

First edition
2005-02-15

**Pallets for materials handling —
Flat pallets —**

Part 2:
**Performance requirements and selection
of tests**

Palettes pour la manutention — Palettes plates —

Partie 2: Exigences de performance et choix des essais



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2005

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Licensed to CHEP/JAUME PENA
ISO Store order #: 681358/Downloaded: 2005-07-13
Single user licence only, copying and networking prohibited

Contents

Page

Foreword	iv
Introduction	v
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	1
4 Conditioning	2
5 Number of replicates	3
6 Performance requirements	3
7 Selection of the tests	5
8 Test load — nominal load.....	6
9 Duration for static stiffness tests	7
10 Number of impacts for dynamic tests.....	7
11 Test report.....	7
Annex A (informative) Plots of typical force versus deformation from pallet tests showing the deformation of ultimate load, U.....	8
Annex B (normative) Alternative support profile for test 1	10
Bibliography	11

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

This document is issued in the Technical Specification series of publications (according to the ISO/IEC Directives, Part 1, 3.1.1.1) as a “prospective standard for provisional application” in the field of pallets for materials handling because there is an urgent need for guidance on how standards in this field should be used to meet an identified need. This document is not to be regarded as an “International Standard”. It is proposed for provisional application so that information and experience of its use in practice may be gathered. An international project to gather test data was launched in 2001 and the results of this project will be used in the development of an International Standard based on this Technical Specification. Comments on the content of this document should be sent to the ISO Central Secretariat for the attention of ISO/TC 51.

ISO/TS 8611-2 was prepared by Technical Committee ISO/TC 51, *Pallets for unit load method of materials handling*.

ISO 8611 consists of the following parts, under the general title *Pallets for materials handling — Flat pallets*:

- *Part 1: Test methods*
- *Part 2: Performance requirements and selection of tests* [Technical Specification]
- *Part 3: Maximum working load* [Technical Specification]

Introduction

The necessary performance requirements for pallets depend on their end use. This part of ISO 8611 specifies which test methods are applied for the different situations of end use.

Pallets for materials handling — Flat pallets —

Part 2: Performance requirements and selection of tests

1 Scope

This part of ISO 8611 specifies the performance requirements and the selection of tests for flat pallets of all materials being subjected to the tests defined in ISO 8611-1. It is not intended to apply to pallets with a fixed superstructure or a rigid, self-supporting container that may be mechanically attached to the pallet and which contributes to the strength of the pallet.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 445, *Pallets for materials handling — Vocabulary*

ISO 8611-1:2004, *Pallets for materials handling — Flat pallets — Part 1: Test methods*

ISO/TS 8611-3, *Pallets for materials handling — Flat pallets — Part 3: Maximum working load* ¹⁾

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 445 and the following apply.

3.1

test load

P

applied load itself and, where used, load applicators, load board or load box

3.2

breaking of one component

fracture of a structural element which significantly affects the strength, stiffness or functionality of a pallet

3.3

ultimate load

U

load at which compression, displacement or deflection is no longer contained, resulting in the destruction of the specimen or breaking of one component, or when displacement, deformation or deflection becomes excessive

NOTE See Table 1 and Annex A.

1) To be published.

3.4
nominal load

R
lowest load value for the specified support conditions, independent of the type of load (excluding concentrated loads)

NOTE 1 Specified support conditions refers to the range of conditions of use in Clause 7.1.

NOTE 2 Nominal load is used for the purposes of comparison.

3.5
payload

Q
load carried by the pallet in use

NOTE 1 Adapted from ISO 445.

NOTE 2 This may be above, identical with or below the nominal load.

3.6
racking

storage of loaded pallets in beam racks

3.7
stacking

placing of pallets with unit loads one upon the other without recourse to intermediate shelves or racking

NOTE Adapted from ISO 445.

4 Conditioning

4.1 General

When moisture or temperature conditioning is relevant, such conditions shall be maintained during the test. When several materials are used, the most sensitive condition shall be used.

4.2 Wooden pallets

The reference moisture content is (20 ± 2) %. If the pallets are used at a higher moisture content, they shall be tested at this higher moisture content and the moisture content shall be recorded in the test results.

NOTE Electrical measurements permit subsequent allowance to be made for the effect of moisture content on performance (see bibliography item [2]).

4.3 Metal pallets

For metal pallets no conditioning is necessary.

4.4 Plastic pallets

Plastic pallets shall be conditioned for each test as follows.

- Tests 1a, 1b, 2a, 2b, 4a, 4b, 5a, 5b, 8a, 8b, 9, 11, 12 and 13: $(23 \pm 2)^{\circ}\text{C}$.
- Tests 6 and 7: $(40 \pm 2)^{\circ}\text{C}$.
- Test 10: $(23 \pm 2)^{\circ}\text{C}$ and $(-10 \pm 2)^{\circ}\text{C}$.

For maximum working loads and test 10, when plastic pallets are used in controlled or more extreme conditions the corresponding conditioning for the tests shall be arranged between supplier and purchaser.

4.5 Paper pallets

Paper pallets shall be conditioned for each test as follows.

- Tests 1a, 1b, 2a, 2b, 4a, 4b, 5a, 5b, 8a, 8b, 9, 10, 11, 12 and 13: (23 ± 2)°C and (50 ± 5) % R.H.
- Tests 6 and 7: (23 ± 2)°C and (90 ± 5) % R.H.

For maximum working loads and test 10, when paper pallets are used in controlled or more extreme conditions the corresponding conditioning for the tests shall be arranged between supplier and purchaser.

4.6 Wood-based composite pallets

Wood-based composite pallets shall be conditioned for each test as follows.

- Tests 1a, 2a, 4a, 5a, 8a, 9 and 10: (23 ± 2)°C and (50 ± 5) % R.H.
- Tests 1b, 2b, 4b, 5b, 6, 7, and 8b: (23 ± 2)°C and (90 ± 5) % R.H.

If the pallet will be exposed to water in the distribution environment, the conditioning shall be to a water temperature of (20 ± 5)°C for 24 h immersed in water and held just below the surface. Blocks of wood-particle board which can be shown to have been tested according to nationally recognized standards (see bibliography item [1]) are exempted from conditioning.

For maximum working loads and test 10, when wood-based composite pallets are used in controlled or more extreme conditions the corresponding conditioning for the tests shall be arranged between supplier and purchaser.

5 Number of replicates

For each test at least 3 new and untested pallets shall be used.

6 Performance requirements

Performance requirements for tests 1, 2, 4, 5, 6, 7, 8 and 10 in ISO 8611-1:2004, modified as appropriate, are given in Table 1. The mean observation from the tests shall be compared to the performance requirements in Table 1.

Performance requirements for tests 3, 9, 11, 12, 13, 14, and 15 in ISO 8611-1:2004 are not included in Table 1 pending more experience with these tests. However, these tests are useful for comparing the performance between pallets and for improving pallet designs.

Table 1 — Performance requirements for tests

Test no.	Test measurement	Handling activity or purpose of the test	Test load level	Performance limits	ISO 8611-1 clause no.
Static tests					8
1	Bending tests				8.1
1a	Bending strength ^{a, d}	Racking	Ultimate load (U_1) or a load causing 6 % of L_1 (L_2) deflection		8.1.3.1 ^g
1b	Bending stiffness ^{b, d}	Racking	≤ 50 % of U_1	2 % of L_1 (L_2) under load 0,7 % of L_1 (L_2) after relaxation period	8.1.3.2 ^g
2	Wing pallet bending tests				8.2
2a	Bending strength ^a	Lifting with slings	Ultimate load (U_2) or a load causing 6 % of L_1 (L_2) deflection		8.2.3.1
2b	Bending stiffness ^b	Lifting with slings	≤ 50 % of U_2	2 % of L_1 (L_2) under load 0,7 % of L_1 (L_2) after relaxation period	8.2.3.2
3	Air bag bending tests				8.3
3a	Bending strength ^a	Racking		Comparative testing	8.3.3.1 ^g
3b	Bending stiffness ^b	Racking		Comparative testing	8.3.3.2 ^g
4	Fork lifting tests				8.4
4a	Bending strength ^a	Lifting with forklift and pallet trucks	Ultimate load U_4		8.4.3.1
4b	Bending stiffness ^b	Lifting with forklift and pallet trucks	≤ 50 % of U_4 bar load applicator	20 mm or 4,5°, whichever is the lesser deflection, under load ^h 7 mm after relaxation period	8.4.3.2
5	Compression tests for blocks or stringers				8.5
5a	Compression strength	Any handling activity ^c that compresses blocks or stringers	Ultimate load U_5 per block or load causing 10 % of y deflection		8.5.3.1
5b	Compression stiffness ^b	Any handling activity ^c that compresses blocks or stringers	≤ 50 % of U_5 per block	4 mm under load 1,5 mm after relaxation period	8.5.3.2
6	Stacking strength ^f and stiffness	Stacking on different loads	Payload	Any one of $y_1, y_2, y_3,$ or y_4 ≤ 15 mm under load ≤ 7 mm after relaxation time Difference between x_1 and x_2 ≤ 3 %	8.6
7	Dead weight bending ^f strength and stiffness	Racking of different loads	Payload	Deflection y \leq deflection y measured in test 1b	8.7 ^g
8	Bottom deck bending tests				8.8
8a	Bending strength ^{a, e}	Stacking	Ultimate load (U_8) or a load causing 6 % of L_1 (L_2) deflection		8.8.3.1 ^g
8b	Bending stiffness ^{b, e}	Stacking	≤ 50 % of U_8	Record deflection	8.8.3.2 ^g
9	Static deck shear	Collapse resistance		Comparative testing	8.9

Dynamic strength tests					9
10	Diagonal rigidity and impact resistance	Resistance to shocks from drops	empty pallet	$\Delta y = 4\%$ $h = 0,5\text{ m}$ No breakage or damage that limits the performance or functionality of the pallet	9.1
11	Impact deck shear resistance	Collapse resistance		Comparative testing	9.2.2
12	Deck edge impact resistance	Resistance to fork tine impacts		Comparative testing	9.2.3
13	Block impact resistance	Resistance to fork tip impacts		Comparative testing	9.2.4
Friction tests					10
14	Surface friction	Slip resistance on fork tines	self weight, W_s	Comparative testing	10.1
15	Surface friction	Slip resistance of loads on pallet deck		Comparative testing	10.2
<p>a The pallet shall be tested using the direction(s) in which it is intended to be racked (see also Annex A).</p> <p>b The rate of deformation during stiffness tests shall be decreasing.</p> <p>c Handling activities that compress blocks are stacking with or without superstructures or posts and heavy rigid loads.</p> <p>d When failure of the pallet occurs due to stress concentrations at the load applicator, the test shall be rejected and shall be repeated.</p> <p>e The top deck of the pallet shall remain flat during the test. When testing paper pallets, it may be necessary to secure the pallet end or side, depending on the testing direction.</p> <p>f Tests 6 and 7 shall be used for determining maximum working loads as described in ISO 8611-3.</p> <p>g This test may be modified as described in Annex B.</p> <p>h The angle is measured between the line from the edge of the support beam in a horizontal plane to the edge of the pallet before loading and the line from the edge of the support beam to the same point after loading.</p>					

7 Selection of the tests

7.1 General intended use

The three main types of general use are as follows:

- 1) handling of goods without racking or stacking;
- 2) stacking without racking;
- 3) racking and stacking.

Additional performances may be required and this part of ISO 8611 gives some tests (lifting with slings, racking across the stringer or pallet skids, resistance to impacts, friction, etc.). General-purpose pallets intended for use in handling and transportation situations shall be tested according to 7.2, and special-purpose pallets intended for use in a limited range of handling and transportation situations shall be tested according to 7.3 or 7.4.

Tests other than those listed in Clause 7 may be used for additional measurement of pallet and design performance.

7.2 Racking and stacking

For pallets intended for use in racking and stacking, tests 1a, 1b, 4a, 4b, 5a, 5b, 8a and 8b shall be used.

NOTE Tests 8a and 8b also cover chain and skate roll conveyor support conditions.

7.3 Stacking without racking

For pallets intended for use in stacking but never racked, tests 4a, 4b, 5a, 5b, 6, 8a and 8b shall be used.

NOTE The fork lift support test is a necessary bending test because in certain pallet designs this condition of support may be limiting.

7.4 Handling of goods without racking or stacking

For pallets intended for handling of goods without racking and stacking, tests 4a, 4b, 5a and 5b shall be used.

7.5 Automatic handling

For special applications (e.g. chain and skate roll conveyor), the strength and stiffness of the bottom deck can be the weakest point of a pallet. In this case, tests 8a and 8b shall be used.

7.6 Special applications

7.6.1 General

In addition to the tests specified in 7.2 to 7.4, some conditions of use may require additional tests, which are specified in ISO 8611-1.

7.6.2 Lifting with slings

For pallets intended for lifting with slings, tests 2a and 2b shall be used.

7.6.3 Resistance to impacts

When additional knowledge is needed on durability of the pallets in specific conditions of use, tests 9, 11, 12 and 13 may be used and adapted to end use.

7.6.4 Friction tests

Tests 14 and 15 may be used to compare different types of pallets and their interaction with transported goods or handling equipment.

8 Test load — nominal load

8.1 Strength tests

The test load for the strength tests, except test 10, has no fixed value.

8.2 Ultimate load, U

Depending on the use condition described in Clause 7, the tests for determining the ultimate pallet load carrying capacity — tests 1a, 2a, 4a, 5a and 8a — shall be carried out and the ultimate loads — U_1 , U_2 , U_4 , U_5 or U_8 , respectively — shall be determined.

8.3 Stiffness tests

The test load, P , for the stiffness tests 1b, 2b, 4b and 5b shall be 50 % of the ultimate load (safety factor 2) or a lower load, which reaches the deflection limits.

8.4 Nominal load

The lowest value of all test loads, P , from successful stiffness tests shall be the nominal load, R , of the pallet, for the conditions of use selected from Clause 7.

EXAMPLE Intended use: racking and stacking

Ultimate load of test 1a	$U_1 = 2\,840\text{ kg}$	$P_{1a} = 50\%$ of U_1	= 1 420 kg
Ultimate load of test 8a	$U_8 = 3\,120\text{ kg}$	$P_{8a} = 50\%$ of U_8	= 1 560 kg
Ultimate load of test 5a	$U_5 = 4\,060\text{ kg}$	$P_{5a} = 50\%$ of U_5	= 2 030 kg
Test 1b (2 % of L_1 max.)		achieved for P_{1b}	= 1 250 kg
Test 4a	$U_4 = 4\,420\text{ kg}$	$P_{4a} = 50\%$ of U_4	= 2 210 kg
Test 4b		passed with P_{4b}	= 2 210 kg
Test 5b (4 mm max.)		passed with P_{5b}	= 2 030 kg
Test 10 (< 0,04 %)	passed ($\gamma = 0,032\%$)		

The nominal load (R) for this pallet is 1 250 kg.

9 Duration for static stiffness tests

The full load duration for the static stiffness tests 1b, 3b, 5b and 8b shall be as shown in Table 2. The test period and relaxation time for tests 2b and 4b shall be 30 min for all types of pallet.

Table 2 — Full load duration for static stiffness tests

Pallet material		Test period	Relaxation time
		h	h
Unprocessed (sawn) timber with metal fastenings		2	1
All metal (welded or pressed construction)		2	1
Where plastics or plastic parts dictate overall performance	tests 6 and 7	48	2
	all other tests	24	2
Paper-based and processed wood (for example particle board) where these materials dictate overall performance		24	1
Pallet assembled using adhesive to connect major components		24	1

10 Number of impacts for dynamic tests

For each dynamic test, three impacts shall be carried out on each pallet surface or horizontal axis as specified in ISO 8611-1:2004, Clause 9. The result of each test shall be the average of these 3 impacts.

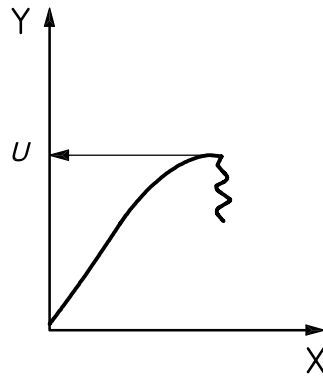
11 Test report

The test report shall be in accordance with ISO 8611-1:2004, Clause 11.

Licensed to CHEP/JAUME PENA
ISO Store order #: 681358/Downloaded: 2005-07-13
Single user licence only, copying and networking prohibited

Annex A
(informative)

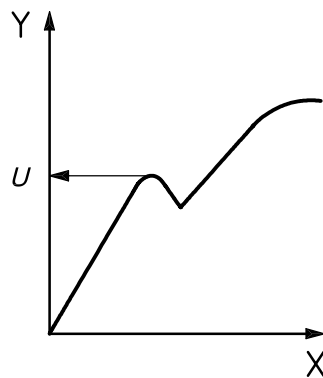
Plots of typical force versus deformation from pallet tests showing the deformation of ultimate load, U



Key

- U ultimate load
- X deformation
- Y load

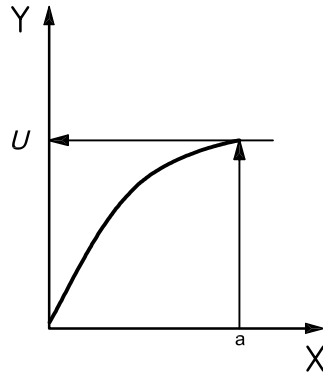
Figure A.1 — Force versus deformation plot indicating total pallet failure



Key

- U ultimate load
- X deformation
- Y load

Figure A.2 — Force versus deformation plot indicating a component failure

**Key**

U ultimate load

X deformation

Y load

a 6 % of test span.

Figure A.3 — Force versus deformation plot indicating excessive deformation

Annex B (normative)

Alternative support profile for test 1

If required, the supports in test 1 may be replaced with supports as shown in Figure B.1. The dimension of 50 mm as shown is the width of the support actually in contact with the pallet under test.

The test load applicators shall remain as specified in ISO 8611-1.

Dimensions in mm

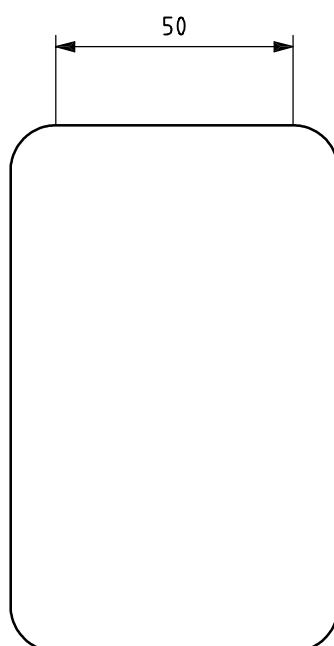


Figure B.1 — Alternative support profile for test 1

Bibliography

- [1] EN 1087-1, *Particle boards — Determination of moisture resistance — Part 1: Boil test*
- [2] EN 13183-2, *Moisture content of a piece of sawn timber — Part 2: Estimation by electrical resistance method*

