or other material) could be concealed.

A.2.5 In order to meet agricultural requirements, exterior and interior surfaces should be as free as possible of recesses, railings, and protuberances, where pests could hide or where soil and other residues could accumulate.

A.2.6 The top and bottom corner fittings should be readily replaceable.

A.3 CONTAINER BASE:

A.3.1 There shall be no sharp corners or edges on the base of the container.

A.3.2 The base bottom skin shall be enclosed by its edge rims.

A.3.3 The base should be structurally attached to the body by means of a minimum number of easily removable and interchangeable fittings.

A.3.4 The top of the base should be smooth to allow for easy sliding of the cargo and there shall be no voids or crevices where a considerable amount of dirt can accumulate. The construction shall allow for the efficient drainage of liquids used for cleaning the unit.

A.3.5 The base structure of the container shall be capable of transferring load to or from the longitudinal members of a carrying vehicle that are assumed to lie within the two 250 mm (10 in) wide zones, defined (by the broken lines) in Figure A1.

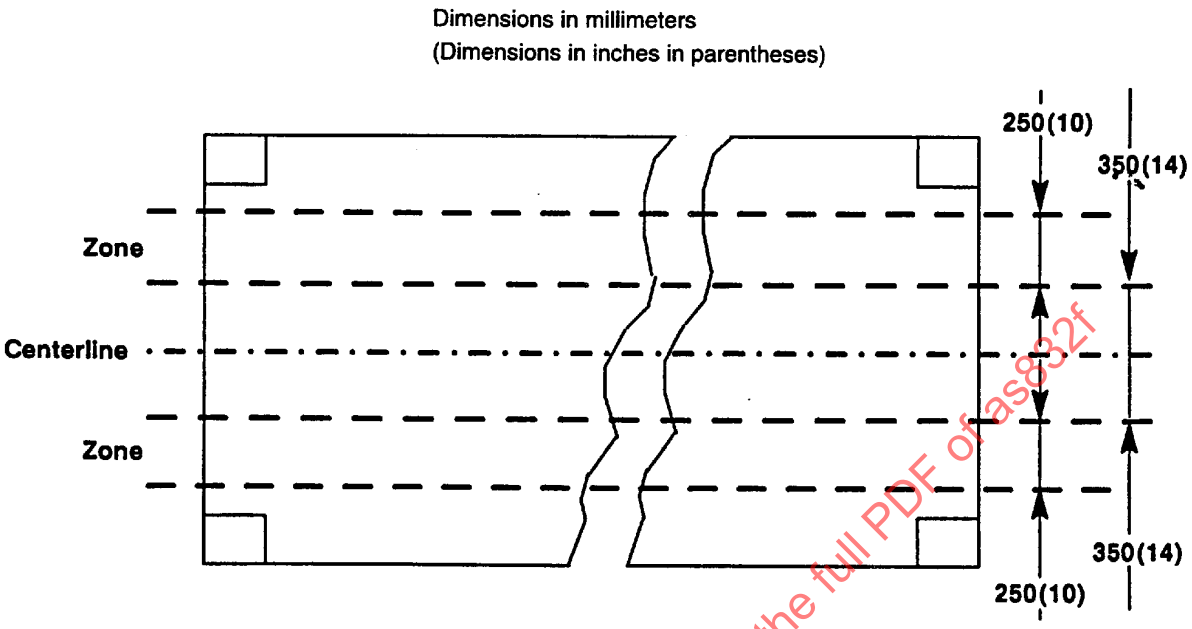


FIGURE A1 - Details of Requirements for Load-Transferring Areas in Base Structures of Containers

A.4 DOORS:

A.4.1 It should be possible for one man to open and close the door in no more than 30 s. No tools should be required to open or close the doors or latches.

A.4.2 The door should have the minimum number of position latches and restraint attachments that will sustain the ultimate load (see 5.3) without unlatching or releasing the container contents.

A.4.3 Latches shall be located so that they cannot damage or be damaged by adjacent units should they inadvertently be left open or become open in flight.

A.4.4 It should be possible to lock (in order to discourage entry) and seal the door so that there shall be some visual indication of unauthorized entry.

A.4.5 Hinges shall be made and fitted so that doors cannot be lifted off the hinge pins, once shut. The screws, bolts, hinge pins, and other fasteners shall be welded to the outer parts of the hinges, unless the closure system has locking devices, inaccessible from the outside, which, when applied, prevent the doors from being lifted off the hinge pins.

A.5 CUSTOMS SEALING:

A.5.1 According to the applicable international conventions (see 3.3), the container design shall provide the features, laid down in A.5.2 and A.5.3, for customs sealing approval.

A.5.2 The container shall be designed, constructed and equipped in such a manner that:

a. Goods cannot be removed from, or introduced into, the sealed container without leaving obvious traces of tampering or without breaking the customs seal.

b. Customs seals can be simply and effectively affixed.

c. It contains no concealed space where goods may be hidden.

d. All space capable of holding goods are readily accessible for customs inspections.

A.5.3 In particular, the following design features shall be provided:

a. The constituent parts of the container (sides, floor, doors, roof, frames, etc.) shall be assembled either by means of devices that cannot be removed and replaced from the outside without leaving obvious traces, or by methods that will produce a structure which cannot be modified without leaving obvious traces. When the sides, floor, doors, and roof are made of various components, these shall meet the same requirements and be of sufficient strength.

b. Doors and all other closing systems (including venting areas, if provided in accordance with 5.3.2) shall be fitted with a device on which a customs seal can be fixed. This device shall be such that it cannot be removed and replaced from the outside without leaving an obvious trace, nor should it enable the door or fastening to be opened without breaking the customs seal. The latter shall be adequately protected.

c. Apertures for venting and drainage, if provided, shall be provided with a device to prevent access to the interior of the container. This device shall be such that it cannot be removed and replaced from the outside without leaving an obvious trace.

APPENDIX B
SECTIONS OF OTHER STANDARDS THAT APPLY TO AIR/SURFACE CONTAINERS

B.1 OVERALL EXTERNAL DIMENSIONS AND TOLERANCES PER ISO 668 - (SEE 4.1 AND 5.3.3):

B.1.1 The nominal container lengths are given in Table B1.

TABLE B1 - Nominal Lengths

Freight Container Designation	Nominal Length m	Nominal Length ft
1A	12[1]	40[1]
1B	9	30
1C	6	20
1D	3	10

[1]In certain countries, there are legal limitations to the overall length of vehicle and load.

B.1.2 The external dimensions and tolerances are given in Table B2 (see Figure B1).

TABLE B2 - External Dimensions and Permissible Tolerances

Freight Container Designation	Length, L mm	Length, L Tolerances mm	Length, L ft	Length, L in	Length L Tolerances in	Width, W mm	Width, W Tolerances mm	Width, W ft	Width, W Tolerances in	Height, H mm	Height H Tolerances in	Height, H ft	Height H Tolerances in
1A	12 192	0 -10	40		0 -3/8	2438	0 -5	8	0 -3/16	2438	0 -5	8	0 -3/16
1B	9 125	0 -10	29	11-1/8	0 -3/8	2438	0 -5	8	0 -3/16	2438	0 -5	8	0 -3/16
1C	6 058	0 -6	19	10-1/2	0 -1/4	2438	0 -5	8	0 -3/16	2438	0 -5	8	0 -3/16
1D	2 991	0 -5	9	9-3/4	0 -3/16	2438	0 -5	8	0 -3/16	2438	0 -5	8	0 -3/16

K_1 = Difference between D_1 and D_2 or between D_3 and D_4, therefore $K_1 = [D_1 - D_2]$ or $K_1 = [D_3 - D_4]$

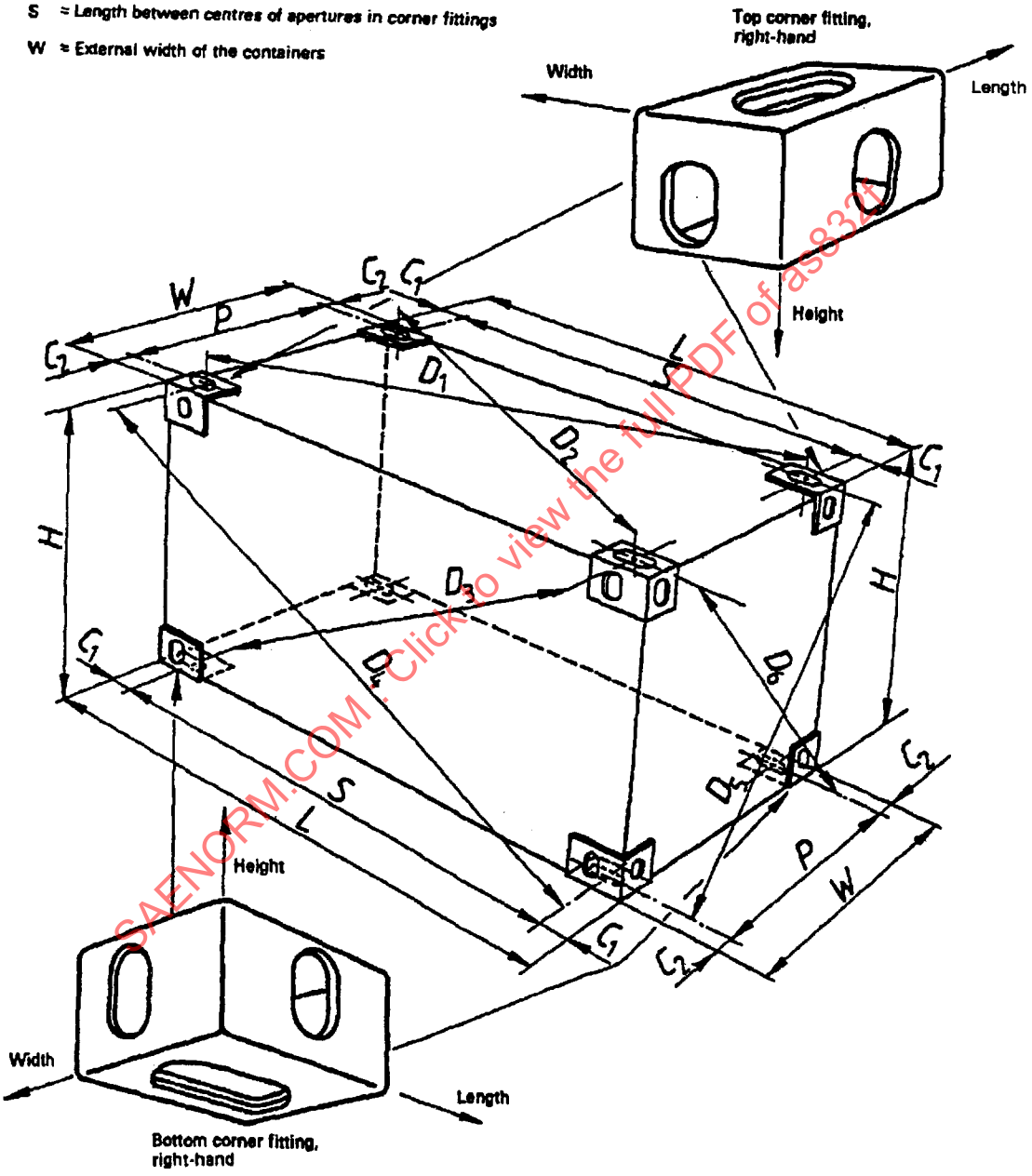
K_2 = Difference between D_5 and D_6, therefore $K_2 = [D_5 - D_6]$

L = External length of the container

P = Width between centres of apertures in corner fittings

S = Length between centres of apertures in corner fittings

W = External width of the containers



NOTE - Dimensions L, H AND W are measured along the appropriate edges.

FIGURE B1 - Corner Fittings

B.1.2.1 The dimensions and tolerances apply when measured at the temperature of 20 °C (68 °F). Measurements taken at other temperatures shall be adjusted accordingly.

B.1.2.2 Corner fitting locations (center-to-center distances and diagonal tolerances) are given in Figure B1 and Table B3.

TABLE B3 - Dimensions and Tolerances Relating to Corner Fitting Locations

Freight Containers Designation	s(ref) mm	s(ref) ft	s(ref) in	p(ref) mm	p(ref) ft	p(ref) in	k_1 max mm	k_1 max in	k_2 max mm	k_2 max in
1A	11 965	39	3-7/8	2259	7	4-31/32	19	3/4	10	3/8
1B	8 918	29	3-1/8	2259	7	4-31/32	16	5/8	10	3/8
1C	5 853	19	2-7/8	2259	7	4-31/32	13	1/2	10	3/8
1D	2 787	9	1-23/32	2259	7	4-31/32	10	3/8	10	3/8

NOTE: Attention of manufacturers is drawn to the vital importance of accurately maintaining the reference dimensions of S and P.

The tolerances to be applied S and P are governed by the tolerances shown for the overall length and width in ISO 668 and ISO 1161.

Symbols for Figure B1 and Table B3:

C1 = Corner fitting measurement $101.5^{+0}_{-1.5}$ mm ($4^{+0}_{-1/16}$ in)

C2 = Corner fitting measurement $89^{+0}_{-1.5}$ mm ($3\ 1/2^{+0}_{-1/16}$ in)

D = Distance between centers of apertures, or projected reference points therefrom, of diagonally opposite corner fittings, resulting in six measurements: D1, D2, D3, D4, D5, and D6

H = Overall height

B.2 TOP CORNER FITTINGS PER ISO 1161 - (SEE 5.1.2 AND 5.3.3):

B.2.1 Dimensional Requirements - General:

B.2.1.1 The dimensions and tolerances of the corner fittings shall conform to Figures B2 and B3. Each container shall have two right-hand top corner fittings (on the right as the observer faces either end of the container) and two left-hand top corner fittings which are mirror images of the right-hand fittings.

The corner fittings shown in Figures B2 and B3 illustrate right-hand top corner fittings only. For the left-hand corner fittings, the dimensions are simply transposed.

B.2.2 Detailed Dimensional and Manufacturing Requirements:

B.2.2.1 Sharp corners shall be removed as far as practicable.

B.2.2.2 Where dimensions are not specified for inner and outer edges of apertures, these edges shall be given a radius of +0 +0
3 -1.5 mm (l/8 -1/16 in).

B.2.2.3 At the junction of the 6 mm (1/4 in) outside edge radii with the 14 mm (9/16 in) edge radius, the corner should be rounded by blending the radiused edges, and removing minimum amounts of material from the flat outer faces and walls.

B.2.2.4 Where a corner fitting has an optional inner sidewall and is made to the minimum dimension of 149 mm (5 7/8 in), the junction of the mandatory horizontal face to the optional inner sidewall may be provided with a radius not exceeding 5 mm (7/32 in).

If a greater radius is required, the 149 mm (5 7/8 in) dimensions shall be increased accordingly.

B.2.3 Strength Requirements:

The corner fittings shall be designed and constructed in such a manner and of such materials as to enable them to pass the operating and testing requirements laid down in ISO 1496/1.