

INTERNATIONAL STANDARD

ISO
4171

Second edition
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Air cargo equipment — Interline pallets

Équipement pour le fret aérien — Palettes pour le transport aérien



Reference number
ISO 4171:1993(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 4171 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 4171:1980), of which it constitutes a technical revision.

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International Organization for Standardization

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Air cargo equipment — Interline pallets

1 Scope

This International Standard establishes dimensional, structural and environmental requirements for pallets used to transport cargo in aircraft using nets meeting the requirements of ISO 4170.

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

ISO 4170:1987, *Air cargo equipment — Interline pallet nets*.

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

ISO 8097:1993, *Aircraft — Minimum airworthiness requirements and test conditions for certified air cargo unit load devices*.

IATA, *Unit Load Devices (ULD) Technical Manual*, 5th edition.¹⁾

3 Dimensions

3.1 Basic pallet sizes

This International Standard establishes five basic sizes of pallets as given in table 1.

Table 1

Size code in accordance with ISO 8097	Pallet size	
	mm	in
A	2 235 × 3 175	88 × 125
B	2 235 × 2 743	88 × 108
K	1 534 × 1 562	60,4 × 61,5
L	1 534 × 3 175	60,4 × 125
M	2 438 × 3 175	96 × 125

3.2 Basic pallet configuration

The pallets consist of two basic components, a core and edge rails, forming an essentially flat panel designed to transport cargo on aircraft systems and to be handled on ramp and terminals with ground equipment meeting the standards listed in clause 2 as applicable. The aircraft conveyor systems may be defined as given in table 2.

1) Available from International Air Transport Association, 2000 Peel Street, Montreal, CANADA H3A 2R4 or Route de l'Aéroport 33, Case Postale 672, 1215 Geneva 15, SWITZERLAND.

Table 2

Device	Characteristic	Dimension	
		mm	in
Ball mat	Ball diameter	25,4	1
	Basis ball pitch	127	5
Roller system	Pallet maximum overhang on major axis	362	14,25
	Pallet maximum overhang on minor axis	254	10
	Roller maximum pitch on major axis	673	26,5
	Roller maximum pitch on minor axis	254	10
	Minimum roller diameter	25,4	1
	Minimum roller length	51	2
Swivel caster	Minimum wheel diameter	25,4	1
	Minimum contact length	51	2
	Maximum caster pitch	305	12

4 Construction

4.1 General

4.1.1 Design, material and construction

The design, materials and construction of the pallet shall be of aircraft quality. The design shall be such as to minimize the need for maintenance and to ease and minimize the cost of maintenance and repair.

4.1.2 Surfaces and edges

The pallet surfaces and edges shall present no roughness or sharp edges potentially injurious to personnel or liable to damage cargo, aircraft and ground equipment parts.

4.1.3 Bottom surface

The bottom surface of the pallet shall be nominally flat and continuous.

4.1.4 Load capacity, operational criteria and performance requirements

The pallet assembly shall meet the requirements of clauses 5 to 11.

4.2 Pallet core

The pallet core shall be enclosed on all four sides by edges rails. If the pallet core is of sandwich-type

construction, the upper and lower skins shall be enclosed by the edge rail. In all cases, the design of the edge rail/core connection and the edge rail corner connection shall be adequate to ensure the integrity of the assembly under the impact and bridging loads expected in service.

4.3 Pallet edge rails and corners

4.3.1 Pallet edge

The pallet edge rail shall conform to the sectional dimensions shown in figure 1.

4.3.2 Seat track

The edge rail shall incorporate a continuous seat track into the upper surface. The seat track shall have dimensions in accordance with ISO 7166. The seat track centreline location is shown in figure 1. The corresponding net attachment locations shall be in accordance with ISO 8097 pallet/net compatibilities. The track should have provisions and/or ways for water draining.

4.3.3 Corners

The pallet corner shall have a $63 \text{ mm} \pm 12,7 \text{ mm}$ ($2,5 \text{ in} \pm 0,5 \text{ in}$) radius in plan view. The corner shall have vertical dimensions as shown in figure 1.

5 Design loads

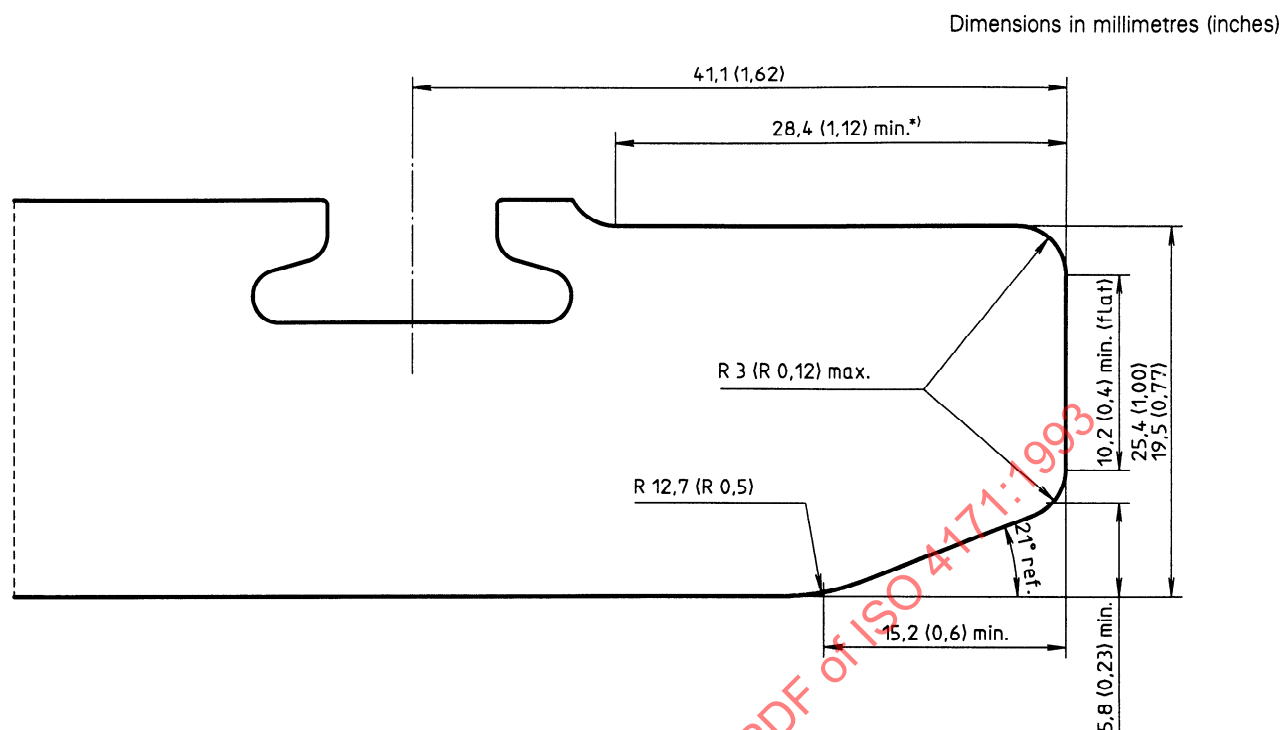
5.1 Table of loads

The pallet, used in conjunction with the corresponding net, shall be able to support the loads listed in table 3.

Table 3

Size code in accordance with ISO 8097	Maximum gross weight ¹⁾	
	kg	lb
A	6 804	15 000
B	4 536	10 000
K	1 588	3 500
L	3 175	7 000
M	6 804	15 000

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



*) To provide clearance for vertical restraint fittings.

Figure 1 — Pallet edge

5.2 Pallet net

5.2.1 The net assembly required to restrain the cargo on the pallet shall be made in accordance with ISO 4170. Net attachment fittings shall be in conformity with ISO 7166.

5.2.2 Pallet/net compatibility, number of net attachment fittings and type (single or double stud) shall be in accordance with ISO 8097.

5.3 Design and test requirements

The pallet shall meet the critical performance design and test requirements for Class II systems. See ISO 8097.

6 Operational criteria

6.1 Impact against locks

The pallet assembly shall withstand, without damage, an impact of a fully loaded pallet striking the locks at an impact speed of 0,3 m/s.

6.2 Core stiffness

The minimum core stiffness for a pallet with size code A, B, L or M shall be $331 \text{ N}\cdot\text{m}^2/\text{m}$ ($2\,932 \text{ lbf}\cdot\text{in}^2/\text{in}$) width/length of core.

The minimum core stiffness for a pallet with size code K shall be $76,5 \text{ N}\cdot\text{m}^2/\text{m}$ ($678 \text{ lbf}\cdot\text{in}^2/\text{in}$) width/length of core.

These core stiffnesses are calculated using a modulus of elasticity of $68\,670 \text{ N}/\text{mm}^2$ ($99,6 \times 10^5 \text{ lbf}/\text{in}^2$), a minimum guaranteed sheet thickness of 3,75 mm (2,3 mm for size code K) and the factor $1 - \nu^2$ for two-dimensional calculation.

6.3 Temperature resistance

The pallet assembly shall maintain its structural and operational integrity over the temperature range $-54 \text{ }^\circ\text{C}$ to $+71 \text{ }^\circ\text{C}$ ($-65 \text{ }^\circ\text{F}$ to $+160 \text{ }^\circ\text{F}$).

6.4 Protection against deterioration

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

7 Local indentation performance

7.1 Roller test

7.1.1 Apply a $8\,900 \text{ N}$ ($2\,000 \text{ lbf}$) load by steel roller, 51 mm (2 in) long by 25,4 mm (1 in) diameter as shown in figure 2.

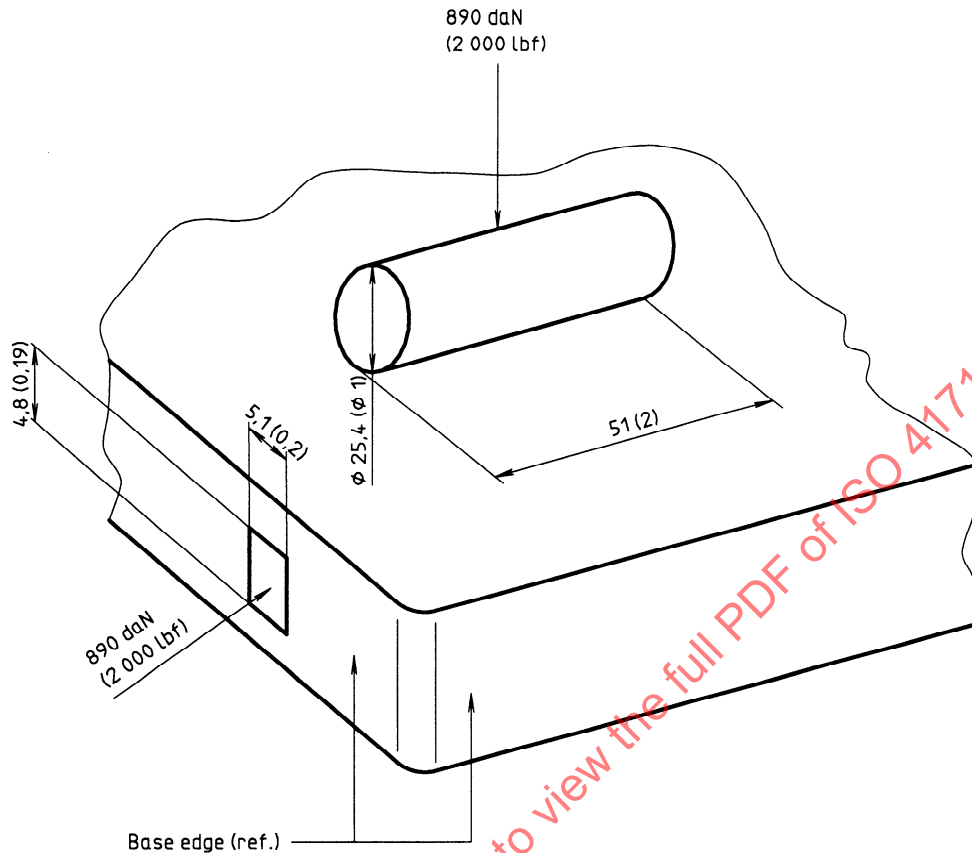


Figure 2 — Local indentation loading

7.1.2 Apply a 8 900 N (2 000 lbf) load parallel to the base over an area of 5,1 mm (0,2 in) long by 4,8 mm (0,19 in) wide on the vertical face of the edge as shown in figure 2.

7.1.3 The maximum indentation (permanent set) allowed at any location of the base shall be 0,25 mm (0,01 in) for the above tests.

7.2 Ball test

7.2.1 Subject the pallet base surface or a representative portion thereof to a force of 4 005 N (900 lbf) using a 25,4 mm (1 in) diameter steel ball.

7.2.2 There shall be no permanent indentation in excess of 0,5 mm (0,02 in).

8 Test No. 1 — Bridging and cresting test (surface mode)

8.1 General

This test is intended to prove the ability of the pallet to traverse from one item of handling equipment to another when the level of the conveyor surfaces are not in the same plane. At the point where the pallet balances on the end of the higher surface, the entire load is supported by one row of rollers.

8.2 Procedure

Load the pallet to its maximum gross weight less the tare of the pallet and net. Traverse the pallet on a roller system compatible with the minimum requirements of ISO 4116²⁾ pass it across a stepped junction with another similar roller system, with the height

2) Equivalent to IATA AHM 911.

difference at the junction being not less than 152 mm (6 in).

With the point balance (cresting) at the edge of the higher platform, hold the pallet in this position for a minimum of 5 s.

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

8.3 Requirements

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

9 Test No. 2 — Horizontal load test (operational loads)

9.1 General

This test is intended to prove the ability of the pallet to withstand the maximum operational horizontal loads that may be experienced during handling and transportation.

9.2 Procedure

Secure the pallet under test, together with a net meeting the requirements of ISO 4170 or IATA Standard Specification 50/2 to the aircraft restraint system or a system equivalent to each of those shown in ISO 8097, applicable to the pallet configuration.

Apply a test load equal to the maximum gross weight less the tare of the pallet plus net horizontally to one side of the pallet and net assembly. Simultaneously apply downwards an equal test load to the top surface of the pallet.

Repeat the test with the test load applied to the side perpendicular to the one tested previously.

9.3 Requirements

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

10 Test No. 3 — Upward load test operational loads

10.1 General

This test shall be carried out to prove the ability of the pallet to withstand the maximum operational upward loads that may be experienced during handling and transportation.

10.2 Procedure

Secure the pallet under test, together with a net meeting the requirements of ISO 4170 or IATA Standard Specification 50/2 to the aircraft restraint system or a system equivalent to each of those shown in ISO 8097, applicable to the pallet configuration.

Apply a test load upwards on the pallet and net assembly equal to the maximum gross weight less the tare of the pallet plus net.

10.3 Requirements

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

11 Execution of test

Pallets shall be subjected to each of the tests specified in clauses 7 to 10, unless evidence can be shown that the subject unit is equivalent to other units which have performed satisfactorily in these tests. The tests shall be made in the first instance in conjunction with the pallet net specified in ISO 4170.

12 Markings

12.1 Mandatory markings

All pallets in conformity with this International Standard shall be permanently marked (engraved) at two locations on the top surface not more than 25,4 mm (1 in) from the outer edge of the pallet, preferably at the extreme outer edge. The markings shall be positioned on two sides diagonally opposite to one another between 100 mm (4 in) and 300 mm (12 in) from the corner (see figure 3). These markings may additionally be engraved on the edges adjacent to the surface markings.

Each pallet shall carry at least the following markings:

- a) ULD Identification Code;
- b) the maximum gross weight, in kilograms and pounds (optional);
- c) the actual tare, in kilograms and pounds.

12.2 Additional optional bar code markings

In addition to the mandatory markings as specified in 12.1, each pallet may optionally be marked with a

bar-coded Identification Code. If so marked, four bar code labels shall be permanently affixed on to the top surface of the pallet outer edge in cutouts milled in the edge rail. The dimensions of the cutouts shall meet the tolerances shown in figure 4 to enable the affixing of a 120 mm x 20 mm (4,7 in x 0,8 in) bar code label.

The bar code label cutouts shall be positioned on all four sides, diagonally opposite to each other, as specified in figure 4.

Dimensions in millimetres (inches)

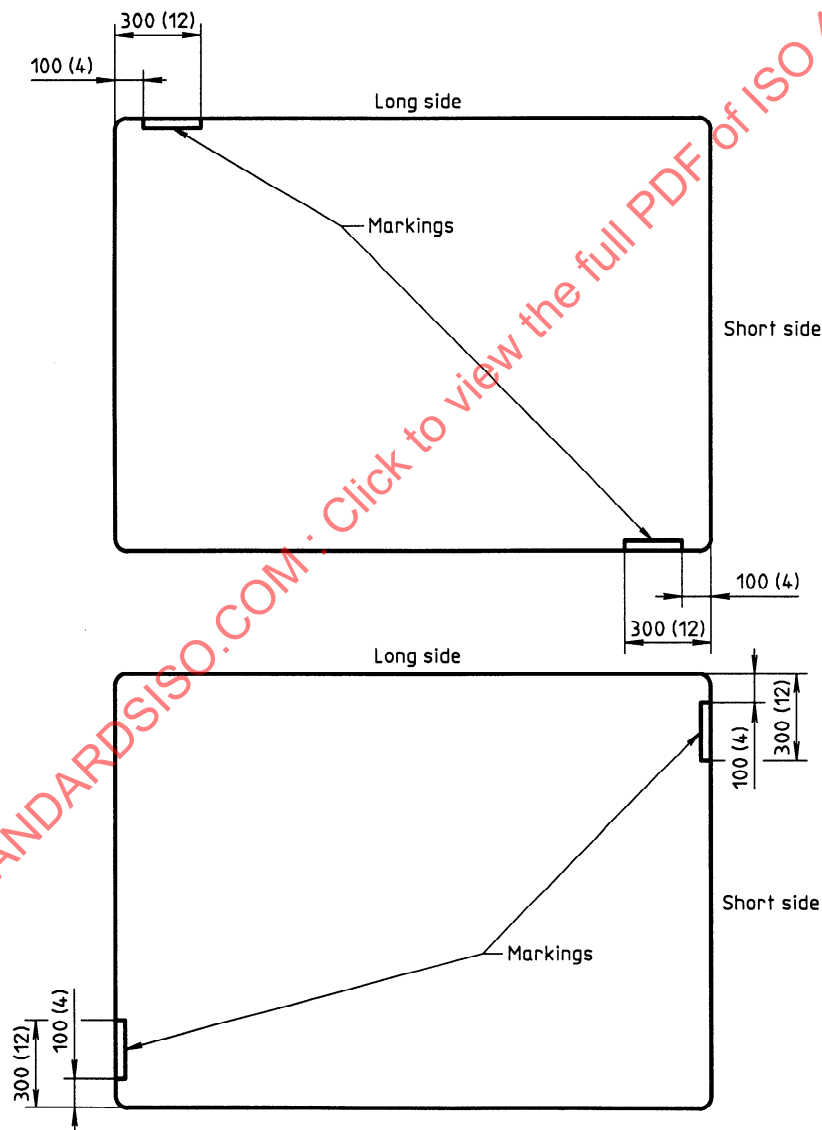
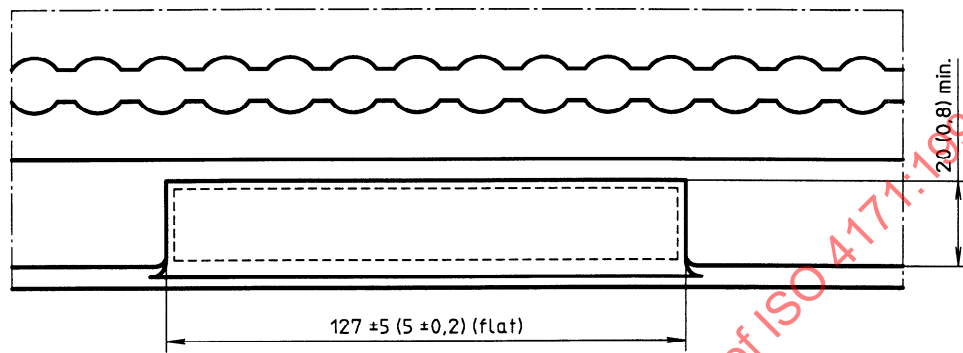
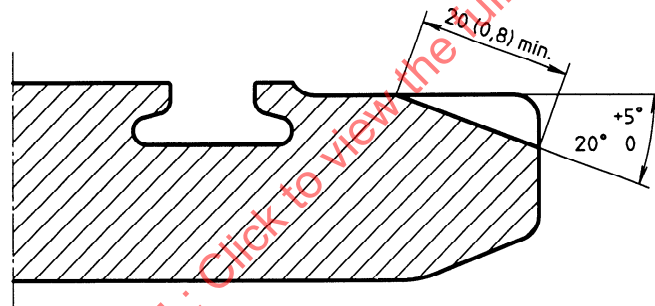


Figure 3 — Location of pallet markings

Dimensions in millimetres (inches)



a) Pallet edge - Plan view



NOTE - Cutout depth should ensure continuity of the pallet vertical edge.

b) Pallet edge - Cross-section

Figure 4