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Series 1 freight containers — Specification and testing — Part VII : Air mode containers

Conteneurs de la série 1 — Spécifications et essais — Partie VII : Conteneurs pour transport aérien

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1496/VII (originally ISO/DIS 2979) was drawn up by Technical Committee ISO/TC 104, *Freight containers*, and circulated to the Member Bodies in July 1973.

It has been approved by the Member Bodies of the following countries :

Australia	Hungary	Sweden
Austria	Israel	Switzerland
Belgium	Mexico	Thailand
Brazil	Netherlands	Turkey
Bulgaria	New Zealand	United Kingdom
Canada	Poland	U.S.A.
Czechoslovakia	Romania	U.S.S.R.
Germany	South Africa, Rep. of	

This International Standard has also been approved by the International Air Transport Association (IATA) and by the International Union of Railways (UIC).

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

France
Japan

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Series 1 freight containers — Specification and testing — Part VII : Air mode containers

0 INTRODUCTION

Aircraft capable of transporting intermodal cargo containers are of two distinct types — fixed wing and rotary wing. Containers are stowed in fixed-wing aircraft in internal compartments only. When transported by rotary-wing aircraft, they may be internally or externally stowed. If externally stowed, the containers are suspended below the structure. These differences give rise to two sets of operating requirements and are described in 0.1 and 0.2.

0.1 Fixed-wing aircraft

Fixed-wing aircraft are subject to change in motion (acceleration and deceleration) both on the ground and in the air.

On the ground, these changes in motion result from various combinations of gravity, landing-gear motions, surface conditions or runways and taxiways, action of shock-absorbing mechanisms, structural elasticity, thrust, rate of change of attitude, braking, and relative wind velocity.

In the air, these changes in motion result from the various combinations of those factors listed above, as well as from the combined effect of changes of altitude, rate of pitch, roll, yaw, and velocity.

In comparison with surface transport, the air transport time is relatively short and the containers are protected when stowed internally aboard the aircraft. From a container design standpoint, the most important ambient environmental factors are temperature and pressure.

Containers for internal air transport are loaded in random intermix linear lengths of 10 ft, 20 ft, 30 ft and 40 ft throughout the aircraft fuselage with the length dimension normally parallel to the centreline of the aircraft. When so loaded, the units are restrained at the container base by a series of slots located along the base as indicated in 5.3.5. Series 1D containers may be placed transversely or at other angles if permitted by the aircraft configuration.[1] The container bottom must be capable of allowing the unit to be conveyed both on ground transport and within the aircraft on roller sections. The requirements for container base stiffness given in 5.3.1.2 b) relate to the design requirements of a specific present-day aircraft and may be relaxed for future aircraft.

0.2 Rotary-wing aircraft

The requirements for containers transported by rotary-wing aircraft are set forth in annex B. A separate International Standard relating to these containers may be prepared when required.

0.3 Relevant publications

For airworthiness requirements, the following document should be consulted :

USA-FAA — Technical Standard Order (TSO) C-90 (NAS 3610), *Specification for cargo unit-load devices or other appropriate regulatory specifications.*

This International Standard also takes into account the following document :

IATA 50/6, *Container specification for high capacity aircraft.*

and was developed in liaison with ISO/TC 20, *Aircraft and space vehicles*, and the International Air Transport Association (IATA).

0.4 Grouping of container types for specification purposes

Part I	General cargo	00 to 09, 50 to 59, 65 to 69
Part II	Thermal	20 to 42
Part III	Tank	70 to 79
Part IV	Bulk	80 to 84
Part V	Platform container	60
Part VI	Collapsible	61 to 64
Part VII	Air mode	90 to 99

NOTE — Container grouping for Parts I to VI will be set forth in detail in the relevant documents.

1) When so located, these containers must have the restraint loads specified in 5.2.5 included in the design as applicable.

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1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard sets out the basic requirements for the specification and testing of ISO series 1A, 1B, 1C and 1D air mode freight containers for general cargo, which are suitable for international exchange and for conveyance by road, rail and sea as well as air, including interchange between these forms of transport.

1.2 The marking requirements for these freight containers are to be in accordance with the principles embodied in ISO 790.

1.3 To denote the container as an air-surface container which can only be stacked two high, the symbol set forth in annex A shall be located at the top left-hand corner of the end and side walls.

1.4 The container types covered by this International Standard are as follows :

Type[1)]	Marking code identification
Air mode	90 – 95 : Fixed wing

2 REFERENCES

ISO 668, *Freight containers – External dimensions and ratings.*

ISO 790, *Marking of series 1 freight containers.*

ISO/R 1161, *Specification of corner fittings for series 1 freight containers.*

ISO 2716, *Identification marking code for freight containers.*

3 SPECIFIC CHARACTERISTICS

Recognizing the unique aircraft requirements, container design should utilize that combination of design and materials which results in as small a tare weight as possible.

4 DIMENSIONS AND RATINGS

4.1 External dimensions

The overall external dimensions and tolerances of the freight containers covered by this International Standard are those established for series 1A, 1B, 1C and 1D freight containers in ISO 668. No part of the basic container shall project beyond the boundaries defined by these overall external dimensions.

Where a container is collapsed for transport when unladen, the height in the collapsed condition shall be a maximum of 813 mm (32 in) for the 1D container, and 610 mm (24 in) for the 1A, 1B and 1C containers.

Joining of collapsed containers to other collapsed containers to form a unitized package, within the external dimensions established in ISO 668, may be by corner fittings or other means. The unitized package shall meet the design features of clause 5, with the following exemptions :

a) The stacking requirements of 5.2.1 do not apply.

b) The gross weight as specified in clause 5 implies, for unitized package of collapsed containers, the total tare weight.

4.2 Internal dimensions

The minimum internal dimensions of the container shall comply with table 1.

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TABLE 1 – **Minimum internal dimensions**

Freight container designation	Minimum width		Minimum height		Minimum length		
	mm	in	mm	in	mm	ft	in
1A	2 299	90 1/2	2 197	86 1/2	11 998	39	4 3/8
1B	2 299	90 1/2	2 197	86 1/2	8 931	29	3 5/8
1C	2 299	90 1/2	2 197	86 1/2	5 867	19	3
1D	2 299	90 1/2	2 197	86 1/2	2 802	9	2 5/16

1) See ISO 2716.

4.2.1 *Door openings*

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

Door openings shall be as large as possible.

General freight containers designated 1A, 1B, 1C and 1D shall have a door opening preferably having dimensions equal to those of the internal cross-section of the container, and in any case not less than 2 134 mm (84 in) high and 2 286 mm (90 in) wide.

4.3 Ratings

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

4.3.1 maximum gross weight[1], *R* : The maximum allowable combined weight of the container and its cargo.

The values of the rating *R* are given in table 2 and are to be used for design purposes.

4.3.2 tare weight[1], *T* : The weight of the empty container, including its normal complement of loading restraint devices.

4.3.3 maximum payload, *P* : The maximum allowable weight[1] of the cargo, equal to the difference between the maximum gross weight and the tare weight.

The values of *P* for design purposes can be determined from table 2.

4.4 Maximum gross weight[1] for air transport

To ensure that the container and its payload do not exceed aircraft structural limitations, containers in air service shall be marked so that they will not be operated, in any transport system, at gross weights in excess of those indicated in table 2.

However, a uniformly distributed load of not more than 6 758 kg (14 900 lb) may be placed in any 3,05 m (10 ft) linear length for 1A, 1B and 1C containers.

TABLE 2 – **Maximum gross weight of container (fixed wing)**

Freight container designation	Maximum gross weight	
	kg	lb
1A	20 412	45 000
1B	15 876	35 000
1C	11 340	25 000
1D	5 670	12 500

5 DESIGN FEATURES

5.1 Definitions

For the design features, the following definitions apply :

5.1.1 operational load : The minimum statically applied load which the container shall be designed to withstand. See 5.2.5.1.

5.1.2 ultimate load : The load under which the container may exhibit permanent deformation but does not rupture to the extent of discharging cargo. See 5.2.5.2.

5.2 General

Each freight container shall be weatherproof except when collapsed.

At its maximum gross weight it shall be capable of fulfilling the following operating requirements :

5.2.1 *Stacking*

Air mode containers shall be capable of supporting in a stacked position one other air mode container meeting the requirements of this International Standard. This relates to terminals and to the top two tiers in ships' cells when loaded to full rated capacity with eccentricity up to 38 mm (1/2 in) in the longitudinal and 25,4 mm (1 in) in the lateral directions. A container, when supported by its four bottom corner fittings by a firm horizontal surface or equivalent, shall be capable of withstanding both the gravitational and inertial loads acting on its four top corner fittings due to the landing of the second air mode container. The load imposed by the second container shall be derived from the downward acceleration. (See 5.2.4.1 and 5.6.)

5.2.2 *Lifting from top corner fittings*

Series 1A, 1B, and 1C containers shall be capable of being lifted from the top at the corners with the lifting forces applied vertically. The 1D container shall be capable of being lifted from the top at the corners with the lifting forces applied at any angle between the vertical and 30° to the vertical.

5.2.3 *Lifting by bottom corner fittings*

Series 1A, 1B, 1C and 1D containers shall be capable of being lifted from the 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. Lifting forces shall be applied at 30° to the vertical.

It may be assumed that each corner fitting bears an equal load.

1) The term "weight" is retained here instead of the correct technical term "mass" in order to conform to current commercial usage.

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5.2.4 *Ground handling*

5.2.4.1 VERTICAL MOVEMENTS

The ground handling equipment will subject the container to certain loads that must be considered by a designer. The lowering of containers onto supports is assumed to produce a dynamic load. The combined effect of this dynamic load and gravity is assumed to produce an equivalent vertical acceleration of 2,0 *g*. The movement of containers by handling equipment shall not impose loads on the container greater than those given in 5.2.5.1.

5.2.4.2 BRIDGING AND CRESTING

The container shall be capable of traversing a 2° crest or bridge condition with no permanent deformation or damage. When the container is uniformly loaded to a maximum gross weight, it shall be capable of being supported at the cresting line by a roller contact of 2 032 mm (80 in) with a roller diameter of 38 mm (1.5 in) maximum.

5.2.5 *Design loads*

5.2.5.1 OPERATIONAL LOADS

The container shall be designed to the operational loads given in table 3 while supported on a roller system in accordance with 5.3.2 and while base restrained in accordance with 5.3.4, 5.3.5 and 5.3.6 with the cargo's centre of gravity located at any point in the range specified in 5.10 and under these loads shall exhibit no permanent deformation.

Under these operational loads, the maximum lateral deflection permitted, measured at the intersection of the top and side panels of the container with the base restrained by the locks, is 38 mm (1.5 in).

The downward load due to gravity is assumed to act simultaneously with the forward, aft and side loads. All other loads for containers transported by fixed-wing aircraft are assumed to act singly.

5.2.5.2 ULTIMATE LOADS

The container shall be designed to the ultimate loads given in table 4 while supported on a roller system in accordance with 5.3.2 and while base restrained in accordance with 5.3.4, 5.3.5 and 5.3.6 with the cargo's centre of gravity located at any point in the range specified in 5.10.

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

The ultimate loads given in table 4 are mutually exclusive except that the downward load due to gravity is assumed to act simultaneously with the forward, aft and side loads.

NOTE – The load given in 5.2.5.1 and 5.2.5.2 include those loads required for all transport systems (including road, rail, sea) covered by this International Standard.

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TABLE 3 – **Operational loads**

Freight container designation	Maximum unit gross weight		Operational loads									
			Forward		Aft		Side		Up		Down	
	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
1A	20 412	45 000	20 412	45 000	20 412	45 000	20 412	45 000	20 412	45 000	61 235	135 000
1B	15 876	35 000	15 876	35 000	15 876	35 000	15 876	35 000	15 876	35 000	47 628	105 000
1C	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	34 020	75 000
1D	5 670	12 500	5 670	12 500	5 670	12 500	5 670	12 500	5 670	12 500	17 010	37 500

TABLE 4 – **Ultimate loads**

Freight container designation	Maximum unit gross weight		Ultimate loads									
			Forward		Aft		Side		Up		Down	
	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
1A	20 412	45 000	30 618	67 500	30 618	67 500	30 618	67 500	51 030	112 500	102 060	225 000
1B	15 876	35 000	23 814	52 500	23 814	52 500	23 814	52 500	39 690	87 500	79 380	175 000
1C	11 340	25 000	17 010	37 500	17 010	37 500	17 010	37 500	28 350	62 500	56 700	125 000
1D	5 670	12 500	8 505	18 750	8 505	18 750	8 505	18 750	14 175	31 250	28 350	62 500

5.3 Floor and bottom

The floor and bottom along with the restraint slots shall constitute the base of the container.

5.3.1 *Container bottom*

5.3.1.1 The container shall have a smooth bottom below which there shall be no protrusions.

5.3.1.2 To maintain a reasonable allowable unit load on the roller system within the aircraft, the following requirements for the smooth shall apply :

a) The bottom of the unloaded container shall be smooth to a perfectly flat plane within 1,5 mm (1/16 in). This shall allow for a waviness factor of crest-to-crest peak at a pitch of 914 mm (36 in) minimum.

b) In order to allow 1A and 1B containers to conform to the aircraft system deflected shape, the base, when loaded in accordance with 4.4, shall have freedom to deflect ± 9,5 mm (± 3/8 in) without rigid restraint by the side walls. Base stiffness in the forward and aft directions in the plane of the base shall not exceed an EI value of 338 000 $N \cdot m^2/m$ [3×10^6 $lbf \cdot in^2/in$].

5.3.2 *Container base for handling*

The container base, when loaded in accordance with 4.4, shall be capable of being supported and moved on minimum conveyor systems such as the following or their equivalents :

a) Four rows of rollers equally spaced over a minimum width of 1 930 mm (76 in), measured between centres, with each row composed of 38 mm (1.5 in) diameter rollers 76,2 mm (3 in) long, uncrowned and with an edge radius of 1,4 mm (0.06 in) spaced on centres 254 mm (10 in) apart. The container must travel perpendicular to the roller axes.

b) Swivel casters with 25,4 mm (1 in) diameter wheels and contact length of 50,8 mm (2 in) located on a 305 mm × 305 mm (12 in × 12 in) grid pattern. The container may travel in any direction.

c) Ball transfer units with 25,4 mm (1 in) diameter steel balls located on a 127 mm × 127 mm (5 in × 5 in) grid pattern.

GENERAL NOTE – Restraint methods as shown in figures 3 and 4 shall be considered for all containers on the above-listed minimum conveyor systems.

5.3.2.1 Due to the flat-bottom configuration, for surface transport, ISO-type adapter fittings or other separator means may be attached to the applicable corner fittings. (See ISO/R 1161.) For stacking in ships' cells (i.e. the top two tiers) and in terminals, such adapter fittings shall be attached to the applicable corner fittings.

5.3.2.2 The container base deflection, when loaded in accordance with 4.4, shall not exceed 25,4 mm (1 in).

5.3.3 *Floor*

The floor of the freight container, when supported in accordance with 5.3.2 a), b) and c), shall be capable of withstanding without rupture a uniformly distributed load of not less than 5,0 *P*.

In addition, the floor shall be capable of withstanding

a) a wheel load over the entire floor of not less than 2 730 kg (6 000 lb) per wheel, applied to a contact area not greater than 142 cm^2 (22 in^2), assuming a wheel width of not less than 180 mm (7 in) and a distance between wheel centres of 760 mm (30 in), and

b) a wheel load of 4 090 kg (9 000 lb) per wheel over the area extending 460 mm (18 in) inside the door.

5.3.4 *Container base restraint*

The container shall be restrained within the aircraft by means of a series of slots located along each side at the base and dimensioned as shown in figures 1 and 2. The container surface between slots at the side shall be smooth and continuous so as to afford an indented or slotted area within the intended slot only.

5.3.5 *Base restraint loads*

Side loads shall be reacted at the container base. Upward, forward and aft loads shall be reacted by a fitting as shown in figures 3 and 4, inserted into the restraint slots. The design shall allow the forward and aft loads to be reacted by the following number of load-bearing slots :

- 1D, 10 ft container : 2 slots
- 1C, 20 ft container : 5 slots
- 1B, 30 ft container : 8 slots
- 1A, 40 ft container : 11 slots

The ultimate forward and aft loads for any slot shall be 8 505 kg (18 750 lb). For forward and aft loads, the load-bearing slots shall be considered effective whether on one or both sides of the container. The container shall be designed to be restrained against vertical loads by 50 to 60 % of the total number of slots equally distributed on each side. The upward load shall be reacted by a minimum fitting, as shown in figure 3, inserted in the side restraint slots.

5.3.6 *End slots*

The container shall be provided with end slots in accordance with figure 5.

5.3.6.1 BASE RESTRAINT LOADS – 1 D CONTAINERS

In addition to the requirements of 5.3.4 and 5.3.5, end restraint slots shall be designed to restrain a 1D container for ultimate forward, aft and vertical upward loads when used in conjunction with restraint fittings in accordance with figure 4 and slot dimensions in accordance with figure 5.

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5.3.7 *Edge characteristics*

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

5.4 Roof

The roof of the freight container shall be capable of withstanding a uniformly distributed load of not less than 300 kg (660 lb) on an area of 600 mm × 300 mm (24 in × 12 in) applied vertically downwards. The roof shall also be capable of withstanding a uniformly distributed load of 2,5 *P* applied vertically upwards.

5.5 Walls

Each end wall shall be capable of withstanding a uniformly distributed internal load of not less than 1,5 *P*. Each side (length dimension) shall be capable of withstanding a uniformly distributed internal load of not less than 1,5 *P*.

5.6 Corner fittings

Series 1A, 1B, 1C and 1D containers shall be equipped with corner fittings at the top and bottom corners. The top corner fittings shall meet the requirements of ISO/R 1161. The container roof shall be recessed 6 mm (1/4 in) below the top surface of the top corner fittings.

The bottom faces of the bottom corner fittings shall be flush with the container base and shall meet the requirements set forth in figures 7, 8 and 9.

When required for handling on aircraft conveyance systems, the bottom corner fittings may be recessed and shall meet the requirements set forth in figures 10, 11 and 12. Where the recessed corner fitting is employed, the difference in planes of the corner fitting related to the edge member shall be compensated by blending the edge member at 21° to the plane of the recessed corner fitting.

In a collapsible-type container, top-lifting apertures, identical to those in the top corner fitting in the assembled condition, shall be provided for top lifting in the collapsed condition. A positive means of locking to other similar containers when stacked in the collapsed condition shall also be provided as a permanent feature of the container.

5.6.1 *Deck lashing*

No requirement for deck lashing is set forth as air-surface containers shall be carried only in the top two positions of ships' cells.

5.7 Fork-lift pockets

Fork-lift pockets may be provided as optional features for the 1C and 1D freight containers. The dimensional requirements for such pockets are specified in figure 6.

5.8 Provisions for handling by means of straddle carriers and similar equipment

Provisions for handling all series 1 freight containers by means of straddle carriers and similar equipment may be provided as optional features. The dimensional requirements for such provisions are specified in annex C.

NOTE – The requirements of 5.6, 5.7 and 5.8 do not preclude the provision of additional facilities for lifting, either from the top or at the base of the freight container.

5.9 Cargo restraint

Securing points shall be provided internally at the base frame for the attachment of devices for the lashing of the cargo. These points shall be "D" rings or equivalent, rated at 1 814 kg (4 000 lb) each, and shall be located on 609,6 mm (24 in) centres around the internal periphery of the container base. The ring shall be capable of reacting this load in any direction.

5.10 Centre-of-gravity requirements

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

a) ± 10 % of the internal width measured from the geometric centre;

b) ± 5 % of the internal length measured from the geometric centre;

c) distance of 356 mm (14 in) above the lower surface of the base to midway between the floor surface and the under side of the roof.

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

5.11 Service conditions

5.11.1 The container materials utilized shall meet the fire-resistance requirements of the appropriate air-worthiness regulatory body.

5.11.2 The container shall employ devices permitting air to flow in or out for normal pressure equalization.

5.11.3 The container shall be equipped with means for providing emergency pressure relief, equivalent to a panel size of 77,4 cm² (12 in²) for each 3 048 mm (10 ft) section. The panel shall be protected from cargo load shifting to ensure that the required panel area is available during aircraft emergency operation. This panel, or its equivalent, shall be considered as a blowout panel to relieve internal pressure when in service.

NOTE – This may be provided by a section or sections that provide continuous unrestricted air flow from inside to outside.

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

5.11.5 Material utilized in the container shall be capable of withstanding the environmental conditions experienced in sea transport.

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6 TESTING

6.1 General

Freight containers complying with the operating requirements specified in clause 5 shall not be inferior to containers which have met the tests specified in 6.2 to 6.11 inclusive. It is recommended that the test for weather-proofness (Test No. 10) be made last.

Unless otherwise noted, operational design loads are employed in all tests. In selected cases, tests may be repeated under ultimate load conditions, when required, for substantiation of analytical date. If this becomes necessary, the container so tested shall not be used in service.

6.1.1 The symbol R denotes the maximum gross weight of the freight container and the symbol P denotes the maximum payload of the container under test, i.e., the tare weight T subtracted from the maximum gross weight.

$$R = P + T$$

6.1.2 The test load within the container shall be uniformly distributed.

6.1.3 All tests noted are static tests.

6.1.4 A certificate showing the date of latest calibration of the test instruments shall be made available.

6.1.5 Test equipment and methods of testing described are not intended to be restrictive. Alternative equivalent methods to accomplish the desired result may be employed.

6.1.6 When restraint or movement on an aircraft system is used, the test system shall be in accordance with 5.3.2, 5.3.4 and 5.3.5. Latches and guide rails of suitable strength shall be provided to guide the container along the conveyor and secure it at its latch points. The test system shall be of sufficient length to permit cycling of the longest container to be tested.

6.2 Test No. 1 – Stacking

6.2.1 *Procedure*

The freight container under test shall be placed on four level pads, one under each bottom corner fitting or equivalent corner structure. The pads shall be centralized under the fittings and be substantially of the same plan dimensions as the fittings. The container shall be loaded to 1,8 R.

6.2.1.1 One container of the same dimensions and maximum gross weight, uniformly loaded to 1,8 R, shall be stacked on top of the container under test. The top container shall be stacked offset from the container under test by 25,4 mm (1 in) laterally and 38 mm (1.5 in) longitudinally.

6.2.1.2 Alternatively, the container under test as specified in 6.2.1.1 may be subjected to a load of 1,8 R applied through four pads of the same plan area as the corner fittings, the load being equally divided among the four corner fittings. Each pad shall be offset in the same direction by 25,4 mm (1 in) laterally and 38 mm (1.5 in) longitudinally.

6.2.2 *Requirements*

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

6.3 Test No. 2 – Lifting from the top corner fittings

6.3.1 *Procedure*

The test container shall be loaded to 2 R.

The container shall then be carefully lifted from all four top corners in such a way that no noticeable acceleration or deceleration forces are applied. No portion of the container shall touch the ground during the test.

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 30° from the vertical.

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

6.3.2 *Requirements*

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

6.4 Test No. 3 – Lifting from the bottom corner fittings

6.4.1 *General*

This test shall be carried out on series 1A, 1B, 1C and 1D containers.

6.4.2 *Procedure*

The test container shall be loaded to a total weight equivalent to 2 R.

The container shall then be lifted from all four bottom corners in such a way that no noticeable acceleration or deceleration forces are applied. For all containers, lifting forces are applied by means of lifting devices bearing on the bottom corner fittings only and attached to a single transverse central spreader beam above the container. The angle of the lifting slings shall not be less than 30° from the

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vertical. In each case, the lines of action of the lifting force and the outer face of the corner fitting shall be no farther apart than 38 mm (1 1/2 in). The lifting shall be carried out in such a manner that the lifting devices bear on the bottom fittings only.

The container shall be suspended for not less than 5 min and then lowered to the ground. No portion of the container shall touch the ground during the test.

6.4.3 *Requirements*

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

6.5 Test No. 4 — Ground handling (Terminal operations)

NOTE — The following test is to meet the operating requirements for restraint in transit as specified in 5.2.4.

6.5.1 *Procedure*

The freight container shall be restrained longitudinally by securing the bottom corner fittings at one end to suitable anchor points. Each end shall be tested.

The freight container, loaded to *R*, shall be secured to rigid anchor points through the bottom apertures of the bottom corner fittings at one end of the container. A force equivalent to a load of 2,0 *R* shall be applied horizontally to the container, through the bottom aperture of the other bottom corner fittings, first towards and then away from the anchor points.

6.5.2 *Requirements*

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

6.6 Test No. 5 — End wall strength

6.6.1 *Procedure*

The container shall be latched to an aircraft system or its equivalent. The number of latches indicated in 5.3.5 shall be engaged on one side of the container and the latch adjusted by a suitable means to assure contact with the end of the latch receptacle slot. The container shall be loaded to a weight equal to 1,00 *P* and the container so positioned that the end wall is the only surface that is loaded.

The freight container shall have each end tested when one end is blind and the other equipped with doors.

For the 1D container, the test shall be repeated using only restraints in fore and aft slots in accordance with figures 4 and 5 and with 5.3.6.

6.6.1.1 Surface transport

An additional test to that of 6.6.1 is required for surface transport. With the corner fittings of the container under test secured to pads or securing fittings, the container shall be subjected to an internal load of 0,4 *P*. The internal load shall be uniformly distributed over the wall under test.

The container shall have each end tested when one end is blind and the other equipped with doors. If construction is symmetrical, only one end need be tested.

6.6.2 *Requirements*

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

6.7 Test No. 6 — Side wall strength

6.7.1 *Procedure*

The container shall be latched to an aircraft system or its equivalent. 50 % of all the latches, equally spaced on both container sides, shall be engaged and the latches adjusted by suitable means to ensure vertical restraint. The container shall be loaded to a weight equal to 1,0 *P* and this lateral force shall be applied uniformly over the inner surface of the side panel. Should the structure not be identical, both sides shall be tested.

6.7.1.1 Surface transport

An additional test to that of 6.7.1 is required for surface transport. With the corner fittings of the container under test secured to pads or securing fittings, the container shall be subjected to an internal load of 0,6 *P* uniformly distributed over the side under test.

Each side wall of the container shall be tested, but only one side wall need be tested if construction is symmetrical.

6.7.2 *Requirements*

During the test the lateral deflection at the intersection of the top and side panels shall not exceed 38 mm (1.5 in).

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

6.8 Test No. 7 — Roof strength

6.8.1 *Procedure*

The container shall be suspended upside down from the aircraft loading system or its equivalent. 50 % of the total number of latches, equally distributed on both sides, shall

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be engaged and adjusted by a suitable means to ensure contact when the load is applied. The container shall have a load equal to 1,0 *P* uniformly distributed over the inside of the roof.

This test shall be repeated for the 1D container using only restraint in fore and aft slots in accordance with 5.3.6.

6.8.1.1 PROCEDURE FOR GROUND HANDLING

A load of 300 kg (660 lb) shall be distributed vertically downwards over an area of 600 mm × 300 mm (24 in × 12 in) located at the weakest area of the roof of the freight container.

6.8.2 *Requirements*

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

6.9 Test No. 8 — Floor strength

6.9.1 *Procedure*

6.9.1.1 The container shall be located on a smooth floor for uniform support when internal fork-lift wheel loads are applied on the inside floor.

An industrial truck equipped with tyres loaded to an axle weight of 5 460 kg (12 000 lb), including the weight of the truck, or 2 730 kg (6 000 lb) per wheel applied to a contact area of 142 cm^2 (22 in^2) assuming a wheel width of 180 mm (7 in) and a distance between wheel centres of 760 mm (30 in) shall be manœuvered over the entire floor area of the freight container in a longitudinal direction. The same industrial truck loaded to 4 080 kg (9 000 lb) per wheel shall then be manœuvered over an area extending 460 mm (18 in) inside the door.

The test shall be repeated with the container resting on the four bottom corner fitting supports of a skeletal-type chassis.

6.9.1.2 While retained on the aircraft loading system or its equivalent, the floor shall be uniformly loaded to 57,5 kN/m^2 (1 200 lbf/ft^2). The load shall be applied to an area 1,524 m (5 ft) wide centered in the container and the load shall equal but not exceed 3 *P*. No permanent deformation or damage shall occur.

The container shall be uniformly loaded to its maximum gross weight and cycled 100 times over a substantially level section of the aircraft system or equivalent at a minimum speed of 18,28 m/min (60 ft/min). Each cycle shall be equal to twice the container length. At test speed, draw-bar pull shall be recorded during the first and last cycles. Maximum allowable draw-bar pull shall be 3 % of the maximum gross weight. Maximum variation of draw-bar pull from the first to the last cycle shall not exceed 0,5 % of the maximum gross weight.

With the container still loaded to its maximum gross weight and retained on the aircraft system or equivalent, the doors shall be fully opened and closed for three complete cycles. The doors shall open and close with no prevalent binding and the locks shall engage and disengage with ease.

The test shall be repeated with the container supported by the four bottom corner fittings.

6.9.1.3 For 1A and 1B containers, the container shall be supported on bars placed on a smooth floor with the container loaded to its maximum gross weight *R*. A bar with a radius of 19 mm (3/4 in) and a height of 9,5 mm (3/8 in) shall support the container across the width at each end and a third bar with a radius of 19 mm (3/4 in) and a height of 19 mm (3/4 in) shall support the container across the width at the centre of the container length. The container base shall contact the floor at a distance of 1 800 ± 305 mm (6 ± 1 ft) from the end supporting bars.

6.9.1.4 With the container loaded to 1,0 *R* and supported by the four bottom corner fittings, the maximum deflection of the lower surface of the container shall not exceed 25,4 mm (1 in).

NOTE — This test is to meet the requirements of 5.3.2.2.

6.9.1.5 Cargo tie-down rings shall be tested by applying a tension load of 1 814 kg (4 000 lb) at 45° to the horizontal and vertical planes with the force passing through the ring attachment.

6.9.2 *Requirements*

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

6.10 Test No. 9 — Bridging and cresting

6.10.1 *Procedure*

The container shall be uniformly loaded to its maximum gross weight and shall be supported at the cresting line by a roller contact of 2 032 mm (8 in) with a maximum roller diameter of 38 mm (1.5 in).

6.10.2 *Requirements*

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

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6.11 Test No. 10 — Weatherproofness

6.11.1 *Procedure*

A stream of water shall be applied to all exterior joints and seams of the freight container from a nozzle of 12,5 mm (0.5 in) inside diameter, at a pressure of about 1 bar (corresponding to a head of about 10 m (33 ft) of water). The nozzle shall be held at a distance of 1,5 m (5 ft) from the container's exterior joints and seams and the stream of water shall have a rate of travel 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 would be given by a single nozzle.

6.11.2 *Requirements*

Upon completion of the test, the container shall be free from penetration of water.

NOTE — An alternative weatherproofness test is available in clause 6.4.7 of the IATA Standard Specification 50/6.

6.12 Test No. 11 — Lifting from fork-lift pockets (when fitted)

6.12.1 *General*

This test is applicable to containers 1C and 1D, when fitted with fork-lift pockets.

6.12.2 *Procedure*

The container under test shall have a load uniformly distributed over the floor in such a way that the weight of the container and test load is equal to 1,25 R, and shall be supported on two horizontal bars, each 200 mm (8 in) wide, projecting 1 828 ± 3 mm (72 ± 1/8 in) into the fork-lift pocket, measured from the outside face of the side of the container. The bars shall be centered within the pockets.

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

6.12.3 *Requirements*

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

6.13 Test No. 12 — Lifting at the base at grappler arms positions

6.13.1 *General*

This test shall be carried out on all containers with provisions for being lifted by grappler arms or similar devices with lifting positions as detailed in annex C.

6.13.2 *Procedure*

The container under test shall have a load uniformly distributed over the floor in such a way that the weight of the container and test load is equal to 1,25 R and shall be supported at the four positions where provision has been made for the equipment specified in 6.13.1 over an area of 32 mm × 254 mm (1.25 in × 10 in) centrally located at each of the four positions, clear of the safety lips.

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

6.13.3 *Requirements*

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

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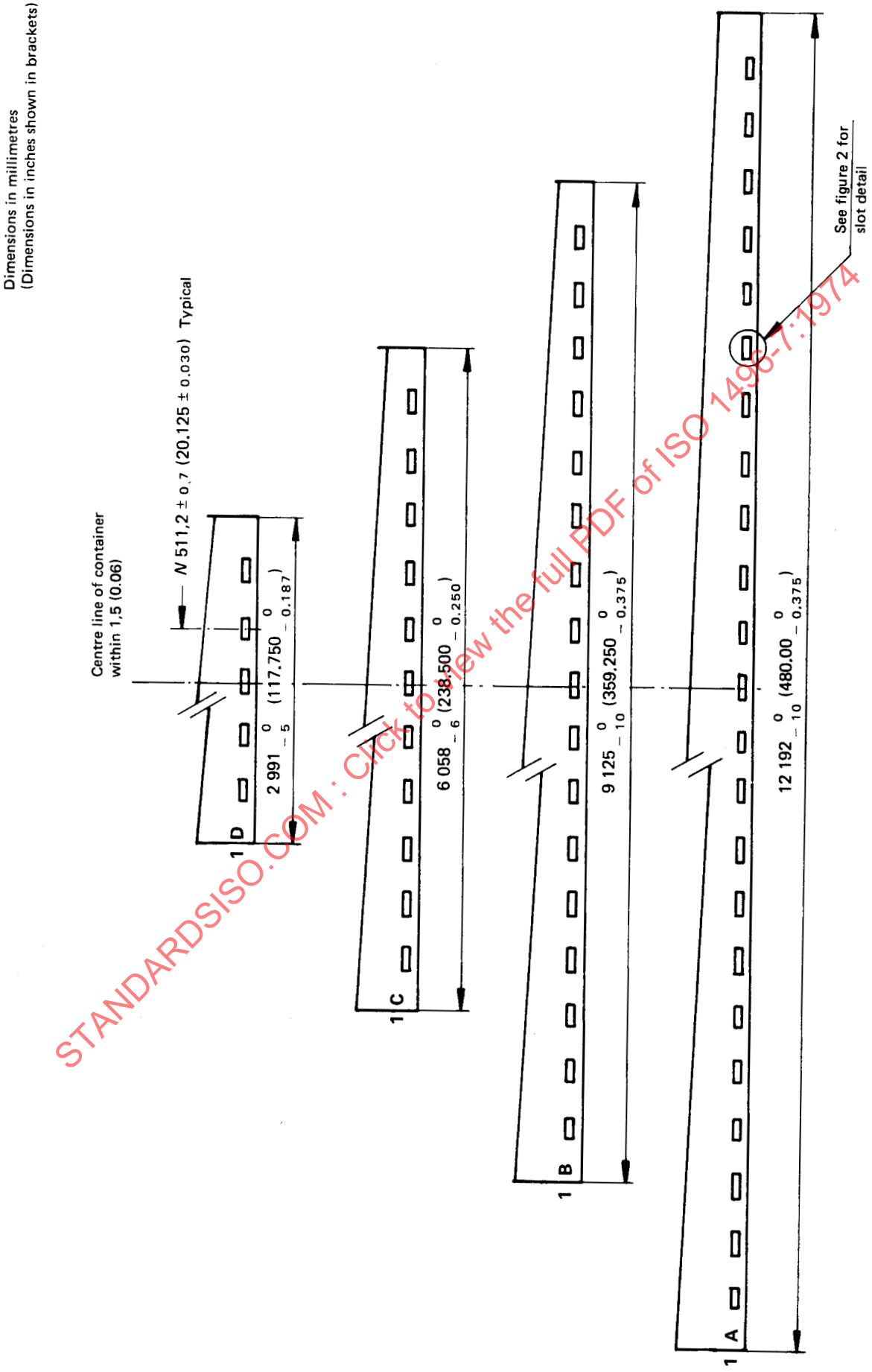

FIGURE 1 – **Location of side restraint slots**

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Dimensions in millimetres
(Dimensions in inches shown in brackets)

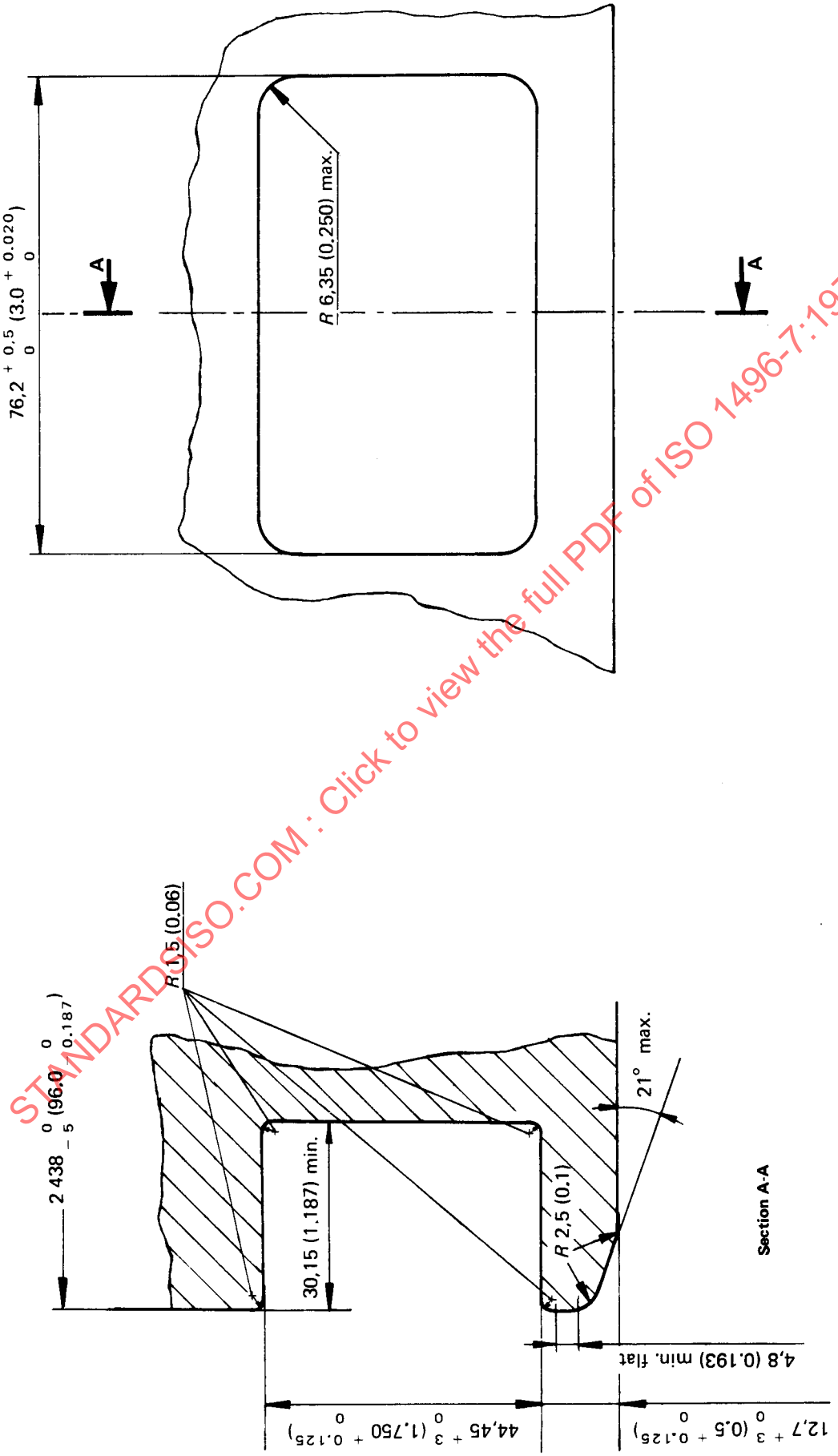

FIGURE 2 – Side slot detail

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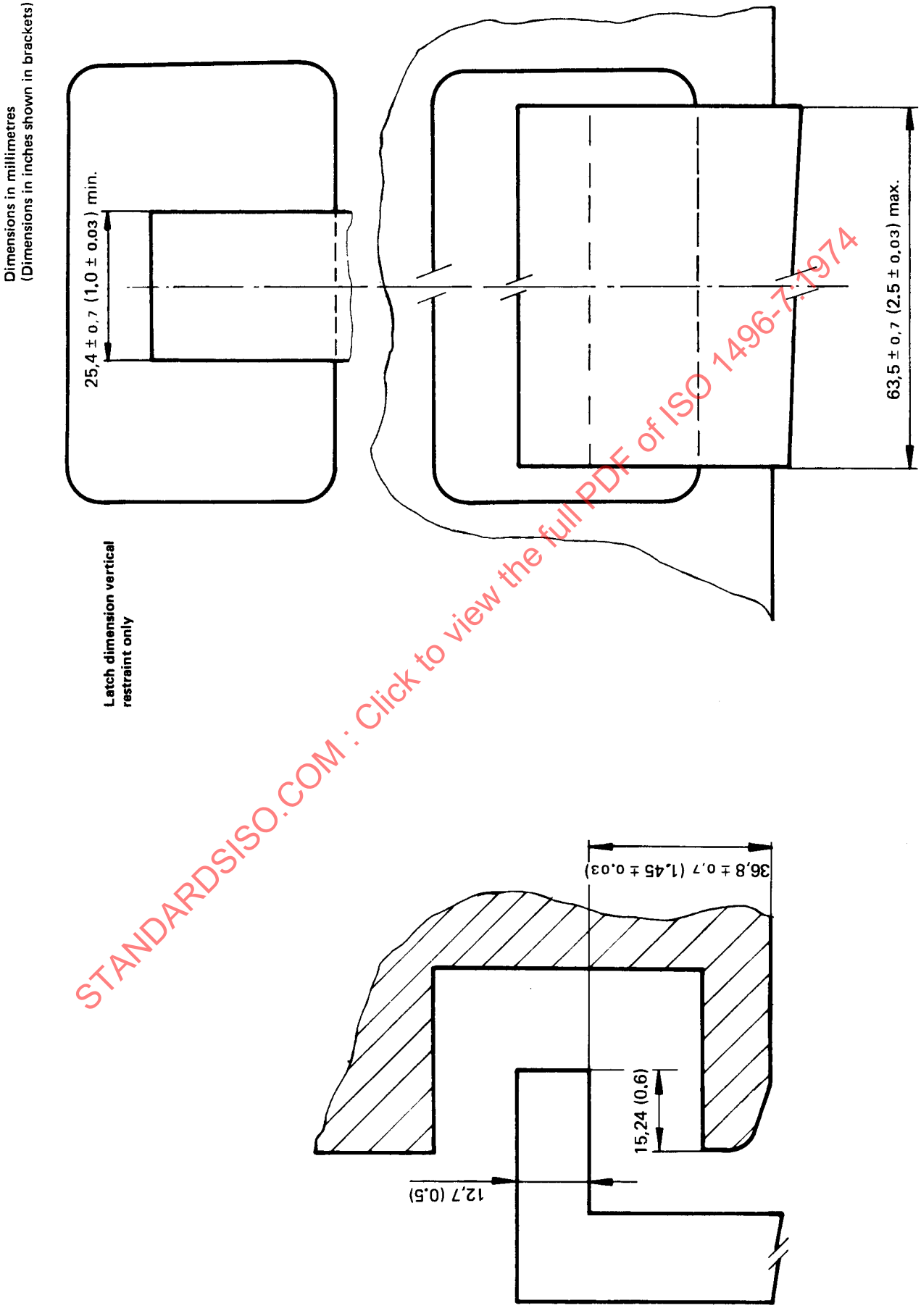

FIGURE 3 — Side latch dimensions — Fore, aft, up and side loads

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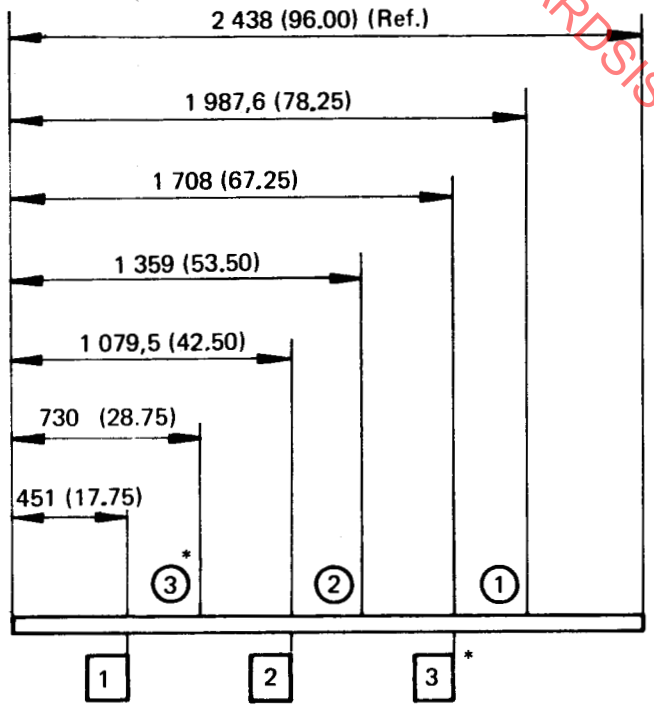
Dimensions in millimetres
(Dimensions in inches shown in brackets)



* Set of 3 latch locations used depending on orientation in aircraft

FIGURE 4A — **End restraint locations**

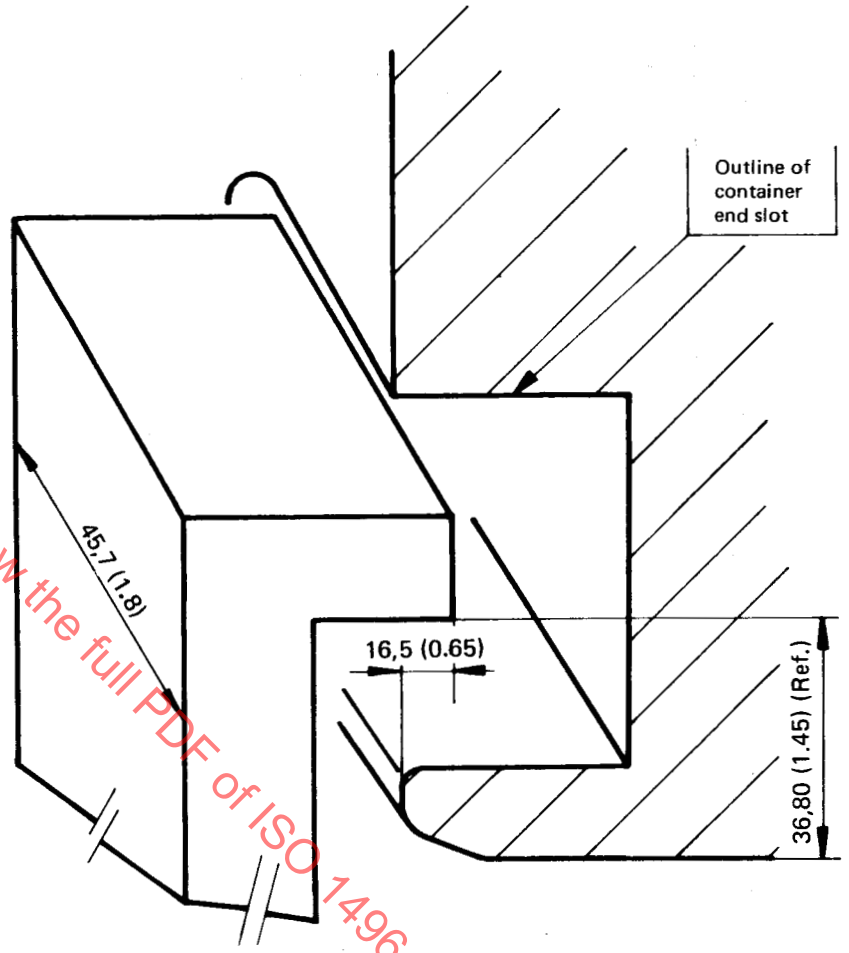


FIGURE 4B — **End latch dimensions**

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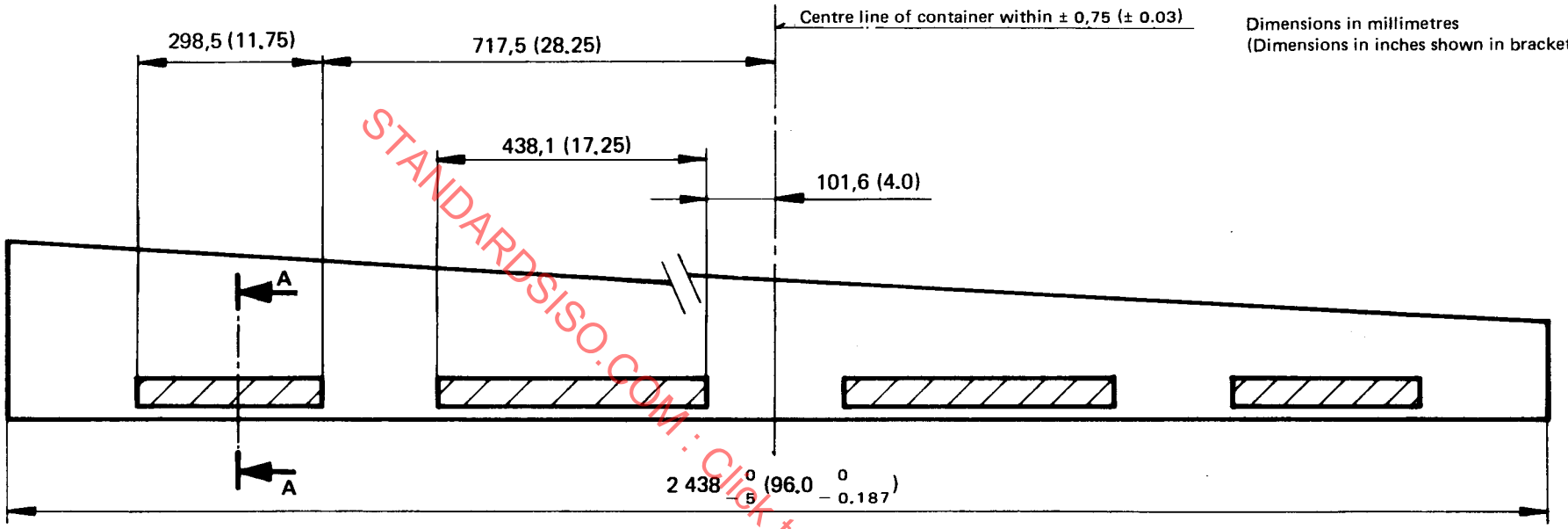

NOTES

1 Slots are indicated thus : 

2 Tolerance : ± 0,7 (± 0.03) unless otherwise stated.

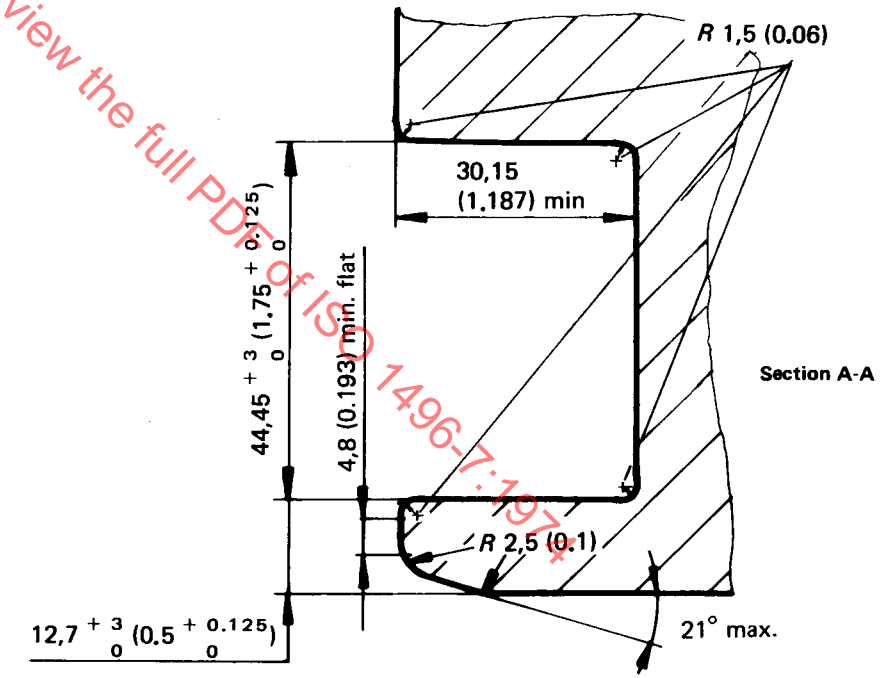

FIGURE 5 — **End slots**

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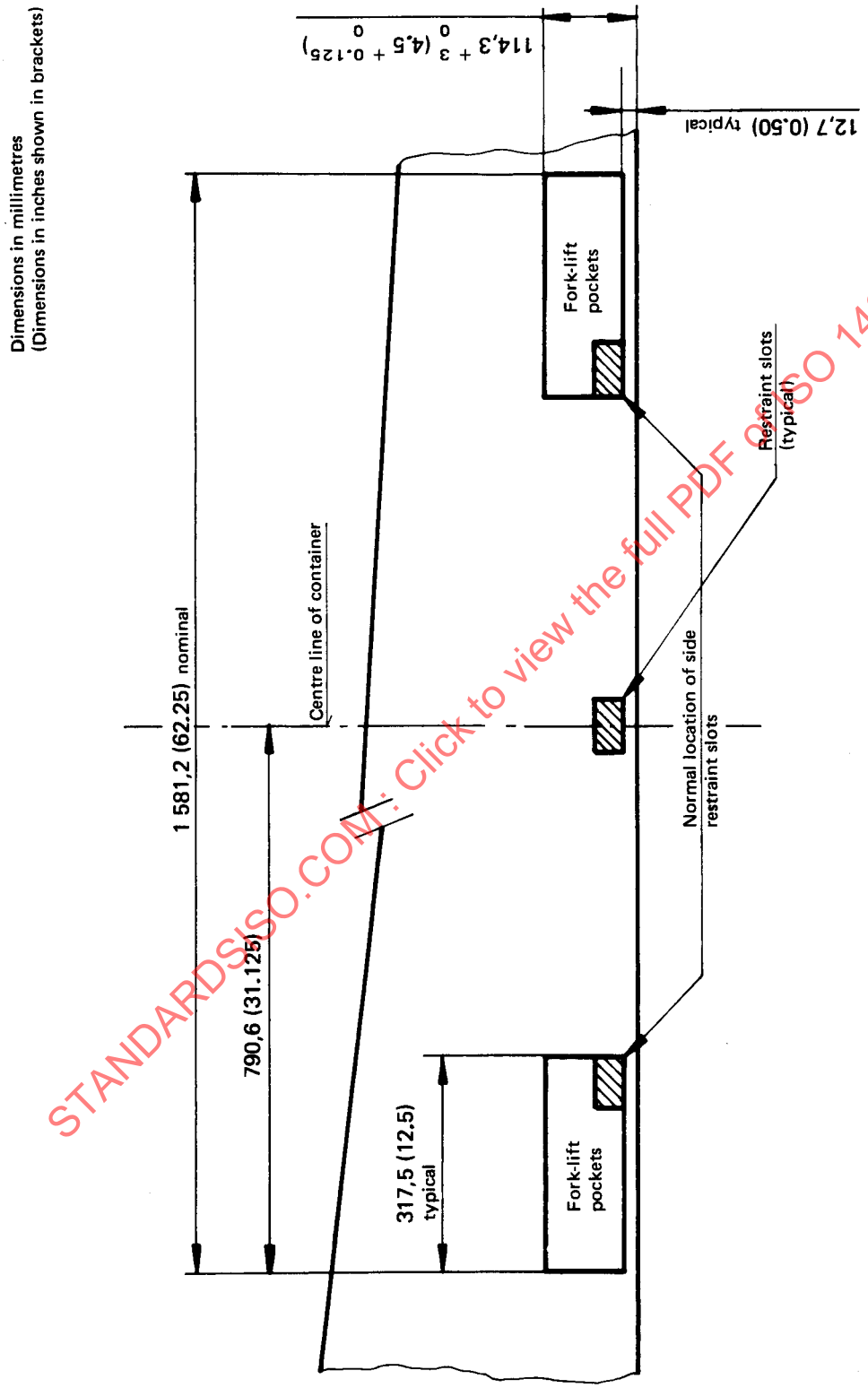

FIGURE 6 – **Optional provisions for handling 1C and 1D containers by means of fork-lift trucks** (see 5.7)

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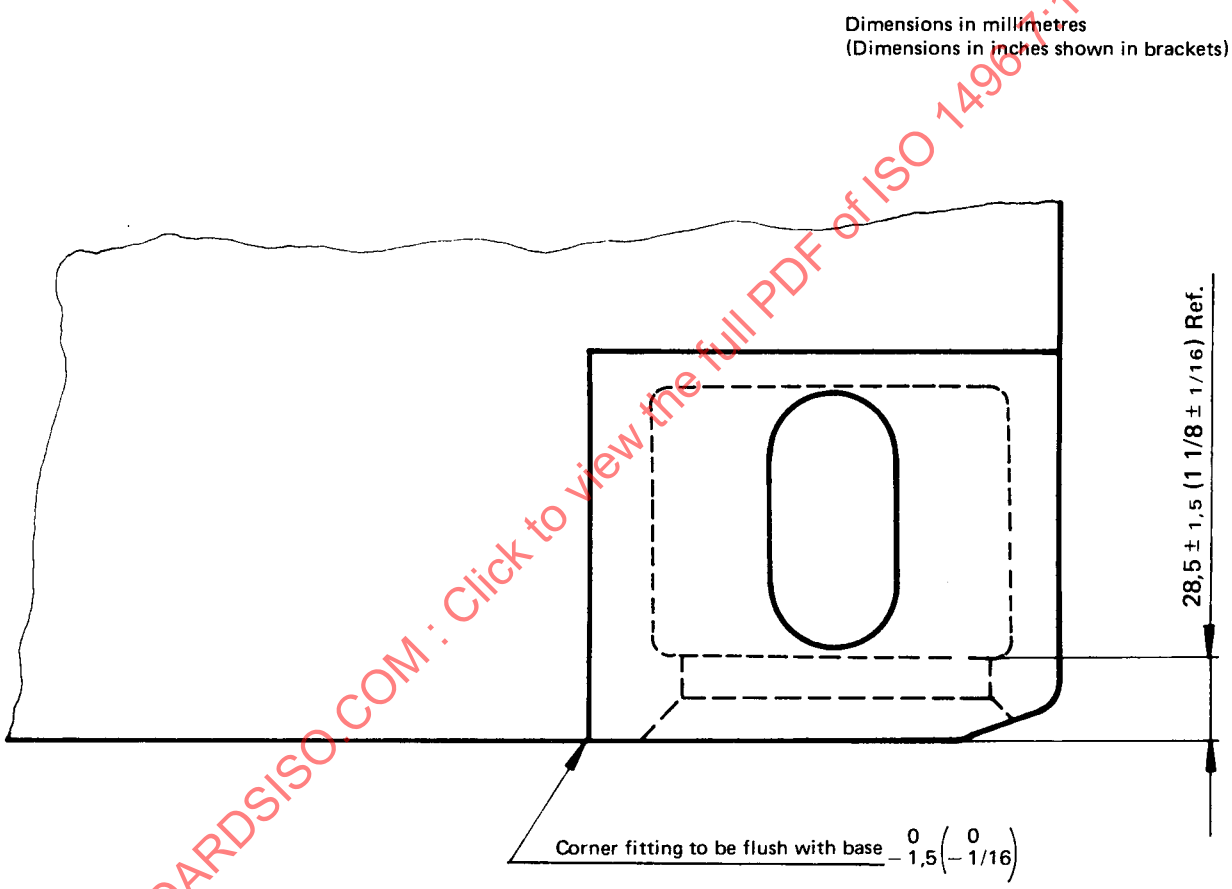

FIGURE 7 — **Location of bottom corner fitting**

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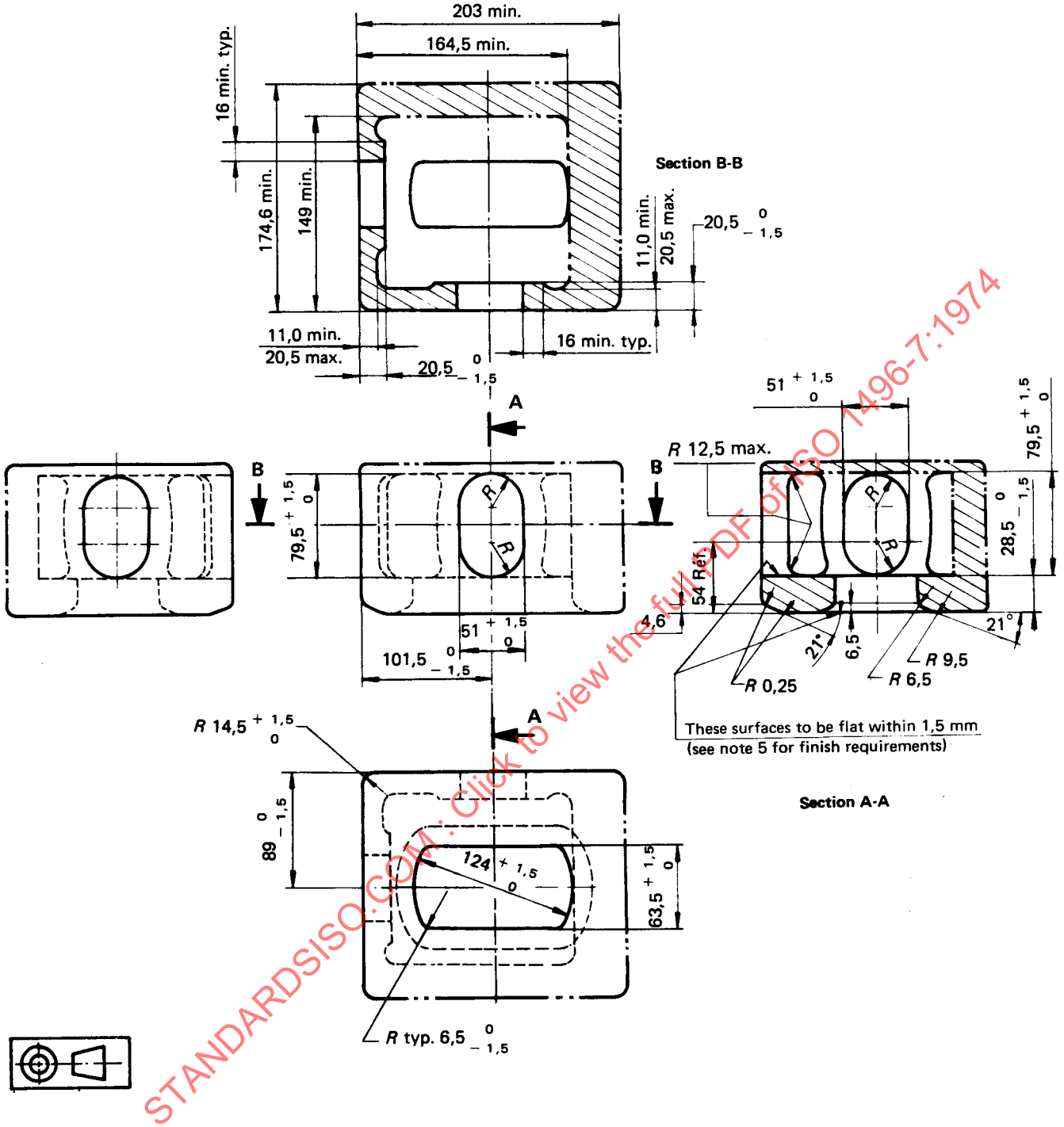

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NOTES

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

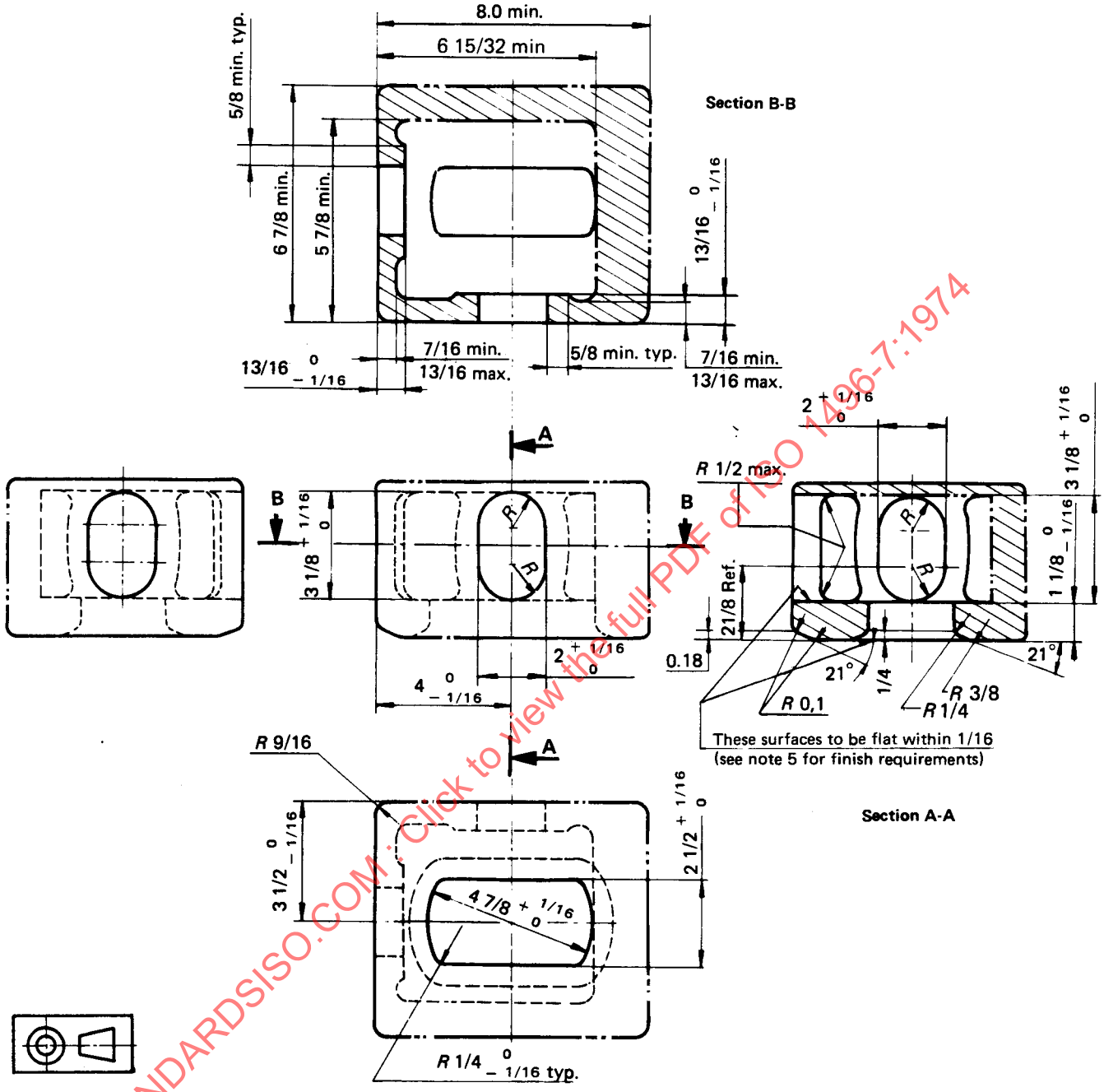
2 Phantom lines (—·—·—) show optional walls which may be used to develop a box-shaped fitting.

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

4 Four fittings required per container, 2 left hand and 2 right hand.

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

FIGURE 8 – **Bottom corner fitting – Dimensions in millimetres** (see figure 7)



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NOTES

1 Solid and dotted lines (—and ---) show surfaces and contours which must 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 must be 1/8 in max. except as noted.

4 Four fittings required per container, 2 left hand and 2 right hand.

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

FIGURE 9 – **Bottom corner fitting – Dimensions in inches** (see figure 7)

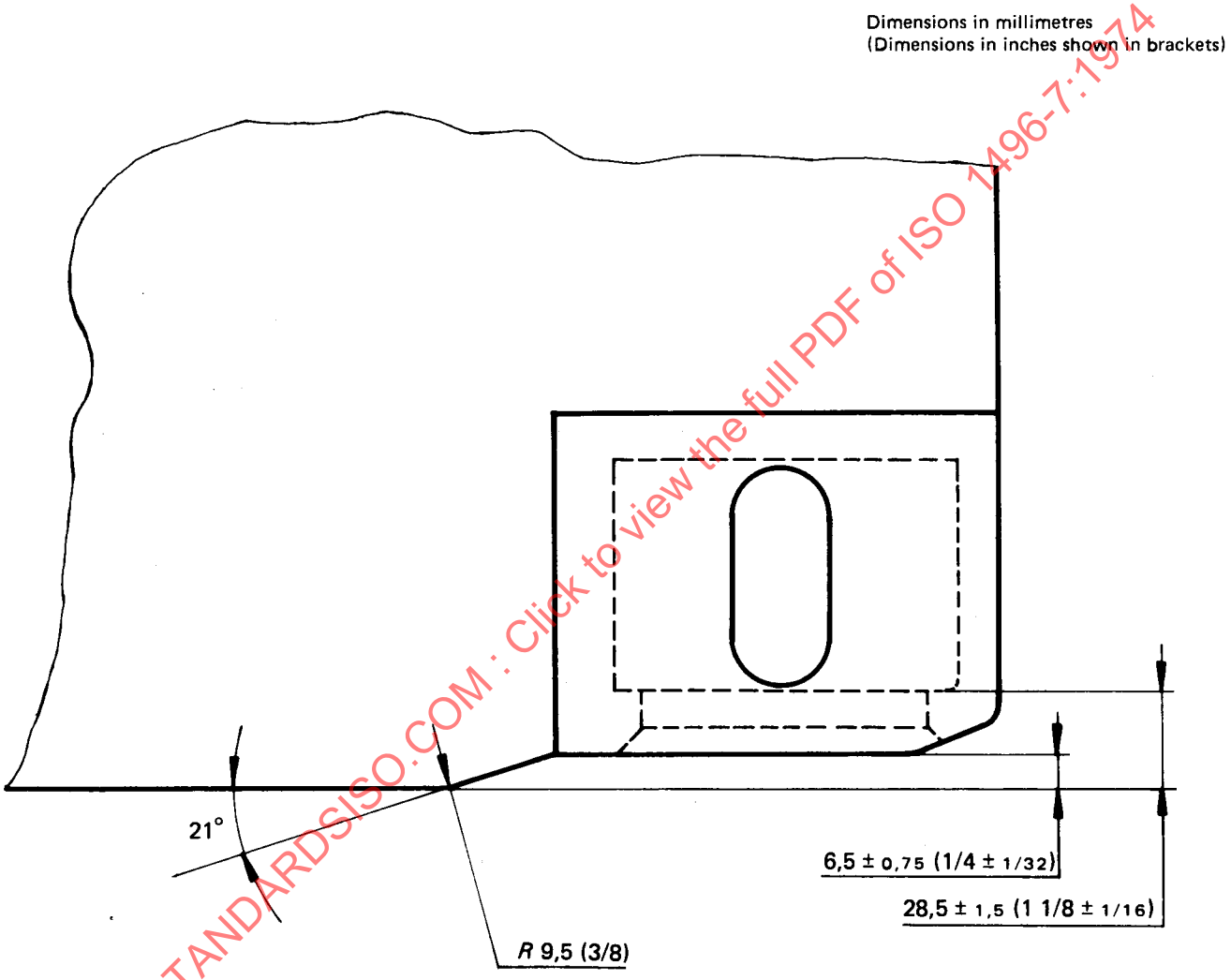

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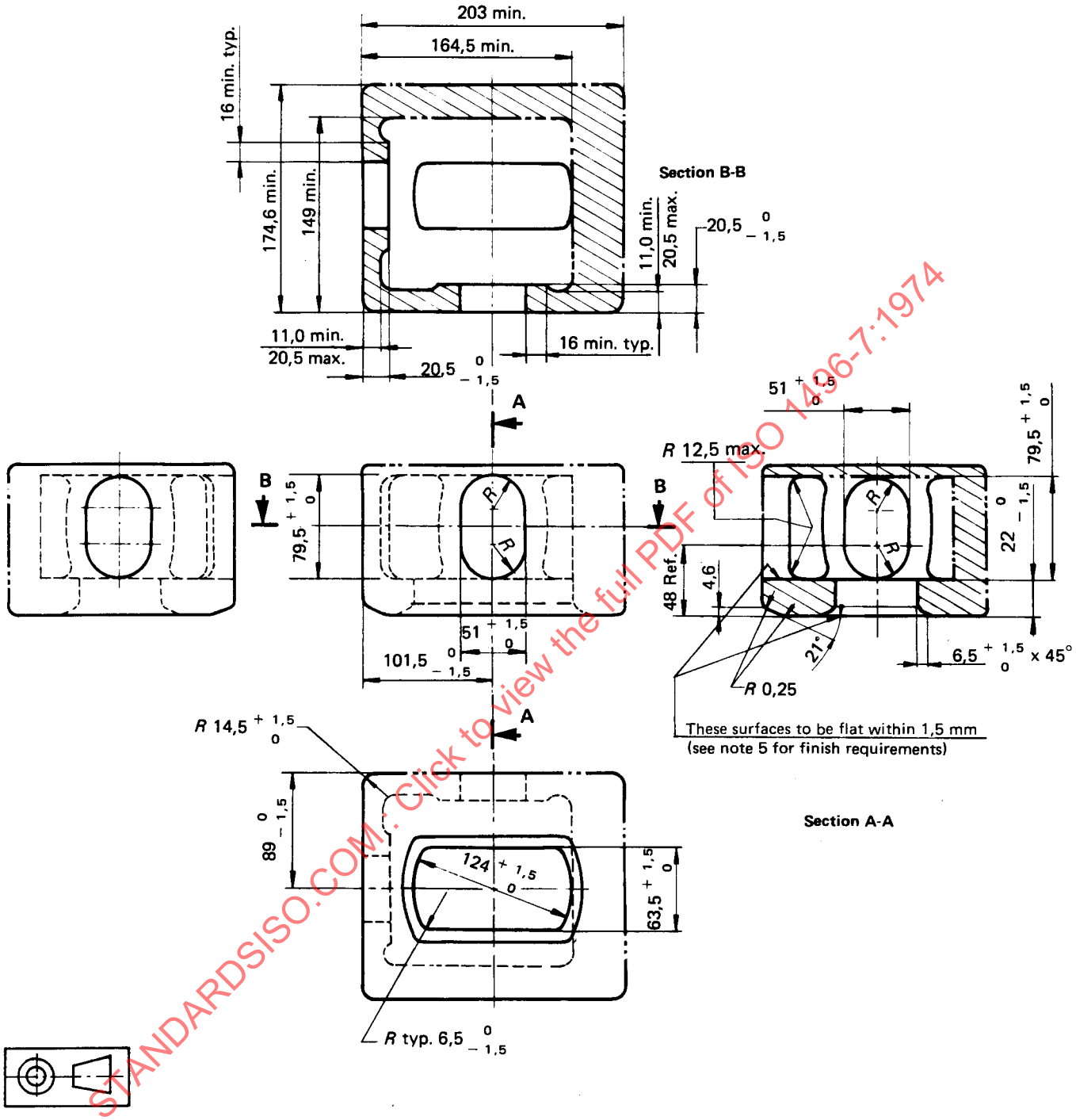
FIGURE 10 — **Location of bottom corner fitting**



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NOTES

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

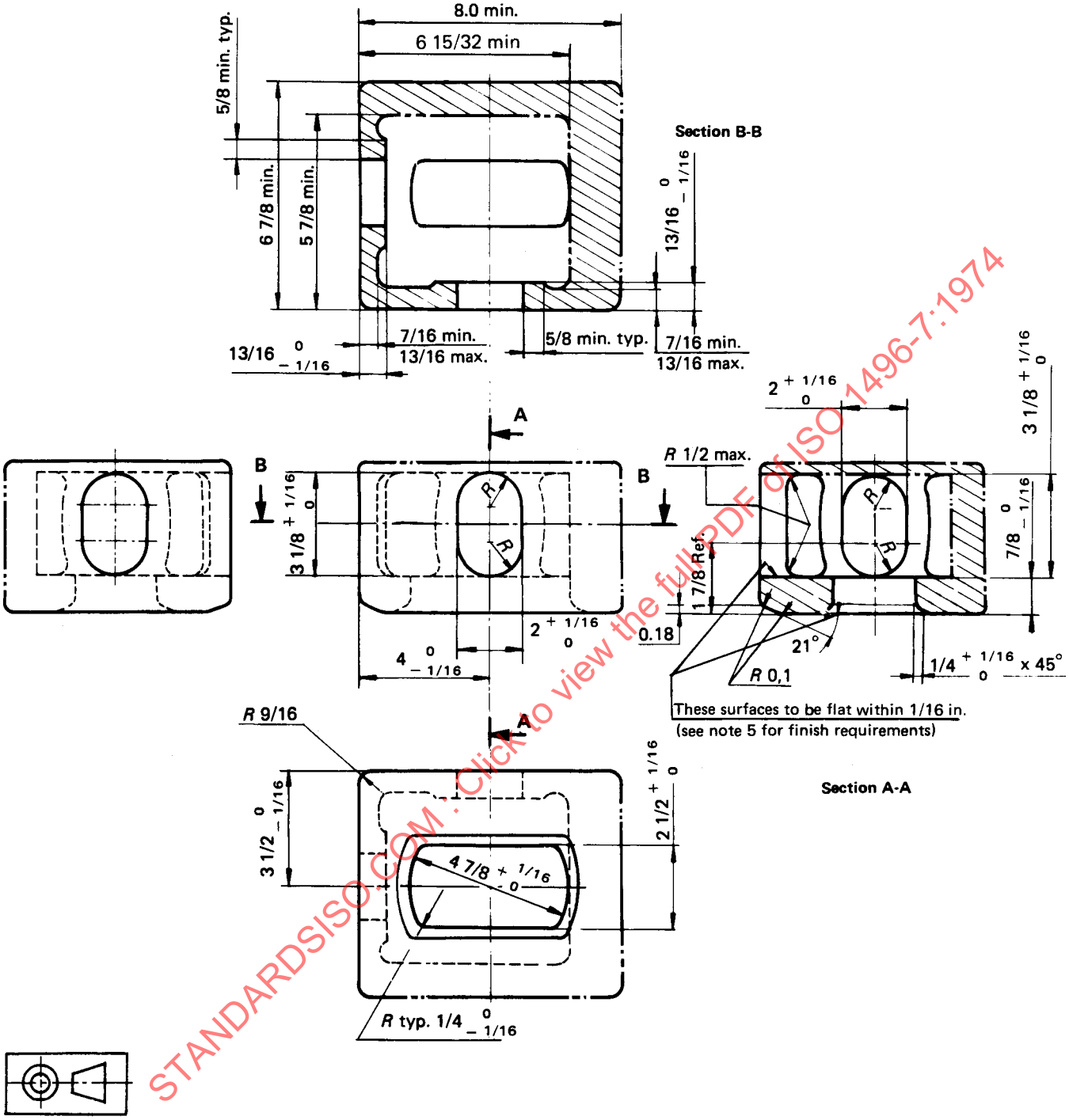
2 Phantom lines (— · — · —) show optional walls which may be used to develop a box-shaped fitting.

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

4 Four fittings required per container, 2 left hand and 2 right hand.

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

FIGURE 11 – **Bottom corner fitting – Dimensions in millimetres** (see figure 10)



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NOTES

1 Solid and dotted lines (— and ---) show surfaces and contours which must 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 must be 1/8 in max. except as noted.

4 Four fittings required per container, 2 left hand and 2 right hand.

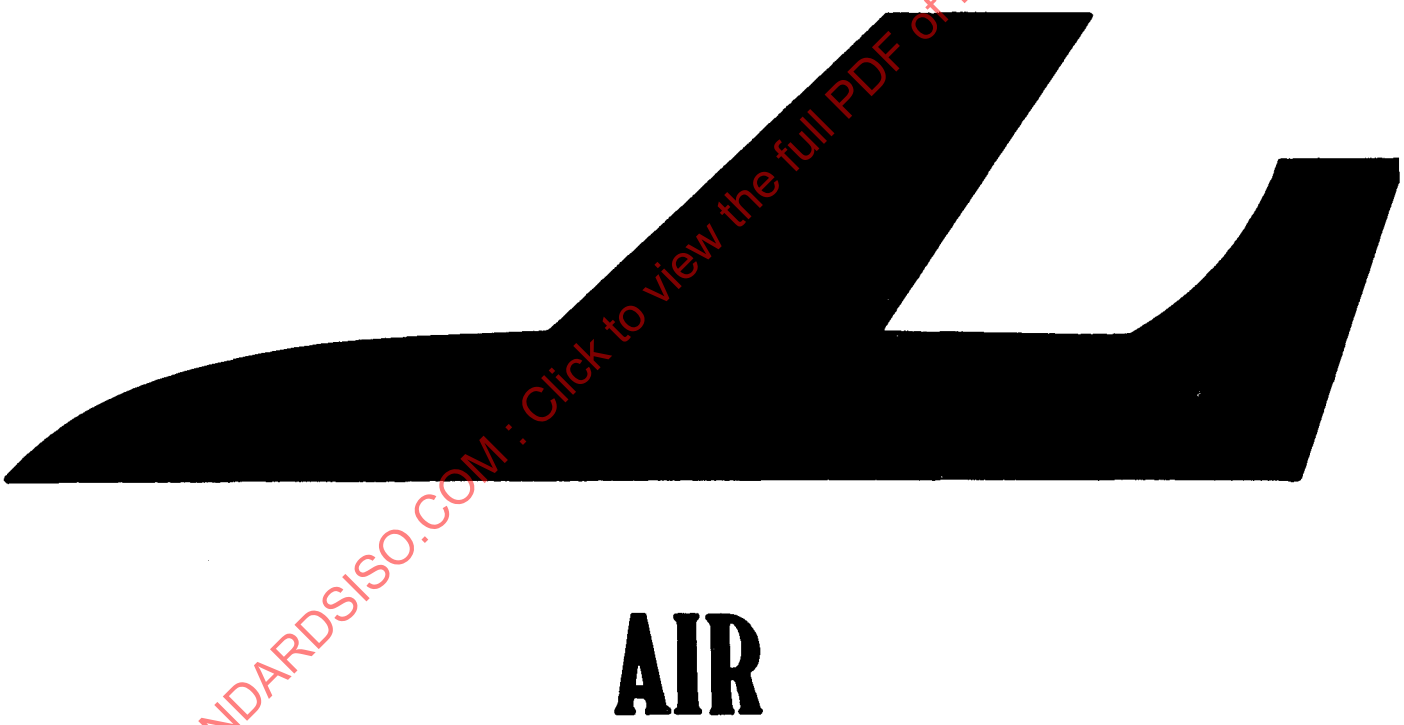
5 Outside surfaces shall have a casting surface of C30 or better.

FIGURE 12 – **Bottom corner fitting – Dimensions in inches** (see figure 10)

ANNEX A

SYMBOL TO DENOTE AIR-SURFACE CONTAINER

To denote that the container is an air-surface container capable of being stacked only two high, the following symbol shall be used.



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The symbol shall be at least 127 mm (5 in) high and 355 mm (14 in) long and the recommended proportions should be used. The capital letters shall be at least 76 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.

ANNEX B

ROTARY-WING AIRCRAFT CONTAINER REQUIREMENTS

The information presented in this annex is intended for those concerned with the transport of containers by rotary-wing aircraft whether internally or slung beneath rotary-wing aircraft. It is anticipated that a separate International Standard will be prepared for containers suitable for carriage internally or slung beneath rotary-wing aircraft.

B.0 INTRODUCTION

The airlift of intermodal containers by rotary-wing aircraft involves carrying the container internally or suspended from the under side of the aircraft for external transport. When the container is carried by suspension, loading is accomplished by the aircraft hovering, or straddling over the container, and lowering a lift-frame or set of slings. Attachment is made to the upper or lower corner fittings. Lifting of the load is either by winch, by ascent of the aircraft, or by both. Unloading requires the aircraft either to descend and hover over the desired area while the container is lowered and the attachments disengaged or to land for disconnection of the container. The container is exposed to ambient atmosphere during the entire operation.

For internal transport, the container is restrained in a manner comparable to that of the fixed-wing aircraft.

Rotary-wing aircraft operate in the same natural environment as fixed-wing aircraft, but generally at lower velocity and lower altitude. They are subjected to changes in motion comparable to those listed for fixed-wing aircraft. The loads resulting from these accelerations and decelerations are transmitted to the container through either the suspension system of the internal restraint system comparable to that of the fixed-wing aircraft. In addition to the loads experienced when transported externally, the container is also subjected to accelerations induced by air loads applied directly to the surfaces of the container. In this document, rotary-wing aircraft are referred to within the context of external cargo transport only.

B.1 SCOPE AND FIELD OF APPLICATION

B.1.1 This annex sets out basic requirements for the specification and testing of ISO series 1 Part VII freight containers for general cargo (designation 1A, 1B, 1C and 1D) for air and surface transport which are suitable for international exchange and for conveyance by road, rail, sea and air, including interchange between these forms of transport.

B.1.2 The marking requirements for series 1 Part VII freight containers are to be in accordance with the principles embodied in ISO 790.

B.1.3 The container types covered by this annex are as follows :

Type[1)]	Marking code identification
Air mode	96 – 99 Rotary wing

B.2 SPECIFIC CHARACTERISTICS

Recognizing the unique aircraft requirements, container design should utilize that combination of design and materials which result in as small a tare weight unit as possible.

B.3 DIMENSIONS AND RATINGS

B.3.1 External dimensions

See 4.1.

B.3.2 Internal dimensions

See 4.2.

B.3.3 Ratings

See 4.3.

B.3.4 Maximum gross weight

To ensure that the container and its payload do not exceed aircraft structural limitations, containers in rotary-wing air service shall be marked so they will not be operated, in any transport system, at gross weights in excess of those indicated in table 5.

However, a uniformly distributed load of not more than 6 750 kg (14 900 lb) may be placed in any 3,05 m (10 ft) linear length for 1A, 1B and 1C containers.

TABLE 5 – **Maximum gross weight of container (rotary-wing)**

Freight container designation	Maximum gross weight	
	kg	lb
1A	20 412	45 000
1B	20 412	45 000
1C	20 339	44 800
1D	10 161	22 400

1) See ISO 2716

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