INTERNATIONAL STANDARD

ISO 8611-3

First edition
2011-05-15

Pallets for materials handling — Flat pallets —

Part 3: Maximum working loads

Palettes pour la manutention — Palettes plates —

Partie 3: Charges maximales en service

Reference number
ISO 8611-3:2011(E)

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Contents

Page

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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.

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.

ISO 8611-3 was prepared by Technical Committee ISO/TC 51, *Pallets for unit load method of materials handling*.

This first edition of ISO 8611-3 cancels and replaces ISO/TS 8611-3:2005, which has been technically revised.

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*

— *Part 3: Maximum working loads*

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Introduction

The forces to which pallets are exposed during use vary significantly. The test procedures described in ISO 8611-1 are approximate simulations of pallet use. These tests help the pallet designer to establish an initial acceptable balance between the cost and the performance of a pallet design. It is intended that all results of tests performed using this protocol be confirmed and verified using field trials before publication of performance or the commercial implementation of a new pallet design.

The nominal load, determined according to this test protocol, does not represent a payload and cannot be verified using field trials. The nominal load is a minimum payload level for use in determining maximum working load according to the procedures in this part of ISO 8611. The maximum working load can be verified for a specified payload and intended use, using field trials. It is intended that the publication of the maximum working load include a description of the payload and the intended modes of use of the pallet.

It is essential to exercise care when comparing the results of tests with historic experience using existing pallet designs. User expectations of pallet performance vary. Some require greater and some accept lower levels of performance. Users are accepting different levels of risk when using pallets. Because of the varied performance expectations of pallet users, the results of tests might not always reflect the user's perception of pallet performance in use.

The nominal load might not reflect users' perception of pallet performance because the nominal load does not represent a payload. It is intended that maximum working loads be used to compare with the historic performance of existing pallet designs.

Regarding the use of the ISO 8611 series,

— ISO 8611-1 describes the test methods,

— ISO 8611-2 describes the performance requirements and selection of tests, and

— this part of ISO 8611 describes tests for determining maximum working loads for known payloads.

ISO 8611-1 and ISO 8611-2 are required for determining nominal load. The nominal load is the lowest safe load value for the specified support conditions, independent of the type of load (excluding concentrated loads).

ISO 8611-1, ISO 8611-2 and this part of ISO 8611 are required for determining maximum working loads for known payloads.

The nominal load for the intended use is established by the selection of tests in ISO 8611-1 and the performance requirement is established from criteria in ISO 8611-2.

The following three types of intended use with specified support conditions are defined:

— handling of loaded pallets with racking and stacking;

— handling of loaded pallets without racking;

— handling of loaded pallets without racking or stacking.

To determine the maximum working load by testing in this part of ISO 8611, the deflection under the known payload cannot exceed the limiting deflection (see 4.2, 4.3 and 4.4) established in ISO 8611-1 and ISO 8611-2. The maximum working load is the greatest payload that a pallet can be permitted to carry in a specific loading and support condition.

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Guidance is given in Annex A as to the general effect on performance of different load types and stabilization methods. These can only give guidance as to the likely result from tests with the known payload.

Other tests for durability evaluation are specified in ISO 8611-1.

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Pallets for materials handling — Flat pallets —

Part 3: Maximum working loads

1 Scope

This part of ISO 8611 specifies the determination of maximum working load for new flat pallets with known payloads in different handling environments.

It is not intended to apply to pallets with a fixed superstructure or a rigid, self-supporting container that can 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, *Pallets for materials handling — Flat pallets — Part 1: Test methods*

ISO 8611-2, *Pallets for materials handling — Flat pallets — Part 2: Performance requirements and selection of tests*

3 Terms and definitions

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

3.1
breaking of one component
fracture of a structural element which significantly affects the strength, stiffness or functionality of a pallet

3.2
concentrated load
load concentrated over an area of less than 50 % of the pallet top deck

[ISO 445:2008, definition 2.3]

3.3
maximum working load
greatest payload that a pallet is permitted to carry in a specific loading and support condition

NOTE 1 This varies according to the type, distribution, arrangement and means of stabilization of the load and the system of support, and can be lower or higher than the nominal load (see ISO 8611-2 and this part of ISO 8611).

NOTE 2 Adapted from ISO 445:2008, definition 2.7.

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3.4
nominal load
R
lowest safe 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 7.1 of ISO 8611-2:2011.

NOTE 2 Nominal load does not represent an actual payload on a pallet in use. The nominal load is used for comparing the performance of different pallets.

NOTE 3 Adapted from ISO 445:2008, definition 2.2.

3.5
payload
Q
load carried by the pallet in use

[ISO 445:2008, definition 2.8]

NOTE This can be above, identical to or below the nominal load.

3.6
platen
solid, rigid surface on a test machine used for applying a load to test a sample pallet

3.7
racking
storage of unit loads in drive-in or beam racks with free, unsupported spans

[ISO 445:2008, definition A.3.1]

3.8
safety factor
ratio of the ultimate load to the nominal load

NOTE In ISO 8611 (all parts), this ratio is at least 2,0.

3.9
solid load
single, compact, rigid, homogeneous load, supported by all the blocks and/or stringers (bearers) of the pallet

NOTE Adapted from ISO 445:2008, definition 2.6.

3.10
stacking
placing of pallets with unit loads one upon the other without recourse to intermediate shelves or racking

NOTE Adapted from ISO 445:2008, definition A.2.1.

3.11
stiffness
relative deformation of a pallet or component under load

NOTE High stiffness means small displacement, deflection or deformation for a given load.

3.12
test load
P
load applicators, the load board or load box and the applied load itself

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3.13
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 of ISO 8611-2:2011.

3.14
uniformly distributed bonded load
load spread evenly across the full surface of the pallet top deck, where the pattern of each single layer changes, so that the packages are interlocked

3.15
uniformly distributed unbonded load
load spread evenly across the full surface of the pallet top deck where the packages are not interlocked, bound or connected

4 Determination of maximum working load with known payloads

4.1 General

Conditions of intended use are given in Table 1.

Table 1 — Conditions of intended use

Handling activity	Racking and stacking	Stacking without racking	Without racking or stacking	Special situation	
				Conveyor	Sling
Racking	1b[a] or 7b[b]				
Forklift	2b[c]	2b[c]	2b[c]		
Stacking	4b[d]	4b[d]			
Twin track conveyors	5b[e]			5b[e]	
Sling under wings					6[f]

[a] Bending — Bending stiffness test.
[b] Airbag bending — Bending stiffness test.
[c] Forklifting — Bending stiffness test.
[d] Stacking — Deck stiffness test.
[e] Bottom deck bending — Bending stiffness test.
[f] Wing pallet bending — Bending stiffness test.

The test load in tests 1b, 2b, 4b, 5b and 6b shall be the payload. The test load in test 7b shall be the airbag.

The maximum working load shall be determined by the appropriate tests as given in 4.2 to 4.4.

Test the pallet in the direction of its intended use. If the pallet is only going to be supported in one direction, then test in that direction. If the pallet is going to be supported in both directions in a rack, or on forks, the weaker direction may be determined and used for determining the maximum working load.

In order to establish the weakest pallet support direction relative to pallet length or width, whenever conducting tests 1b, 2b and 7b, test one pallet across the length of the pallet and then a second pallet across the width of the pallet. There is no requirement for further tests on the stronger dimension unless the result is within 15 % of the weaker.

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4.2 Pallets for handling of goods with racking and stacking

Pallets intended for handling of goods in racking and stacking shall be tested using test 1b (see Figure 1). For the determination of bending stiffness, use test 2b (see Figure 2) for the forklifting test and use test 4b (see Figure 3) for the stacking test as given in 8.2 and 8.4 of ISO 8611-1:2011 using the payload.

Whenever conducting test 4b, the payload shall include the total mass representing the maximum number of unit loads stacked one upon the other during use. The top deck is tested using the mass of all unit loads in a stack. The bottom deck shall be tested by a mass equivalent to one less than the total mass of unit loads. Dead weights or a test machine may be used to apply the extra load necessary to one payload as shown in Figure 3.

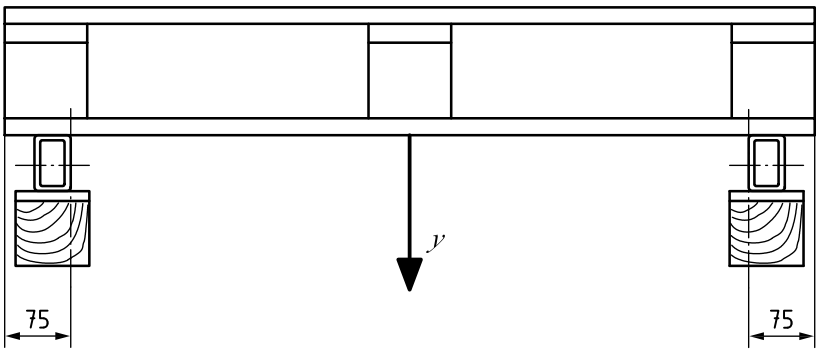
The maximum pallet deflection, y, when conducting tests 1b, 2b and 4b for any payload cannot exceed the deflection at ½ U_1, U_2 and U_4 from tests 1a, 2a and 4a in ISO 8611-1 and ISO 8611-2.

NOTE Most often, test 1b is limiting. If it is known that one condition of use is limiting, only those tests necessary for that condition need be conducted.

For conditions of sling support under pallet wings, test 6b shall be conducted.

A conveyor support can be limiting and test 5b may be necessary.

Dimensions in millimetres



Key

y deflection

Figure 1 — Test for racking conditions — Test 1b — Bending test

4.3 Pallets for handling of goods with stacking without racking

Pallets intended for handling of goods and stacking without racking shall be tested using test 2b (forklifting test, see Figure 2) as given in 8.2 of ISO 8611-1:2011 and Table 1 of ISO 8611-2:2011, and using test 4b (stacking test, see Figure 3) as given in 8.4 of ISO 8611-1:2011 and Table 1 of ISO 8611-2:2011, using the payload.

The maximum working load shall be the lowest value achieved in tests 2b and 4b.

The maximum pallet deflection, y, when conducting test 2b for any payload cannot exceed the deflection at ½ U_2 from test 2a in ISO 8611-1. The maximum pallet deflection, y, when conducting test 4b for any payload cannot exceed the deflection at ½ U_4 from test 4a for the top deck or the bottom deck in ISO 8611-1.

NOTE If it is known that one condition of use is limiting, only the test necessary for that condition need be conducted.

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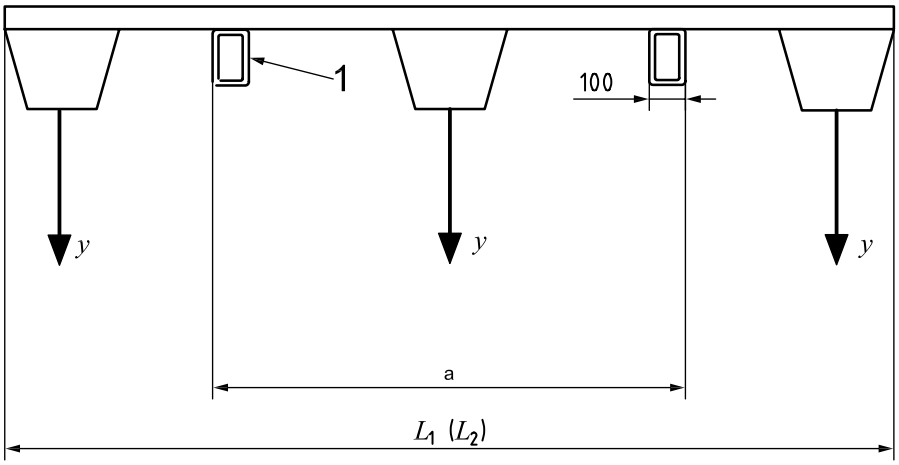
Dimensions in millimetres



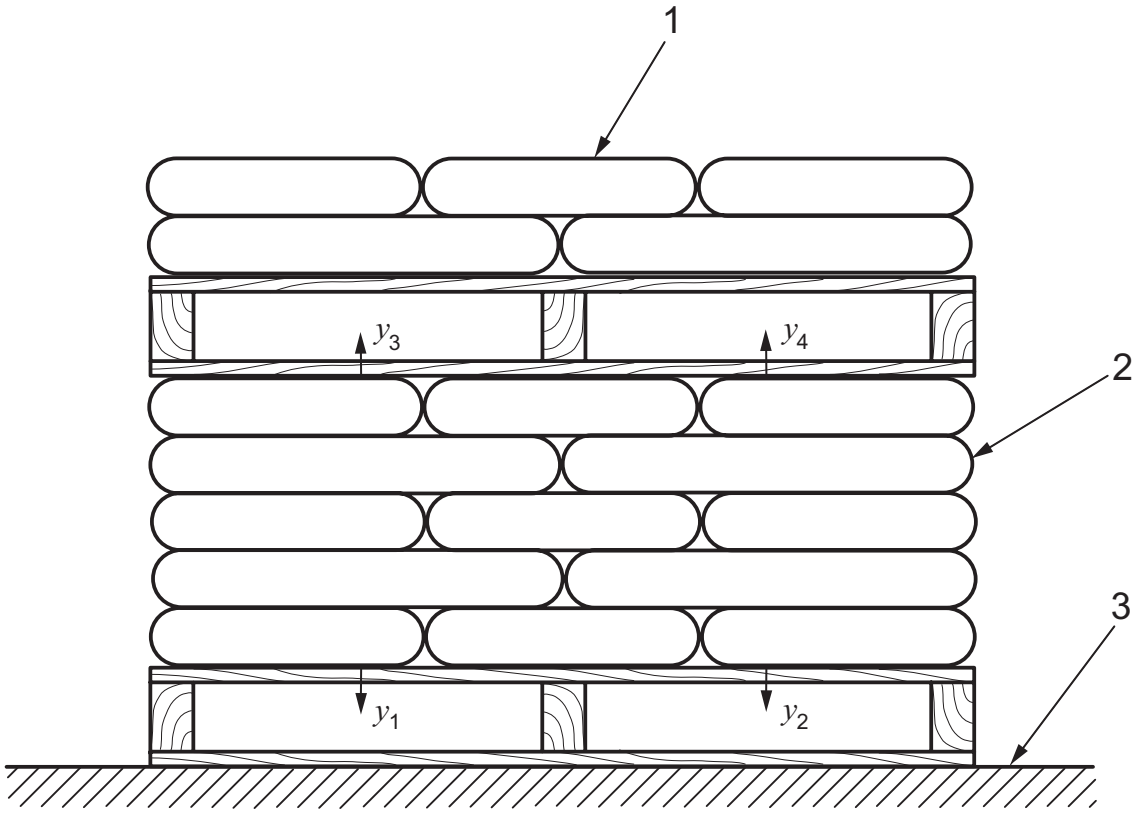
Key

1 support

y deflection

a Distance between the supports.

Figure 2 — Test 2b — Forklifting test



Key

1 test load, payload, or test machine

2 payload

3 load support

y_1, y_2 downward deflection

y_3, y_4 upward deflection

NOTE The payload shown in this figure is an example only.

Figure 3 — Test 4b — Stacking test

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4.4 Pallets for handling without racking or stacking

Pallets intended for use in the transportation of goods on forklift trucks or pallet trucks without racking or stacking shall be tested using test 2b. The forklifting test shall be as given in 8.2 of ISO 8611-1:2011, and Table 1 of ISO 8611-2:2011 with payload.

The maximum pallet deflection when conducting test 2b for any payload cannot exceed the deflection at ½ U_2 from test 2a in ISO 8611-1.

4.5 Determination of maximum working load

The lowest mass of the payload which causes the deflection, y, to reach the deflection at ½ of U_1, or U_7, U_2, U_4 or U_5, for the specified condition of use shall be the maximum working load.

EXAMPLE Intended use: racking and stacking.

An example of the determination of maximum working load for use in racking and stacking using arbitrary data is given in Table 2.

Table 2 — Example of the determination of maximum working load for use in racking and stacking

Determination of maximum working load for use in racking and stacking	
Ultimate load of test 1a $U_1 = 3\ 124$ kg	50 % of U_1[a] leads to a maximum working load of $P_{1a} = 1\ 562$ kg
Test 1b ($\leqslant$50 % of U_1)	Reached at $P_{1b} = 1\ 375$ kg
Test 2b ($\leqslant$50 % of U_2)	Passed with $P_{2b} = 1\ 750$ kg
Ultimate load of test 4a $U_4 = 4\ 862$ kg	50 % of U_4[a] leads to a maximum working load of $P_{4a} = 2\ 431$ kg
Test 4b	Passed with $P_{4b} = 2\ 431$ kg
Ultimate load of test 5a $U_5 = 4\ 466$ kg	50 % of U_5[a] leads to a maximum working load of $P_{5a} = 2\ 233$ kg
Test 5b (15 mm max.)	Passed with $P_{5b} = 2\ 233$ kg
[a] The load safety factor is 2.	

The maximum working load for this pallet is 1 375 kg.

5 Test report

The test report shall be in accordance with ISO 8611-1:2011, Clause 9.

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Annex A
(informative)

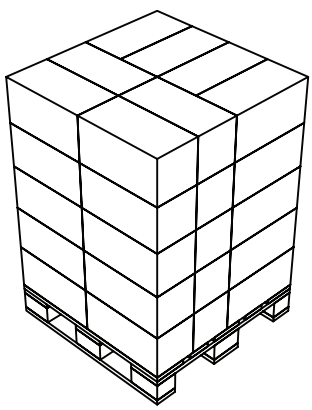
The effect of packaging design, pallet stiffness and load stabilizer selection on the deformation of unit loads in warehouse storage racks

NOTE This annex is for information only and cannot be used in place of testing.

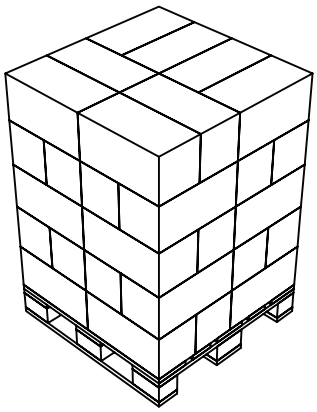
The data contained in Tables A.1, A.2 and A.3 are from Reference [2].

These data are presented as demonstration of the effects of unit load design on the deformation of pallets in storage racks. The relative deformation measurements reflect the potential differences between nominal load estimates and various maximum working load estimates for pallets used in warehouse storage racks.

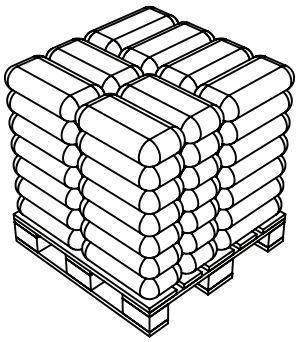
Diagrams or illustrations of the unit loads tested are given in Figure A.1.



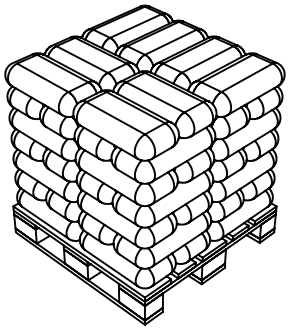
a) Cased goods — Column stacked



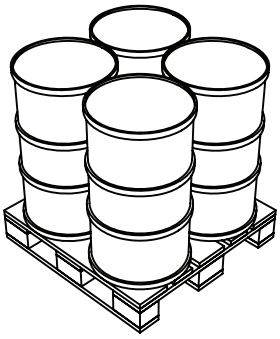
b) Cased goods — Interlock stacked



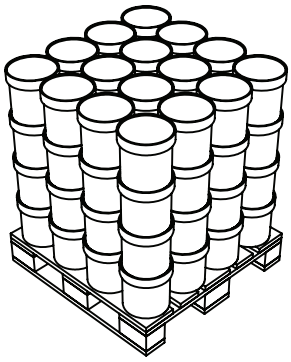
c) Sacks — Column stacked



d) Sacks — Interlock stacked



e) Drums



f) Pails

Figure A.1 — Illustrations of loads tested

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Table A.1 — The effect of load stabilizers and pallet stiffness on the relative deformation of cased-goods and unit loads in warehouse storage racks

Pallet stiffness kN/cm	Airbag	Column-stacked cases	Load stabilization method		
			Stretch wrap	Vertical strapping	Interlock-stacked cases
High (3,6)	1,00	0,83	0,77	0,44	0,67
Medium (2,3)	2,05	1,44	1,22	0,83	1,44
Low (1,6)	2,61	2,33	1,94	0,89	2,22

Table A.2 — The effect of packaging design on relative unit-load deformation in warehouse storage racks

Airbag	Sack	Case	Plastic pail	Steel drum
1,00	0,87	0,82	0,70	0,54

Table A.3 — The effect of load stabilizers on relative, cased-goods, unit-load deformation in warehouse storage racks

Column stacked	Interlock stacked	Stretch wrap	Vertical strapping
1,00	0,96	0,87	0,61

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[2] WHITE, M.S., WILBUR, D., RUPERT, R. and MCLEOD, J. *Determination of pallet maximum working loads from nominal load measurements*. Center for Unit Load Design, Virginia Tech., Blacksburg, VA, USA, 1999

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