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ISO 4117

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Air and air/land cargo pallets — Specification and testing

Palettes pour le transport aérien et de surface — Spécifications et essais

Reference number
ISO 4117:1993(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4117 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Sub-Committee SC 9, *Air cargo and ground equipment*.

This second edition cancels and replaces the first edition (ISO 4117:1980), which has been technically revised.

Annex A of this International Standard is for information only.

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Introduction

In this International Standard, the minimum essential criteria are expressed by the use of the word "shall". Recommended criteria are expressed by the use of the word "should" and, while not mandatory, are considered to be of primary importance in providing serviceable, economical and practical air transport pallets. Deviation from recommended criteria should occur only after careful consideration, extensive testing and thorough service evaluation have shown alternative methods to be satisfactory.

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Air and air/land cargo pallets — Specification and testing

1 Scope

This International Standard specifies dimensional, structural and environmental requirements for 2,44 m (8 ft) wide pallets to be used in freight versions of high-capacity fixed-wing aircraft, intended to be compatible with the 2,44 m × 2,44 m (8 ft × 8 ft) cross-section containers described in ISO 8323. Pallet nets to be used in conjunction with these pallets are described in ISO 4115.

This International Standard establishes three classes of pallet:

— Type A, air-only pallets;

— Type B, air/land pallets;

— Type C, adapter pallets.

Pallets have a nominal width of 2,44 m (8 ft) and nominal lengths of 3 m, 5 m, 6 m, 9 m and 12 m (10 ft, 16 ft, 20 ft, 30 ft and 40 ft).

Air-only pallets (Type A) will normally be handled on aircraft equivalent roller conveying systems and/or on similarly equipped ancillary ground handling devices.

The 5 m (16 ft) pallet is to be used only with this type.

Air/land pallets (Type B) are suitable for air/land handling and transport systems. Supplementary requirements for type B pallets are found in 5.5.1.

Air-adapter pallets (Type C) are used to adapt 2,44 m × 2,44 m (8 ft × 8 ft) surface-mode only containers (see ISO 1496-1) for air transport. Supplementary requirements for the Type C version are found in 5.5.2.

NOTE 1 Use of the adapter pallet with surface-mode only 2,44 m × 2,44 m (8 ft × 8 ft) containers may require uniform load distribution on the base cross members of these containers for carriage on certain aircraft. The aircraft approved weight and balance manual should be referred to for loadability procedures and/or limitations.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4115:1987, *Air cargo equipment — Air/land pallet nets.*

ISO 4116:1986, *Air cargo equipment — Ground equipment requirements for compatibility with aircraft unit load devices.*

ISO 7166:1985, *Aircraft — Rail and stud configuration for passenger equipment and cargo restraint.*

United States Federal Test Method Standard, No. 406.[1)]

3 General characteristics

3.1 Airworthiness

Airworthiness requirements laid down by the applicable authorities shall be recognized for pallet design features.

Ultimate load conditions (see table 3) for pallets of nominal length 3 m, 5 m, 6 m, 9 m and 12 m (10 ft, 16 ft, 20 ft, 30 ft, 40 ft) are in agreement with ISO 8097 for codes 2F1P, 2R1P, 2G1P, 2H1P and 2J1P.

1) This Standard may be obtained from Specification Sales, Building 197, Washington Navy Yard, General Services Administration, Washington DC 20407, USA.

3.2 Tare weight

The tare weight of the pallet assembly shall be a minimum consistent with the requirements of this International Standard and within the limits of sound design practice.

4 Dimensions and ratings

4.1 Dimensions

External dimensions of pallets shall be as specified in table 1 and figure 1.

4.2 Ratings

The pallet shall be designed to restrain the following gross weights[2]:

3 m (10 ft) pallet: 5 670 kg (12 500 lb)

5 m (16 ft) pallet: 11 340 kg (25 000 lb)

6 m (20 ft) pallet: 11 340 kg (25 000 lb)

9 m (30 ft) pallet: 15 875 kg (35 000 lb)

12 m (40 ft) pallet: 20 410 kg (45 000 lb)

5 Design characteristics

5.1 General

5.1.1 The materials and processes used in the construction should give consideration to the extremely hard usage to which the pallet will be subjected in order to provide for maximum service life.

5.1.2 The pallet should be rugged, minimizing maintenance and original costs.

5.1.3 Pallet construction shall be designed for strength and durability to withstand without permanent deformation the static and dynamic loads and impact shocks encountered in normal operational service.

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

All metal parts should be suitably protected against corrosion. All non-metallic materials which are liquid absorbent should be sealed or treated to prevent liquid absorption.

5.1.5 The pallet shall be free of any recesses or voids in which cargo (or other material) can be concealed. To meet agricultural requirements, all pallet surfaces should be as free as possible of recesses and protuberances, where pests can hide, or where soil or other residues can accumulate.

5.1.6 All fasteners should be of aircraft standard and the number of sizes, styles and strengths shall be kept to a minimum. No slotted head screws shall be used.

5.1.7 All fittings and appurtenances shall be within the maximum outside dimensions of the pallet.

5.1.8 The materials used shall be fire resistant, in accordance with appropriate regulatory requirements.

5.1.9 The pallet shall be so designed that it will withstand handling common to air/land freight terminal and ramp operations.

2) The term "weight" is used throughout this International Standard, instead of the correct technical term "mass", in order to conform to current commercial usage.

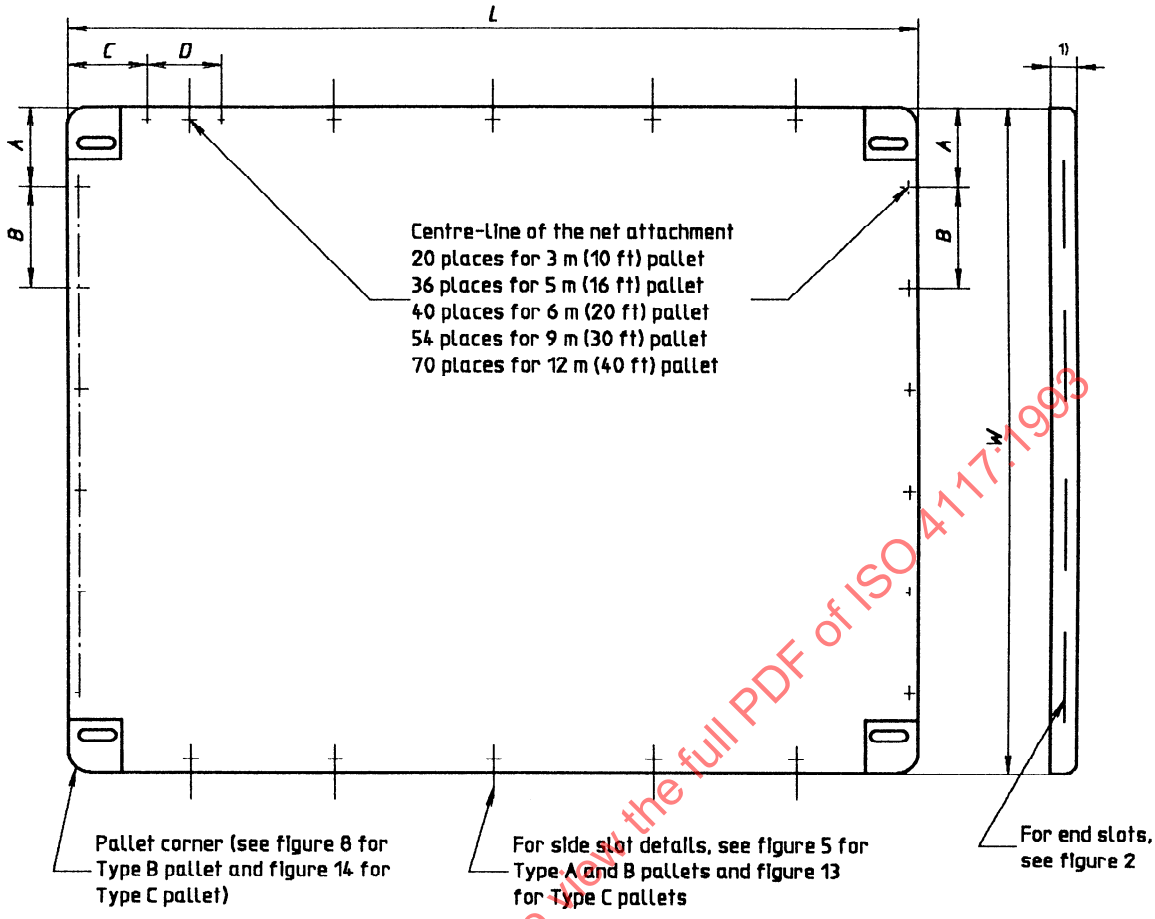


Figure 1 — Pallet dimensions

Table 1 — Pallet dimensions

Overall length L		Overall width W		Nominal thickness	Dimensions A		B		C		D	
mm	in	mm	in		mm	in	mm	in	mm	in	mm	in
$2\ 991\ ^{0}_{-5}$	$117\ 3/4\ ^{0}_{-3/16}$	$2\ 438\ ^{0}_{-5}$	$96\ ^{0}_{-3/16}$	1)	239,27	9,42	391,92	15,43	238	9,37	418,34	16,47
$4\ 978\ ^{0}_{-6}$	$196\ ^{0}_{-1/4}$	$2\ 438\ ^{0}_{-5}$	$96\ ^{0}_{-3/16}$	1)	239,27	9,42	391,92	15,43	238	9,37	409,19	16,11
$6\ 058\ ^{0}_{-6}$	$238\ 1/2\ ^{0}_{-1/4}$	$2\ 438\ ^{0}_{-5}$	$96\ ^{0}_{-3/16}$	1)	239,27	9,42	391,92	15,43	238	9,37	432,31	17,02
$9\ 125\ ^{0}_{-10}$	$359\ 1/4\ ^{0}_{-3/8}$	$2\ 438\ ^{0}_{-5}$	$96\ ^{0}_{-3/16}$	1)	239,27	9,42	391,92	15,43	238	9,37	429,26	16,9
$12\ 192\ ^{0}_{-10}$	$480\ ^{0}_{-3/8}$	$2\ 438\ ^{0}_{-5}$	$96\ ^{0}_{-3/16}$	1)	239,27	9,42	391,92	15,43	238	9,37	419,1	16,5

1) For Type A: 50,8 mm (2 in)

For Type B: 139,7 mm (5,5 in)

For Type C: 57,2 mm (2,25 in)

5.2 Construction

5.2.1 The pallet shall have a nominal thickness as specified in table 1, measured from the lower surface. This thickness may be varied when the design employed results in a lighter and more durable structure capable of accepting uniform loadings of 1 950 kg/m^2 (400 lb/ft^2) when supported on a conveying system (see 5.6.1).

5.2.2 The pallet shall be enclosed on all four sides by an edge member conforming to figures 2, 3 and 5.

The vertical surface of the pallet edge between the restraint provisions shown in figures 2 and 5 (Section A-A, Type A and Type B pallets) shall be smooth and continuous to provide an automatically latching aircraft systems interface.

The pallet bottom skin shall be enclosed by its edge member.

The bottom surface shall be flush with the edge member.

The lower edge of the edge members shall be as shown in figure 5.

The pallet corners shall have a 63,5 mm ± 12,7 mm (2,5 in ± 0,5 in) radius in the plane of the pallet.

5.2.3 The top and bottom surfaces of the pallet shall be parallel, flat and continuous.

Over the entire length of the pallet, the bottom surface shall be smooth and shall be a flat plane to within 1,6 mm (0,062 5 in). The waviness factor from crest to crest shall have a pitch of at least 914 mm (36 in).

No part of the structure shall protrude below the bottom surface.

5.2.4 The pallet lower surface shall comply with following conditions.

a) Ball load capability

The pallet base surface or a representative portion thereof shall be subjected to a load of 408 kg (900 lb) transmitted via a steel ball of 25,4 mm (1 in) diameter without exhibiting permanent indentation in excess of 0,51 mm (0,02 in).

b) Ball caster load capability

The base or a representative portion thereof shall be subjected to a uniformly distributed load of 95,5 kg (210 lb) supported by four 25,4 mm (1 in) diameter steel ball casters on a 127 mm × 127 mm (5 in × 5 in) grid pattern.

The base shall be moved over the casters for a minimum of 5 000 passes along a fixed line in each of two directions, 90° (1,57 rad) to, and intersecting, each other.

The length of the stroke shall be approximately 305 mm (12 in).

At conclusion, there shall be no evidence of deterioration of the base/ball caster interface surface.

c) Abrasion resistance of plastic-coated or magnesium-base materials

Three samples of the pallet base assembly material shall be subjected to the test specified in USFTMS, No. 406, Method 1091, or an equivalent method.

The abrasion wheel shall be dressed every 1 000 cycles.

An ACS-10 wheel with a load of 500 g shall be used for all tests.

The average weight loss shall not exceed the following values:

— after 1 000 revolutions: 0,015 g

— after 2 000 revolutions: an additional 0,005 g

— after 5 000 revolutions: an additional 0,03 g, up to a total of 0,05 g.

5.2.5 The pallet shall be capable of traversing a 2° (0,035 rad) crest or valley with no permanent deformation or damage. To meet this condition, pallets uniformly loaded to gross weight shall be capable of being supported at the cresting point through a roller contact of 2 032 mm (80 in) minimum width with a roller of 38 mm (1,5 in) maximum diameter.

5.2.6 Aircraft restraint provisions as shown in figures 2, 3 and 5 shall be provided.

5.2.7 Net attachments shall be compatible with the configuration shown in figure 1. As an option, a continuous seat track in accordance with ISO 7166 may be incorporated in the pallet upper surface.

5.2.8 The minimum pallet stiffness shall be 225 kN·m^2 per metre (2 000 000 lbf·in^2 per inch) of width or length for all pallet sizes.

5.3 Design loads

5.3.1 General

The centre of gravity of the load shall be assumed to vary by

± 10 % of the pallet width measured from the centre-line;

± 5 % of the pallet length measured from the centre-line;

1 219 mm (48 in) measured vertically from the pallet bottom surface.

To achieve the above asymmetric conditions, the cargo density shall be assumed to vary linearly.

5.3.2 Operational loads

Taking a design case where the pallet is supported on a roller system in accordance with 5.6.1, the pallet shall be designed for the operational load as given in table 2 with the cargo centre of gravity located at any point in the range specified in 5.3.1, and under these loads it shall not exhibit any permanent deformation.

Pallets over 3 m (10 ft) in length shall be designed for a gross weight of 6 760 kg (14 900 lb) in any 3 m (10 ft) section of the pallet.

5.3.3 Ultimate loads

When the roller system is in accordance with 5.6.1, the pallet shall be designed for the ultimate load as given in table 3 with the cargo centre of gravity loaded at any point in the range specified in 5.3.1. The pallet may exhibit permanent deformation, but shall not rupture to the extent of discharging cargo.

Table 2 — Operational loads

Pallet length		Maximum gross weight		Operational load									
				Forward		Aft		Side		Up		Down	
m	ft	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
3	**10**	5 670	12 500	5 670	12 500	5 670	12 500	5 670	12 500	5 670	12 500	17 010	37 500
5	**16**	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	34 020	75 000
6	**20**	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	11 340	25 000	34 020	75 000
9	**30**	15 875	35 000	15 875	35 000	15 875	35 000	15 875	35 000	15 875	35 000	47 630	105 000
12	**40**	20 410	45 000	20 410	45 000	20 410	45 000	20 410	45 000	20 410	45 000	61 235	135 000

NOTE — All loads in tables 2 and 3 are mutually exclusive, except that a load equal to the maximum gross weight may be considered to act concurrently with the forward, aft and side loads.

Table 3 — Ultimate loads

Pallet length		Maximum gross weight		Ultimate load									
				Forward		Aft		Side		Up		Down	
m	ft	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
3	**10**	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	**16**	11 340	25 000	17 010	37 500	17 010	37 500	17 010	37 500	28 350	62 500	56 700	125 000
6	**20**	11 340	25 000	17 010	37 500	17 010	37 500	17 010	37 500	28 350	62 500	56 700	125 000
9	**30**	15 875	35 000	23 815	52 500	23 815	52 500	23 815	52 500	36 690	87 500	79 380	175 000
12	**40**	20 410	45 000	30 620	67 500	30 620	67 500	30 620	67 500	51 030	112 500	102 060	225 000

NOTE — All loads in tables 2 and 3 are mutually exclusive, except that a load equal to the maximum gross weight may be considered to act concurrently with the forward, aft and side loads.

5.4 Aircraft restraint loads

Up, side, fore and aft loads shall be restrained by fittings inserted in the restraint slots as shown in figures 2, 3 and 5.

5.4.1 Fore, aft and side loads shall be restrained by a fitting as shown in figure 11 inserted in the side restraint slots.

5.4.1.1 The design shall allow the fore, aft and side loads to be exerted on the following number of load-bearing slots:

3 m (10 ft) pallet: 2 slots

5 m (16 ft) pallet: 4 slots

6 m (20 ft) pallet: 5 slots

9 m (30 ft) pallet: 8 slots

12 m (40 ft) pallet: 11 slots

5.4.1.2 The ultimate fore and aft load for any slot shall be 8 340 daN (18 750 lbf).

5.4.1.3 The fore and aft load-bearing slots shall be considered to be either on one or both sides of the pallet.

5.4.2 The up load shall be restrained by a latch as shown in figure 12, inserted in the side restraint slots as shown in figures 3 and 5.

The design shall allow the vertical load to be exerted on the following number of load-bearing slots:

3 m (10 ft) pallet: 6 slots

5 m (16 ft) pallet: 10 slots

6 m (20 ft) pallet: 12 slots

9 m (30 ft) pallet: 18 slots

12 m (40 ft) pallet: 24 slots

The latches shall be equally distributed between both sides and equally spaced along the full length of the pallet. This includes the fore and aft restraint latches.

For 5 m (16 ft) pallets, the areas to be left clear for aircraft latches interface shall be as shown in figure 4.

5.4.3 An end slot shall be provided in accordance with figure 2.

5.4.3.1 Slots shall be designed to restrain a 3 m (10 ft) pallet for ultimate forward, aft and vertical up loads when used in conjunction with restraint fittings in accordance with figure 10.

5.4.3.2 Slots to be used for ground transport restraint on roller bed vehicles shall be provided, as shown in figure 2. The inner face of each outward slot (or block) shall be capable of restraining laterally 33 % of the maximum gross weight. The pallet lower edge member shall be capable of restraining an upward load of 20 % of the maximum gross weight.

5.5 Supplementary requirements for Type B and Type C pallets

5.5.1 Type B pallets

Type IB pallets shall incorporate fittings at the four corners conforming to figures 6 to 8.

Type IIB pallets are 3 m (10 ft) and 6 m (20 ft) pallets only and shall incorporate fork-lift pockets located in accordance with figure 9 and fittings at the corners conforming to figures 6 to 8.

5.5.1.1 Type B pallets shall be capable of withstanding, without permanent deformation, the uniformly distributed ground operational loads specified in table 4 while being lifted from the four corner fittings. (See 6.2.7).

Table 4 — Ground operational loads

Pallet length		Maximum gross weight		Ground operational load	
m	ft	kg	lb	kg	lb
3	10	5 670	12 500	11 340	25 000
5	16	11 340	25 000	22 650	50 000
6	20	11 340	25 000	22 650	50 000
9	30	15 875	35 000	31 750	70 000
12	40	20 410	45 000	40 825	90 000

5.5.1.2 Type B pallets shall withstand without permanent deformation, an industrial truck wheel load of 2 730 kg (6 000 lb) on each of two wheels on 760 mm (30 in) centres anywhere on the pallet, while resting on a surface of sufficient strength and continuity to adequately support the pallet. (See 6.2.8.)

5.5.1.3 Type IIB pallets shall be capable of withstanding a down load equal to 1,25 times the maximum gross weight while supported by the fork-lift pockets. (See 6.2.9.)

5.5.1.4 Each of the four corners shall be capable of supporting at least an 8 340 daN (18 750 lbf) load in either the longitudinal or lateral direction.

5.5.2 Type C pallets

5.5.2.1 The pallet shall incorporate alignment pegs at the four corners, conforming to figures 8 and 14. Each of the alignment pegs shall be capable of supporting at least an 8 340 daN (18 750 lbf) load in the longitudinal, lateral or vertical (down only) direction.

5.5.2.2 The pallet shall incorporate side slots and strap receptacles conforming to figure 13. See figure 15 for a typical usage of restraint straps to secure a surface-mode container to an adapter pallet.

The strap receptacle fitting specified in ISO 7166 shall include a provision for attaching tie-down fittings, each capable of supporting a 2 224 daN (5 000 lbf) ultimate load in the longitudinal and vertical directions.

5.5.2.3 The pallet edges shall have a nominal thickness of 57 mm (2,25 in) from the lower surface.

5.5.2.4 The pallet shall be enclosed on all four sides by an edge member conforming to figures 2, 3, 5 and 13.

5.5.2.5 The pallet corners shall have a 14,5 mm (0,56 in) radius in the plane of the pallet.

5.5.2.6 Aircraft restraint provisions as shown in figures 2, 3, 5 and 13 shall be provided.

5.5.2.7 Up, fore and aft loads shall be supported by a fitting inserted in the restraint slots, as shown in figures 3, 5 and 13.

5.6 Operational criteria

5.6.1 The pallet design shall provide for support and ease of movement at the rated distributed load on minimum conveyor systems, as described as follows:

a) Four rows of rollers approximately 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, with an edge radius 1,5 mm (0,06 in) spaced on 254 mm (10 in) centres. Pallet travel is perpendicular to the roller axis.

b) Swivel casters with 25,4 mm (1 in) diameter wheels having a contact length of 50,8 mm (2 in) located on a 305 mm x 305 mm (12 in x 12 in) grid pattern. Pallet travel is in all directions across the grid.

c) Ball transfer units with 25,4 mm (1 in) diameter balls located on a 127 mm x 127 mm (5 in x 5 in) grid pattern. Pallet travel is in all directions across the grid.

5.6.2 The structural and operational integrity of the pallet shall be maintained over a temperature range of − 55 °C to + 70 °C (− 65 °F to + 160 °F).

6 Test methods

6.1 General

The test methods described are intended to demonstrate that the pallet meets the design requirements.

6.1.1 The tests are static in nature to minimize the complexity and cost of the required testing facilities. As far as practicable, the applied static loads should take into account the combined static and dynamic loads anticipated in service.

6.1.2 It is intended that tests shall be non-destructive in nature and shall not result in damage to the pallet unless ultimate load conditions are employed.

6.1.3 Test equipment and the test methods described are meant to demonstrate that the pallet meets the requirements of this International Standard. Other equivalent methods may be employed to obtain the desired result.

6.1.4 In selected cases, tests may be repeated under ultimate load conditions when required for substantiation of analytical data. Permanent deformation is permitted under ultimate load conditions. A pallet shall be considered within acceptable limits if it exhibits permanent deformation but does not rupture to the extent of discharging cargo, or break free from the restraint system. If this becomes necessary, the pallet so tested may not be used in service unless all its component parts have been inspected and those that exhibit permanent deformation have been replaced.

6.2 Operational loads

6.2.1 Test No. 1: Side load test (air mode)

6.2.1.1 Procedure

Secure the pallet to the aircraft restraint system or its equivalent. Engage the number of latches specified in 5.4.2, equally spaced on both sides of the pallet, in the side slots, and adjust the latches by suitable means to ensure vertical restraint.

With a net in accordance with ISO 4115 attached to the pallet, apply horizontally to one side of the pallet a uniformly distributed test load equal in weight to the maximum gross weight minus the tare, with a centre of gravity as shown in 5.3.1. Simultaneously apply downwards a test load of the same weight to the top surface of the pallet.

Repeat the test on the opposite side unless the sides are identical.

For 3 m (10 ft) pallets only, carry out the test using only restraints in the fore and aft slots, in accordance with figure 10.

6.2.1.2 Requirements

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

6.2.2 Test No. 2: Forward/aft load test (air mode)

6.2.2.1 Procedure

Secure the pallet to the aircraft restraint system or its equivalent. Engage the number of latches specified in 5.4.1.1, equally spaced on one side of the pallet, in the side slots, and adjust the latches by suitable means to ensure contact with the end of the side latch receptacle slot.

With a net in accordance with ISO 4115 attached to the pallet, apply horizontally to one end of the pallet a uniformly distributed test load equal in weight to the maximum gross weight minus the tare, with a centre of gravity as shown in 5.3.1. Simultaneously apply downwards a test load of the same weight to the top surface of the pallet.

Repeat the test on the opposide side unless the ends are identical.

For 3 m (10 ft) pallets only, carry out the test using only restraint in the fore and aft slots, in accordance with figure 10.

6.2.2.2 Requirements

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

6.2.3 Test No. 3: Upward load test (air mode)

6.2.3.1 Procedure

Secure the pallet to the aircraft restraint system or its equivalent. Engage the number of latches specified in 5.4.2, equally spaced on both sides of the pallet, in the side slots, and adjust the latches by suitable means to ensure vertical restraint.

Load the pallet with a uniformly distributed test load equal in weight to the maximum gross weight minus the tare, using a net in accordance with ISO 4115.

For 3 m (10 ft) pallets only, carry out the test using only restraints in the fore and aft slots in accordance with figure 10.

6.2.3.2 Requirements

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

6.2.4 Test No. 4: Floor strength test (roller conveyor test)

6.2.4.1 Procedure

Place the pallet, with a load equal in weight to the maximum gross weight minus the tare, on a system consisting of one half rollers and one half swivel casters (but not ball units), as described in 5.6.1. The maximum vertical displacement of system parts should be less than 0,76 mm (0,03 in).

Move the pallet along the system over a distance not less than the pallet length and back to the starting position. Repeat this traverse cycle for 100 cycles at a mean velocity not less than 18,3 m/min (60 ft/min). Measure periodically the draw-bar pull at test speed or at breakaway.

6.2.4.2 Requirements

During the test, the maximum draw-bar 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 draw-bar pull from the first to the last cycle shall not exceed 0,5 % of the maximum gross weight.

On completion of these tests, the pallet shall show neither permanent deformation nor any abnormality which would render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.2.5 Test No. 5: Bridging and cresting test

6.2.5.1 Procedure

Move the pallet, with a load equal in weight to the maximum gross weight minus the tare, with the centre of gravity in a central position, along a roller system compatible with the minimum requirements of ISO 4116. Make it pass across a stepped junction with another similar roller system, with a height difference at the junction of not less than 150 mm (6 in).

Hold the pallet at the balance point (cresting) on the edge of the higher platform for a minimum period of 5 s.

Then allow the rear end of the pallet to drop from the higher platform onto the lower roller platform.

6.2.5.2 Requirements

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

6.2.6 Test No. 6: Base restraint on roller vehicle

6.2.6.1 Procedure

Secure the pallet to a rigid base, using only latches in accordance with figure 10 engaged in the fore and aft ground transport end slots, as shown in figure 2.

Adjust the latches, by suitable means, to ensure restraint and contact with the inner face of each outward slot.

Apply horizontally to the pallet a test load equal in weight to 33 % of the maximum gross weight in an inward direction to each inner face on one of each outward slots. Simultaneously, apply vertically a test load equal in weight to 20 % of the maximum gross weight in an upward direction to the pallet lower edge member in the opposite slot area. Apply the test loads to both end of the pallet. Repeat the test in the opposite slots unless the slots and edge member are identical.

6.2.6.2 Requirements

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

6.2.7 Test No. 7: Lifting test-corner fitting

This test applies to Type B pallets only.

6.2.7.1 Procedure

Uniformly distribute a load over the floor of the pallet in such a way that the combined weight of the pallet and the test load is equal to twice the maximum gross weight.

Lift the pallet carefully from all four corner fittings in such a way that no significant acceleration or deceleration forces are applied.

After lifting, suspend the pallet for not less than 5 min and then lower it to the ground.

6.2.7.2 Requirements

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

6.2.8 Test No. 8: Floor strength test (industrial truck test)

This test applies to Type B pallets only.

6.2.8.1 Procedure

Carry out the test using a test vehicle equipped with tyres and loaded to an axle weight of 5 460 kg (12 000 lb), i.e. 2 730 kg (6 000 lb) on each of the two wheels. Position the vehicle so that the points of contact between each wheel and the flat continuous surface lie within a rectangular envelope measuring (in a direction parallel to the axle of the wheel) 185 mm (7,25 in) × 100 mm (4 in), and so that each wheel makes physical contact over an area within this envelope of not more than 142 cm^2 (22 in^2). The nominal wheel centres shall be 760 mm (30 in).

The path of the test vehicle shall encompass the entire floor area of the pallet.

One cycle is defined as a test vehicle driving onto the pallet, travelling its entire length, and driving off the pallet from the drive-on end.

Repeat this manoeuvre for a further 99 cycles. Carry out this test with the pallet resting on a surface of sufficient strength and continuity adequate to support the pallet.

6.2.8.2 Requirements

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

6.2.9 Test No. 9: Lifting test — fork-lift pocket

This test applies to Type B pallets only.

6.2.9.1 Procedure

Uniformly distribute a load over the floor of the pallet in such a way that combined the weight of the pallet and the test load are equal to 1,25 times the maximum gross weight.

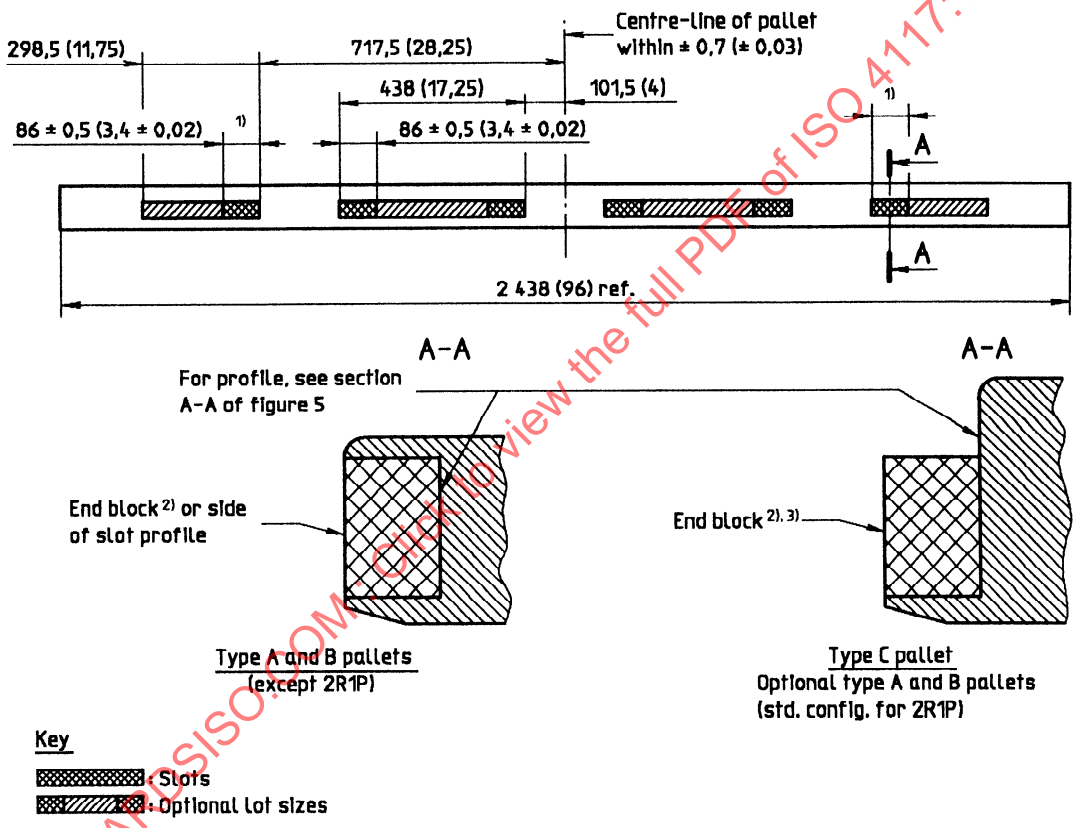
Support the pallet on two horizontal bars, each 200 mm (8 in) wide, projecting 1 832 mm (72,125 in) into the fork-lift pocket, measured from the outside face of the pallet side. Centre the bars within the pockets.

Support the pallet for 5 min and then lower it to the ground.

6.2.9.2 Requirements

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

Dimensions in millimetres
(Dimensions in inches)
Tolerance: ± 0,7 (± 0,03) unless otherwise stated



Key

: Slots

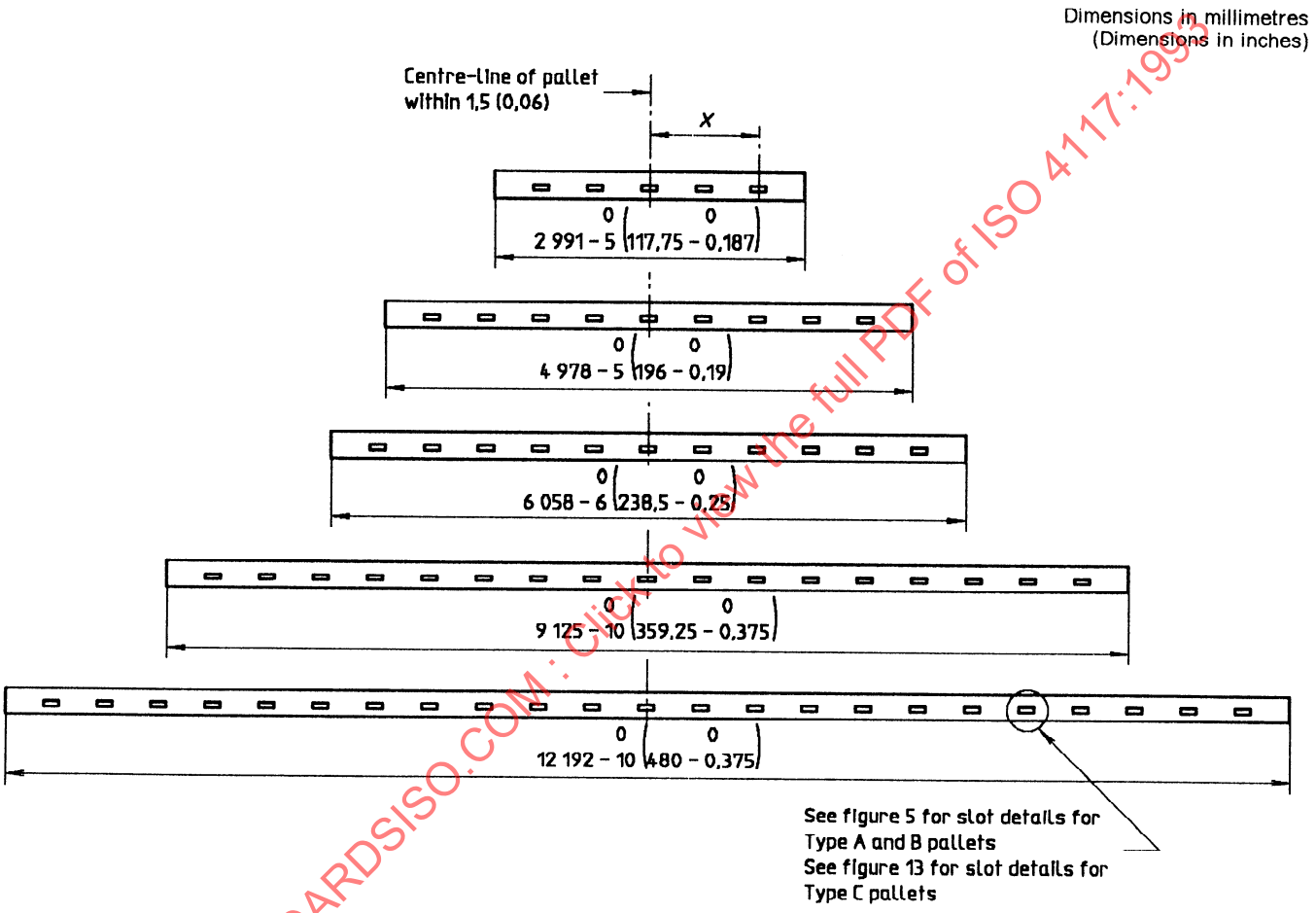
: Optional lot sizes

1) Slots to be used for ground transport restraint. The area shown shall be kept clear for aircraft and ground equipment latch interface.

2) End blocks to be flush with pallet edge within $^{0}_{-1,2}$ mm ($^{0}_{-0,5}$ in).

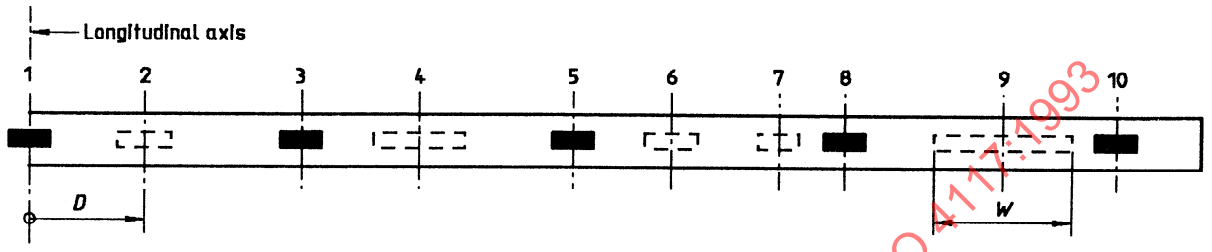
3) Do not use blocks for 2R1P (no fore-aft restraint desired).

Figure 2 — End slots or blocks (both sides)



NOTE — X: typical distance between side restraint slots: 511,2 ± 0,7 (20,125 ± 0,03)

Figure 3 — Side restraint slots location



Key:

: Slot
: Clearance required

Ref. No.	Location D		Width[1] W	
	mm	in	mm	in
1	0	0	76,2*)	3*)
2	216	8,5	101,6**)	4**)
3	511	20,125	76,2*)	3*)
4	733	28,875	171,5**)	6,75**
5	1 022	40,25	76,2*)	3*)
6	1 207	47,5	101,6**)	4**)
7	1 410	55,5	76,2*)	3*)
8	1 534	60,375	76,2*)	3*)
9	1 832	72,125	260,4**)	10,25**)
10	2 045	80,5	76,2*)	3*)

*) $^{+0,5}_{0}$ ($^{+0,02}_{0}$)

**) Minimum only.

1) Including blocks, if fitted.

Figure 4 — Areas to be left clear for aircraft latches interface [5 m (16 ft) pallet only]

Dimensions in millimetres
(Dimensions in inches)

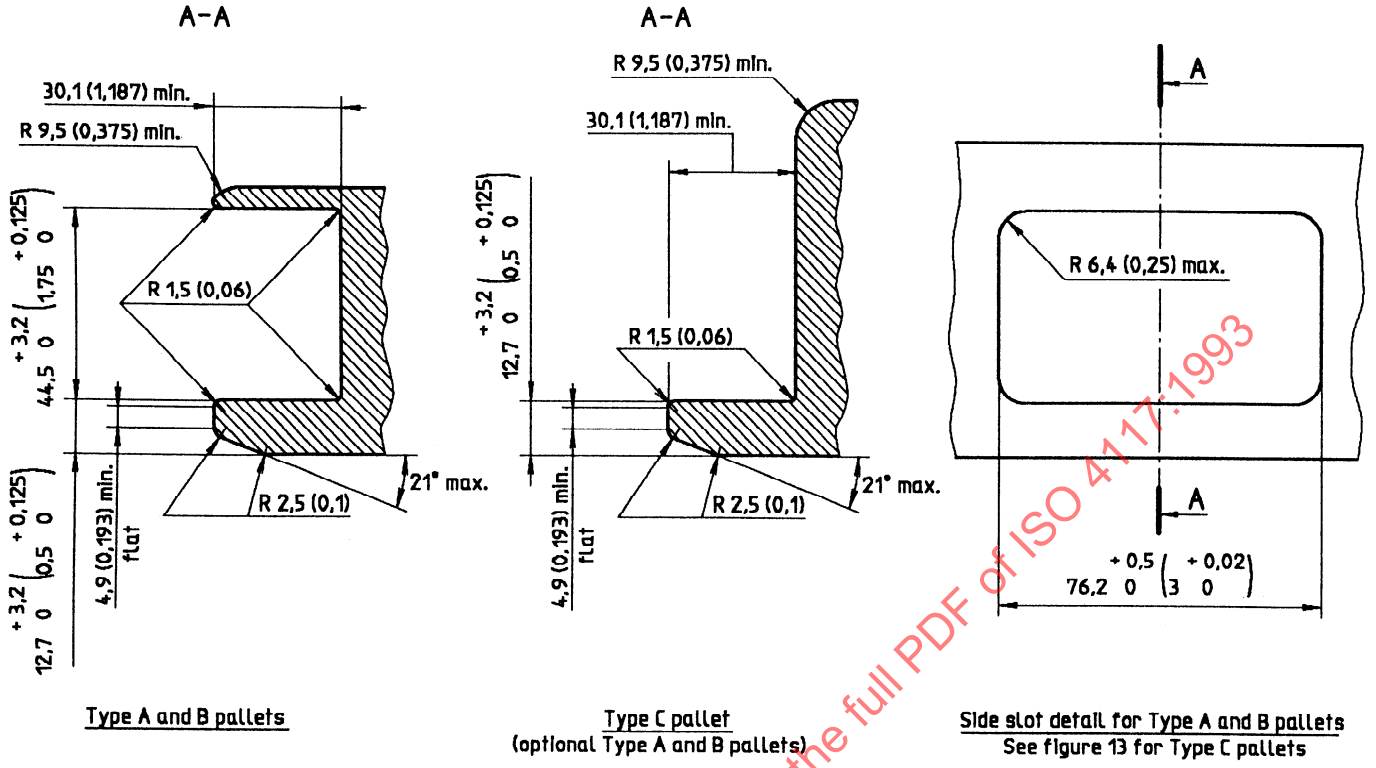
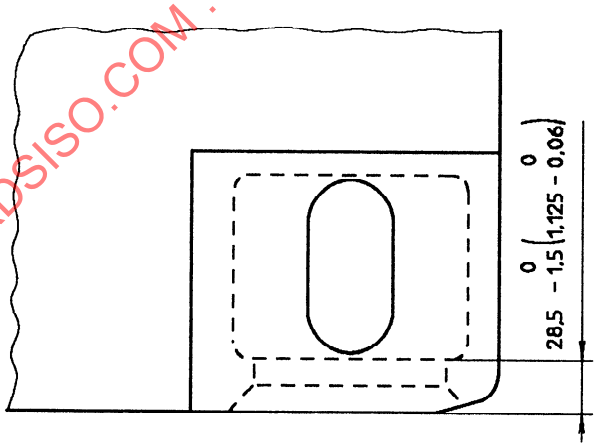


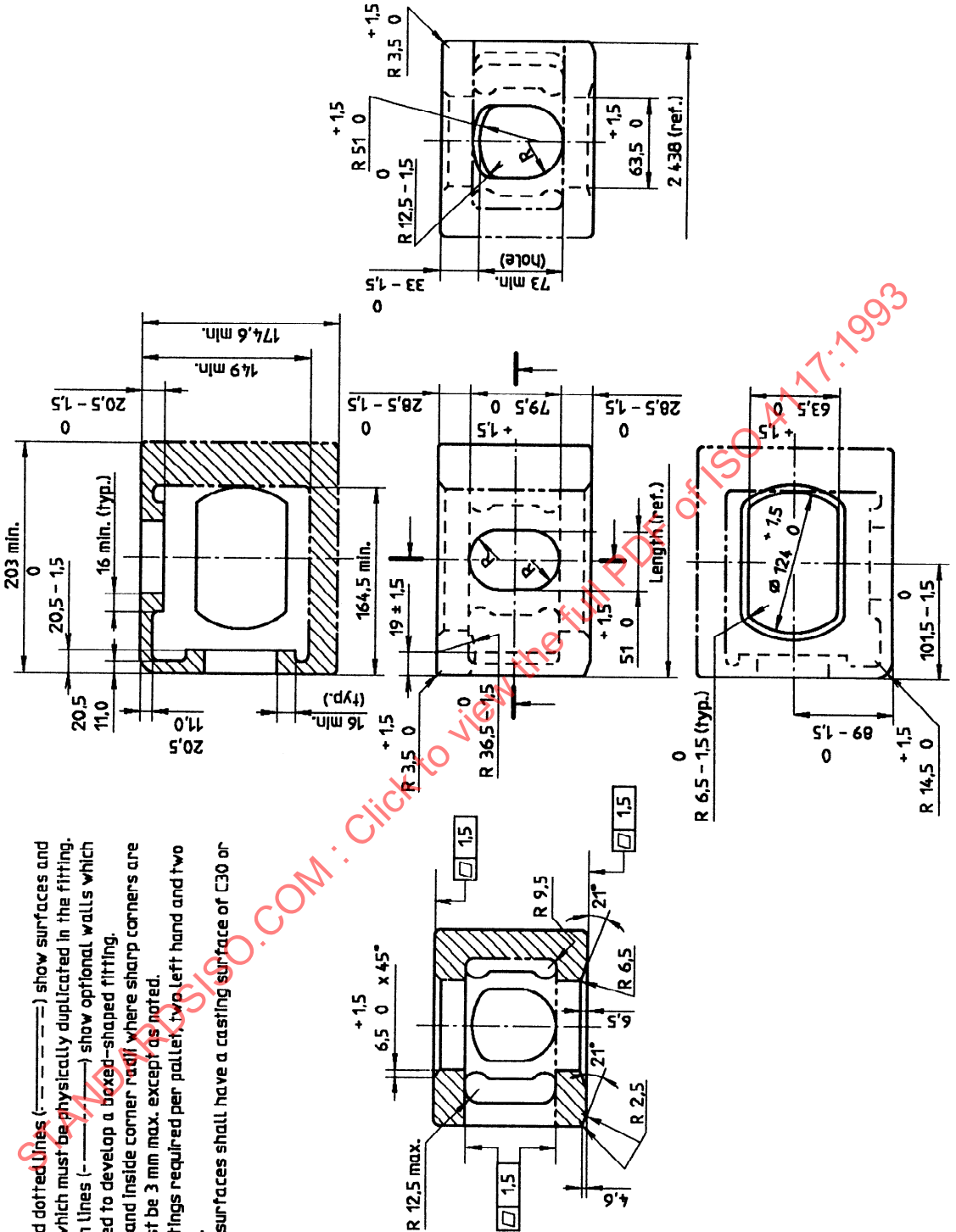
Figure 5 — Side slot details

Dimensions in millimetres
(Dimensions in inches)



NOTE — Corner fitting to be flush with base to within $^{0}_{-1,5}$ mm ($^{0}_{-0,06}$ in).

Figure 6 — Location of bottom corner fitting (Type B pallet)



NOTES

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

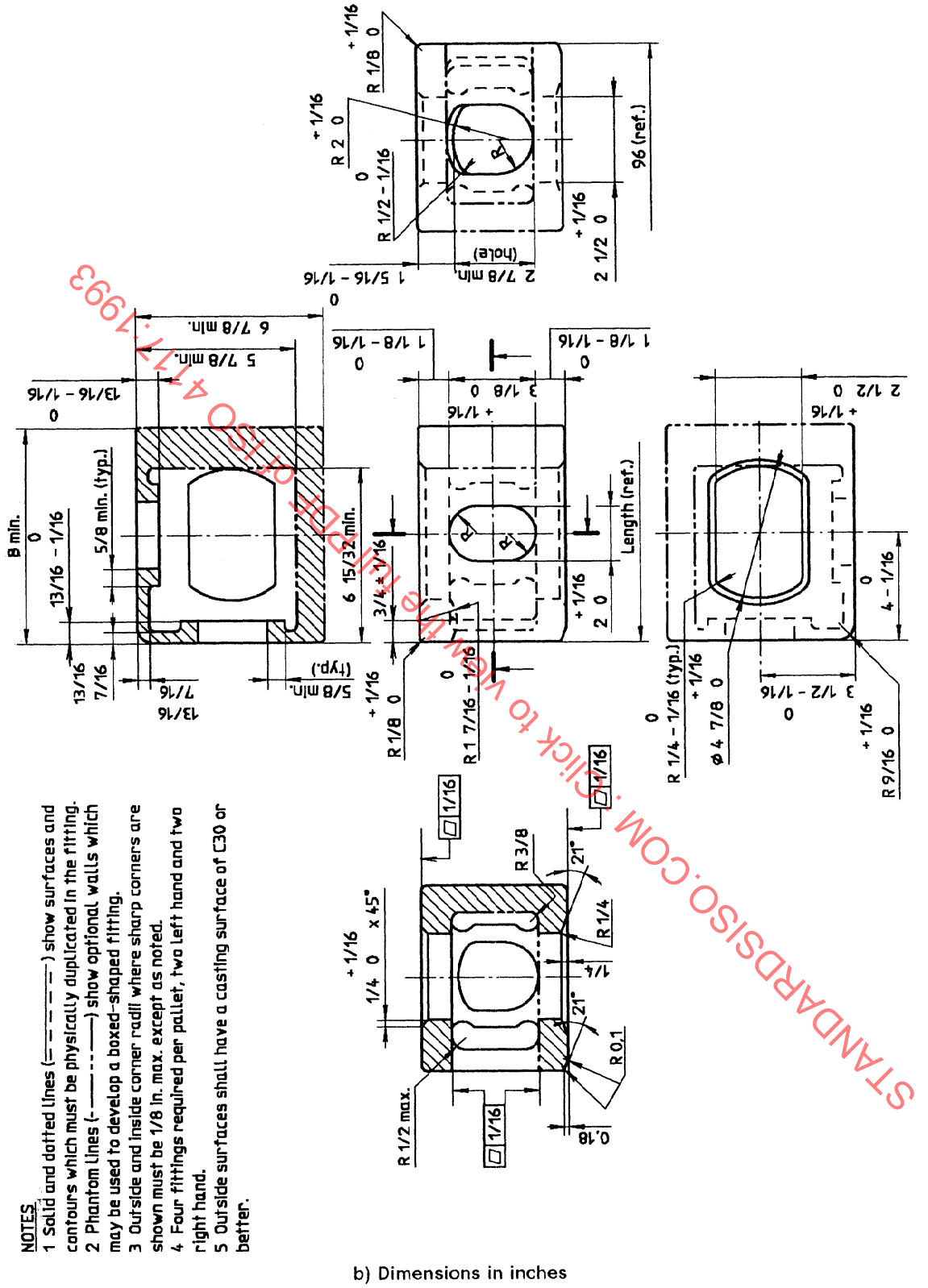
2 Phantom lines (— · — · —) show optional walls which may be used to develop a boxed-shaped fitting.

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

4 Four fittings required per pallet, two left hand and two right hand.

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

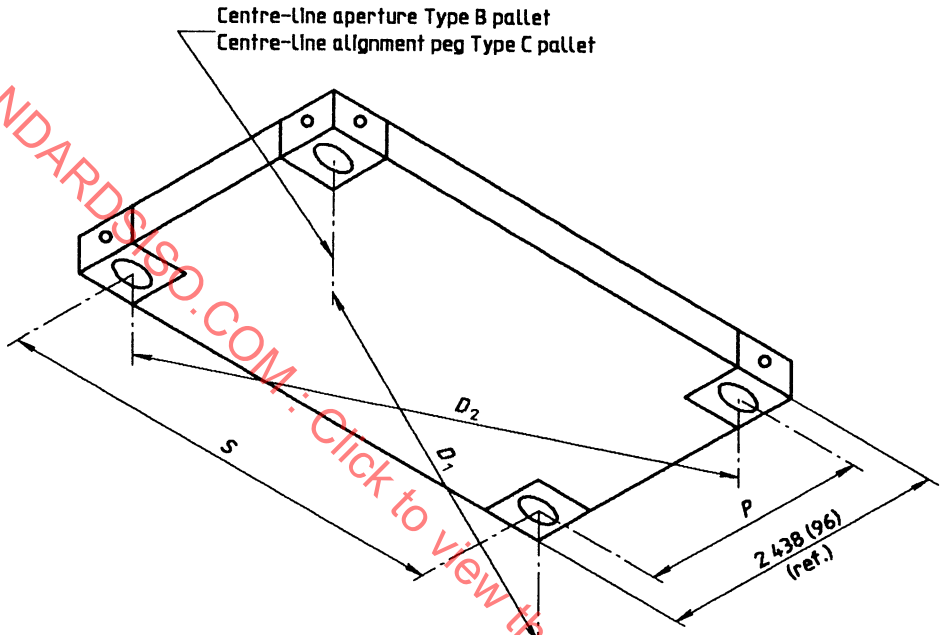
a) Dimensions in millimetres



b) Dimensions in inches

Figure 7 — Flush-mounted corner fitting (see figure 6)

Dimensions in millimetres
(Dimensions in inches)



Overall length		S		P		K_1 max. [1]	
mm	in	mm	in	mm	in	mm	in
12 192	480	11 986	471 7/8	2 260	88 31/32	19	3/4
9 125	359 1/4	8 922	351 1/4	2 260	88 31/32	16	5/8
6 058	238 1/2	5 853	230 7/16	2 260	88 31/32	13	1/2
2 991	117 3/4	2 787	109 23/32	2 260	88 31/32	10	3/8

1) $K_1 = D_1 - D_2$

Figure 8 — Type B and C pallets

Dimensions in millimetres
(Dimensions in inches)

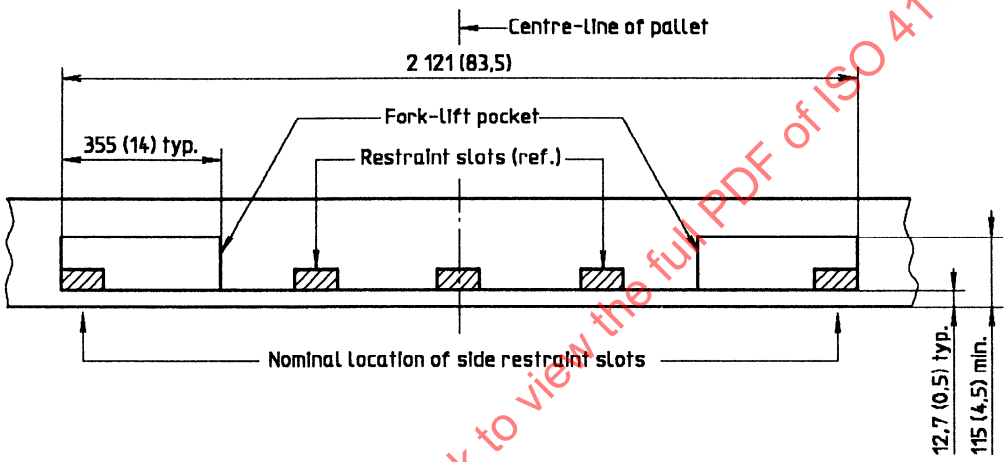
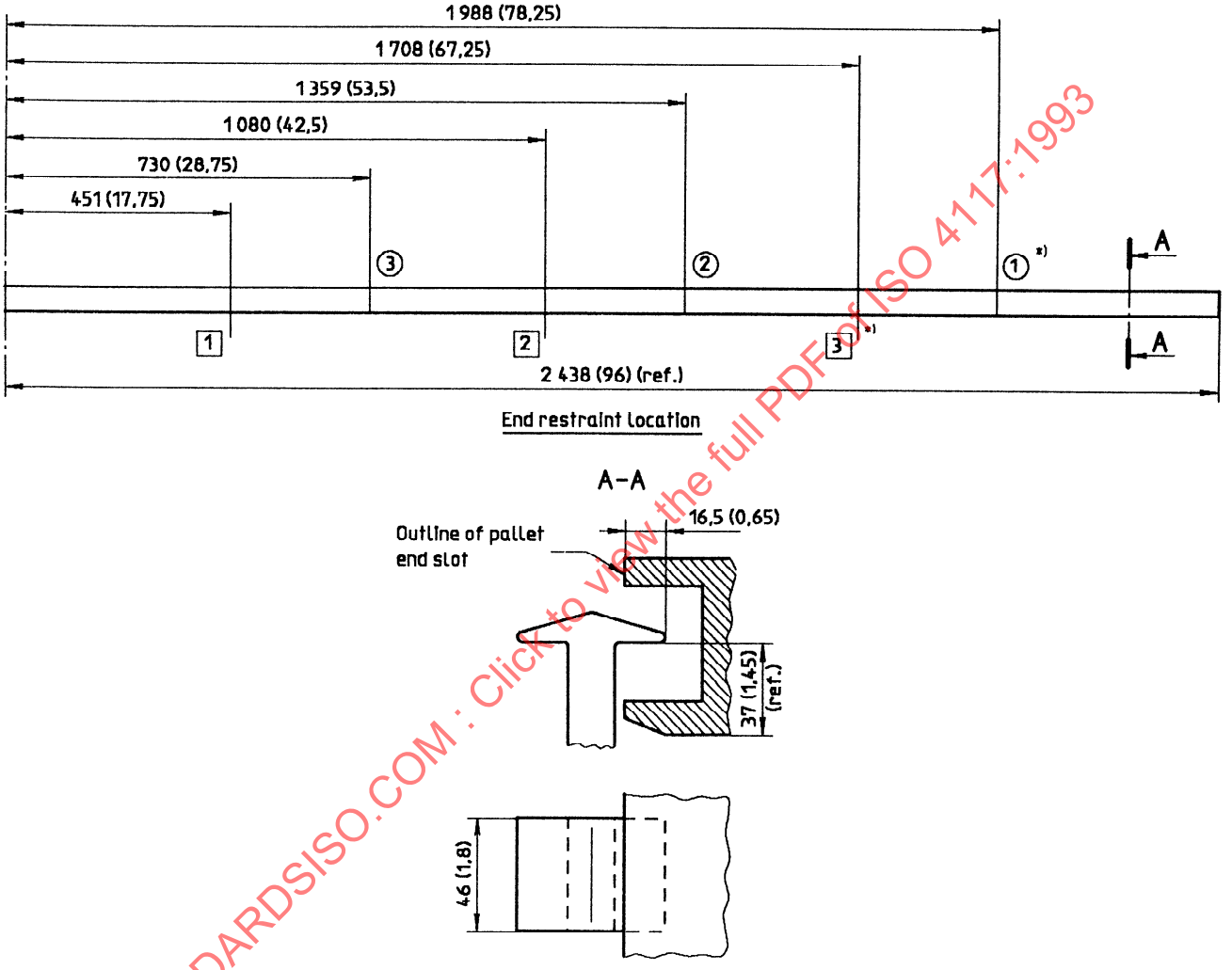


Figure 9 — Configuration of fork-lift pocket

Dimensions in millimetres
(Dimensions in inches)



*) Set of three lock locations used depending on orientation in aircraft

Figure 10 — End restraint fitting and locations

Dimensions in millimetres
(Dimensions in inches)

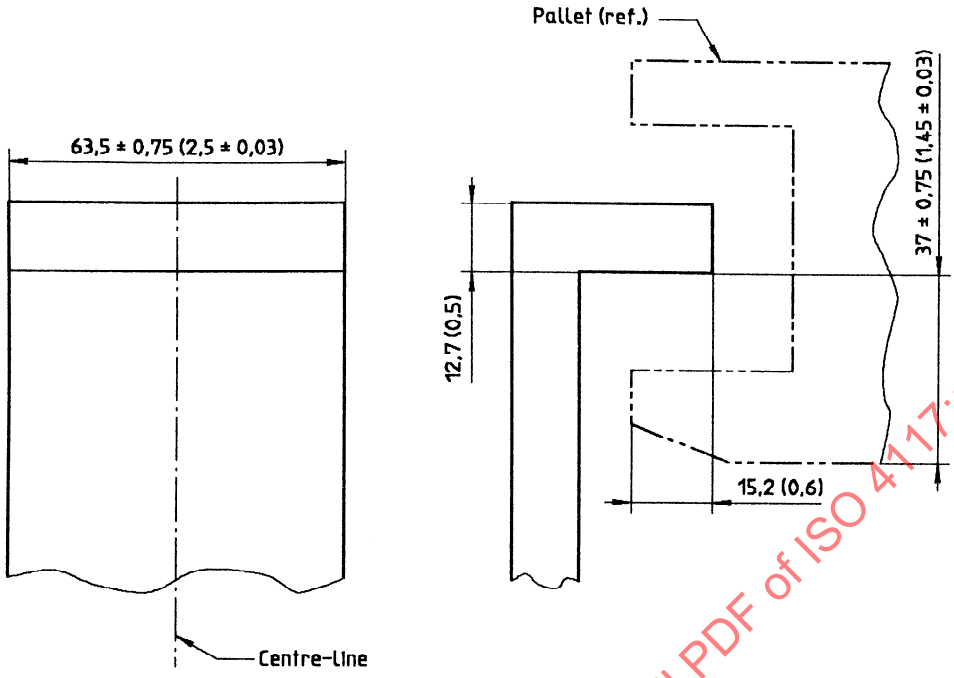


Figure 11 — Fore and aft restraint latch dimensions

Dimensions in millimetres
(Dimensions In inches)

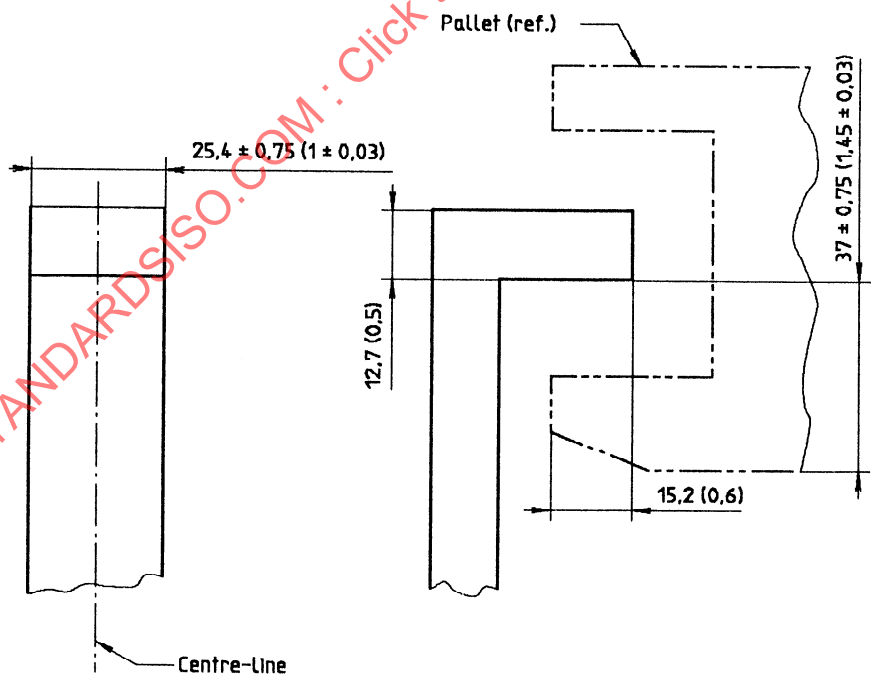
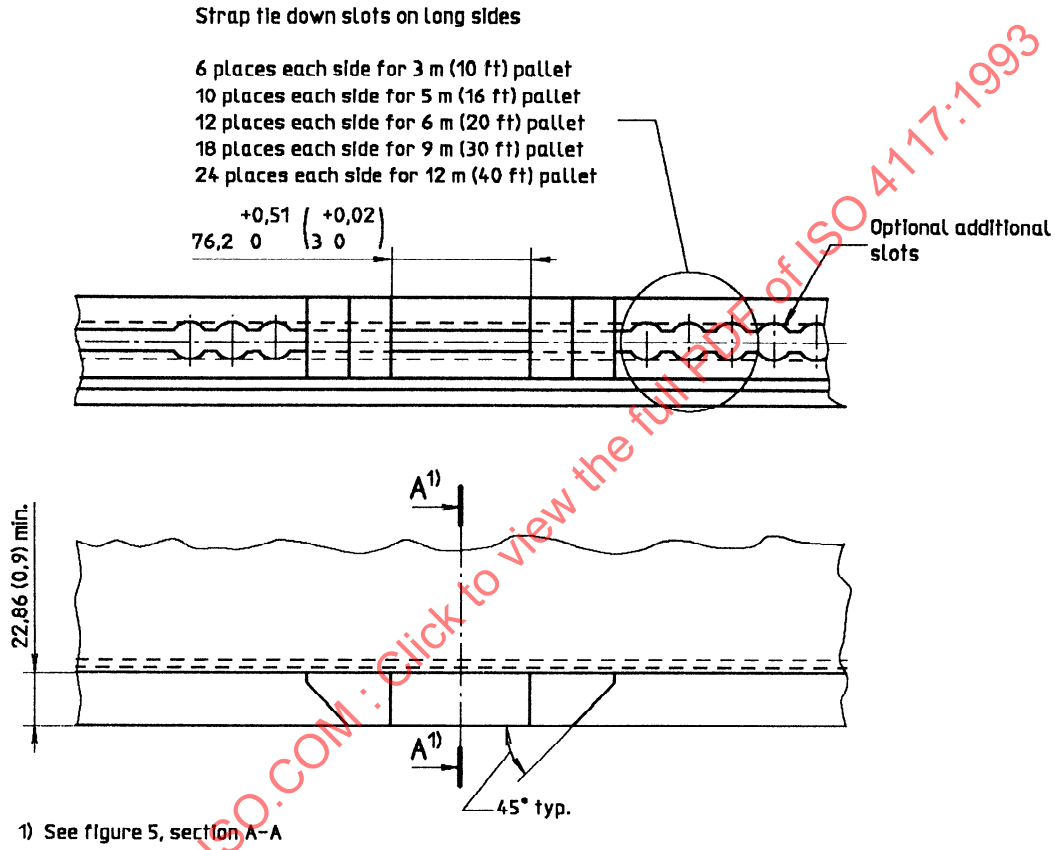


Figure 12 — Vertical restraint latch dimensions

Dimensions in millimetres
(Dimensions in inches)



1) See figure 5, section A-A

NOTE — Side latch blocks shall be flush with pallet edge rail outer profile, to within $^{0}_{-1,2}$ mm ($^{0}_{-0,5}$ in).

Figure 13 — Detail of side slots and strap slots, Type C pallet