INTERNATIONAL STANDARD

ISO 8611-2

Second edition
2021-12

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 sélection des essais

Reference number
ISO 8611-2:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Test conditions **2**
4.1 General 2
4.2 Wooden pallets 3
4.3 Metal pallets 3
4.4 Plastic pallets 3
4.5 Paper pallets 3
4.6 Wood-based composite pallets 3
5 Number of replicates **4**
6 Performance requirements **4**
7 Selection of the tests **7**
7.1 Intended use 7
7.2 Handling of goods with racking and stacking 8
7.3 Handling of goods with stacking without racking 8
7.4 Handling of goods without racking or stacking 8
7.5 Special applications 8
7.5.1 General 8
7.5.2 Automatic handling or conveyors 9
7.5.3 Lifting with slings 9
7.5.4 Resistance to impact 9
7.5.5 Friction tests 9
8 Test load — Nominal load **9**
8.1 Strength tests 9
8.2 Ultimate load, *U* 9
8.3 Stiffness tests 9
8.4 Nominal load 9
9 Duration for static stiffness tests **10**
10 Number of impacts for dynamic tests **10**
11 Test report **10**
Annex A (informative) **Plots of typical force versus deformation from pallet testsshowing the deformation of ultimate load, *U*** **11**
Bibliography **13**

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 51, *Pallets for unit load method of materials handling*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 261, *Packaging*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 8611-2:2011), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Separate performance/deflection limits for the internal and external spans were specified for test 2a and 2b.

— It was clarified that test 5 applies for both twin track conveyors and narrow span beam racking.

— It was clarified in Table 2, that test 4a,b should be conducted for a pallet without racking or stacking but only on the top deck.

— The determination of nominal load was clarified in Table 3.

A list of all parts in the ISO 8611 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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 ISO 8611-3. 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, it is possible that the results of tests do not always reflect the user's perception of pallet performance in use.

It is possible that the nominal load does 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,

— this document describes the performance requirements and selection of tests, and

— ISO 8611-3 describes tests for determining maximum working loads for known payloads.

ISO 8611-1 and this document 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, this document and ISO 8611-3 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 this document.

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

— 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 through testing given in ISO 8611-3, the deflection under the known payload cannot exceed the limiting deflection (see ISO 8611-3:2011, 4.2, 4.3 and 4.4) established in ISO 8611-1 and this document. The maximum working load is the greatest payload that a pallet can be permitted to carry in a specific loading and support condition.

Guidance is given in ISO 8611-3:2011, 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.

Pallets for materials handling — Flat pallets —

Part 2: Performance requirements and selection of tests

1 Scope

This document specifies the performance requirements to establish nominal loads for new flat pallets.

It also specifies the tests required for new flat pallets in various handling environments and the performance requirements for tests with payloads. This document does not 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 8611-1:2021, *Pallets for materials handling — Flat pallets — Part 1: Test methods*

ISO 8611-3, *Pallets for materials handling — Flat pallets — Part 3: Maximum working loads*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
breaking of one component
fracture of a structural element which significantly affects the strength, *stiffness* (3.9) or functionality of a pallet

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

3.3
maximum working load
greatest *payload* (3.5) that a pallet is permitted to carry in a specific loading and support condition

Note 1 to entry: 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* (3.4) (see, for example, Clauses 4 and 6 and see also ISO 8611-3).

3.4
nominal load
R
lowest *test load* (3.10) value for the specified support conditions, independent of the type of load (excluding *concentrated loads* (3.2))

Note 1 to entry: "Specified support conditions" refers to the range of conditions of use in 7.1.

Note 2 to entry: Nominal load does not represent an actual *payload* (3.5) on a pallet in use. The nominal load is used for comparing the performance of different pallets.

3.5
payload
Q
load carried by the pallet in use

Note 1 to entry: This can be above, identical to or below the *nominal load* (3.4).

3.6
racking
storage of unit loads in drive-in or beam racks with free, unsupported spans

3.7
safety factor
ratio of the *ultimate load* (3.11) to the *nominal load* (3.4)

Note 1 to entry: In the ISO 8611 series, this ratio is at least 2,0.

3.8
stacking
placing of pallets with unit loads one upon the other without recourse to intermediate shelves or *racking* (3.6)

3.9
stiffness
relative deformation of a pallet or component under load

Note 1 to entry: High stiffness means small displacement, deflection or deformation for a given load.

3.10
test load
P
load applicators, the load board or load box and the applied load itself including the datum load (1,5 % of the *ultimate load* (3.11))

3.11
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* (3.1), or when displacement, deformation or deflection becomes excessive

Note 1 to entry: See Table 1.

4 Test conditions

4.1 General

Test conditions shall be determined based on the pallet material in accordance with 4.2 to 4.6 and shall be maintained throughout the test. If the pallet comprises several different types of material, the

moisture and temperature conditions shall be in accordance with the material that is most sensitive to changes in conditions.

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 The measurement can be carried out in accordance with EN 13183-2.

4.3 Metal pallets

Conditioning shall not be used for metal pallets.

4.4 Plastic pallets

The test conditions for nominal load, maximum working load and durability tests for plastic pallets shall be the following:

— tests 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a, 6b, 8, 9, 10, 11, 12 and 13: (23 ± 2) °C

— maximum working load tests supporting the payload: (40 ± 2) °C

— test 9: (23 ± 2) °C and (–10 ± 2) °C

For maximum working loads and test 9, wherever plastic pallets are used in controlled or more extreme conditions, the test conditions shall be agreed between the supplier and purchaser.

4.5 Paper pallets

The test conditions for nominal load, maximum working load and durability tests for paper pallets shall be the following:

— tests 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a, 6b, 8, 9, 10, 11, 12 and 13: (23 ± 2) °C and (50 ± 5) % RH

— maximum working load tests supporting payload: (23 ± 2) °C and (90 ± 5) % RH

For maximum working loads and test 9, wherever paper pallets are used in controlled or more extreme conditions, the test conditions shall be agreed between supplier and purchaser.

4.6 Wood-based composite pallets

The test conditions for nominal load, maximum working load and durability tests for wood-based composite pallets shall be the following:

— tests 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a, 6b, 8, 9, 10, 11, 12 and 13: (23 ± 2) °C and (50 ± 5) % RH

— maximum working load tests: (23 ± 2) °C and (90 ± 5) % RH

If it is intended that the pallet be exposed to water in the distribution environment, the pallet shall be immersed in water just below the surface for 24 h at a temperature of (20 ± 5) °C.

Blocks of wood-particle board, which can be shown to have been tested according to nationally recognized standards (for example, see EN 1087-1), are exempt from conditioning.

For maximum working loads and test 9, when wood-based composite pallets are used in controlled or more extreme conditions, the test conditions shall be agreed between the supplier and purchaser.

5 Number of replicates

For each test, at least three untested pallets shall be used.

6 Performance requirements

Performance requirements for tests 1, 2, 3, 4, 5, 6 and 9 in ISO 8611-1 are given in Table 1. The maximum observation from the tests shall be compared with the performance requirements in Table 1.

Performance requirements for tests 8, 10, 11, 12, 13 and 14 in ISO 8611-1 are not included in Table 1, pending more experience with these tests.

Table 1 — List of tests

Test no.	Test measurement	Handling activity or purpose of the test	Test load level	Performance limits	ISO 8611-1:2021 subclause ref.
Nominal load tests					
1	**Bending tests**	Racking			8.1
1a	Bending strength[a,d]		Ultimate load (U_1) or a load causing 6 % of L_1 (L_2) deflection		8.1.3.1
1b	Bending stiffness[b,d]		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
2	**Forklifting tests**	Lifting with forklift and pallet trucks			8.2
2a	Bending strength[a]		Ultimate load, U_2 or Internal span: a load causing 6 % of a-200 mm deflection External span: 23 % of the (L-a)/2 span under load		8.2.3.1

[a] The pallet shall be tested using the direction(s) in which it is intended to be racked (see also Annex A).

[b] The rate of deformation during stiffness tests shall be decreasing.

[c] Handling activities that compress blocks are stacking with or without superstructures or posts and heavy rigid loads.

[d] Wherever failure of the pallet occurs due to stress concentrations at the load applicator, the test shall be rejected and shall be repeated.

[e] The top deck of the pallet shall remain flat during the test.

[f] Test 4b shall be used for determining maximum working load of pallets as described in ISO 8611-3.

[g] 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.

Table 1 *(continued)*

Test no.	Test measurement	Handling activity or purpose of the test	Test load level	Performance limits	ISO 8611-1:2021 subclause ref.
2b	Bending stiffness[b]		50 % of U_2	**Internal span:** 2 % of a-200 mm under load, 0,7 % of a-200 mm after relaxation period **External span:** 7,8 % of the (L-a)/2 span under load, 2,7 % of the (L-a)/2 span after relaxation period	8.2.3.2
3	**Compression tests for blocks or stringers**				8.3
3a	Blocks or stringers strength	Any activity that compresses blocks or stringers, including stacking	Ultimate load, U_3, per block or load causing 10 % of y deflection		8.3.3.1
3b	Blocks or stringers stiffness[c]		50 % of U_3 per block	4 mm under load 1,5 mm after relaxation period	8.3.3.2
4	**Stacking tests**[f]		Payload		8.4
4a	Decks strength test	Stacking	Ultimate U_4 top deck and ultimate U_4 bottom deck or a load causing 6 % of deflection L_1 (L_2)		8.4.3.1
4b	Deck stiffness test[b]		50 % of U_4	2 % of L_1 (L_2) under load 0,7 % of L_1 (L_2) after relaxation period	8.4.3.2
5	**Bottom deck bending tests**				8.5
5a	Bending strength[a,e]	Twin track conveyors	Ultimate load (U_5) or a load causing 6 % of L_1 (L_2) deflection		8.5.3.1
5b	Bending stiffness[b,e]		50 % of U_5	15 mm under load, 7 mm after relaxation time	8.5.3.2

[a] The pallet shall be tested using the direction(s) in which it is intended to be racked (see also Annex A).

[b] The rate of deformation during stiffness tests shall be decreasing.

[c] Handling activities that compress blocks are stacking with or without superstructures or posts and heavy rigid loads.

[d] Wherever failure of the pallet occurs due to stress concentrations at the load applicator, the test shall be rejected and shall be repeated.

[e] The top deck of the pallet shall remain flat during the test.

[f] Test 4b shall be used for determining maximum working load of pallets as described in ISO 8611-3.

[g] 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.