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Pallets for materials handling — Quality of fasteners for assembly of new and repair of used, flat, wooden pallets

Palettes pour la manutention et le transport de marchandises — Qualité des éléments de fixation pour l'assemblage et la réparation des palettes en bois

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15629 was prepared by Technical Committee ISO/TC 51, *Pallets for unit load method of materials handling*.

Annexes A, B and C of this International Standard are for information only.

Introduction

Efficient international transportation of products depends on both pallet strength and functionality, or fit, to the materials handling systems. Existing ISO standards address issues of strength and some issues regarding functionality of pallets. However, major issues related to the minimum material quality and manufacturing and repair workmanship are not addressed in current ISO standards. These factors may significantly impact the efficiency of international unit-load material handling.

In November, 1996, ISO TC 51 approved a new work item “Timber Pallets for Materials Handling — Quality of Component Assembly and Repair” and established WG 7 to prepare a document.

This International Standard contains recommended minimum acceptable quality levels for mechanical fasteners used in the assembly of wooden pallets. Mechanical fasteners commonly used for the assembly of wooden pallets are classified as nails, staples, bolts and screws. The type and properties of fasteners affect pallet performance.

This International Standard does not address safety problems, if any, associated with the use of these fasteners. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

This document addresses the current commercial difficulty in pallet manufacture, that there is no recognized means of defining pallet nails with regard to their quality and strength. Table 2 gives a guide as to strength qualities for nails which are typically used in construction of very strong pallets as opposed to pallets designed for light loads.

Actual nail diameter, profiles and strengths are the responsibility of the specifier and user who may find the full-scale pallet tests described in ISO 8611-1 of value.

In September 1999 it was decided to publish four related International Standards:

— ISO 15629:2002, *Pallets for materials handling — Quality of fasteners for assembly of new and repair of used, flat, wooden pallets*

— ISO 18333, *Pallets for materials handling — Quality of new wooden components for flat pallets*

— ISO 18334, *Pallets for materials handling — Quality of assembly of new, wooden, flat pallets*

— ISO 18613, *Repair of flat wooden pallets*

Pallets for materials handling — Quality of fasteners for assembly of new and repair of used, flat, wooden pallets

1 Scope

This International Standard gives guidelines on nails and staples used in the assembly of new and repair of used wooden flat pallets.

For the purposes of this International Standard the term fasteners applies to nails and staples only.

This International Standard is prescriptive and performance-based and contains physical descriptions of fasteners as well as minimum recommended performance levels.

For information on other fasteners such as bolts and screws used in pallets, see ISO 445.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 445, *Pallets for materials handling — Vocabulary*

ISO 12777-1, *Methods of test for pallet joints — Part 1: Determination of bending resistance of pallet nails, other dowel-type fasteners and staples*

ISO 12777-2, *Methods of test for pallet joints — Part 2: Determination of withdrawal and head pull-through resistance of pallet nails and staples*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 445 apply together with the following.

3.1
fluted nail
round wire nail with thread-crests parallel to the nail shank

4 Nails and Staples

4.1 Classification

As used in pallets, nails are classified as plain- or smooth-shank, helical, annular ring, twisted or barbed. Staples have either round-wire or approximately square-wire legs, referring to the cross-sectional shape of the wire. Nails and staples shall be specified using at least nail wire diameter, length, thread type and point type. These and other characteristics which affect pallet nail and staple performance are listed in Table 1.

Table 1 — Physical and mechanical characteristics of nails and staples used in pallets

Nails — Shank profiles				Staples	
Plain (smooth)	**Helical**	**Annular**	**Square twisted — barbed**	**Round wire**	**Square wire**
Length nail (wire) diameter	Length nail (wire) diameter	Length nail (wire) diameter	Length nail (wire) diameter[a]	Length staple leg diameter	Length Staple leg width and thickness
Head diameter	Head diameter	Head diameter	Head diameter	Crown length	Crown length
—	Thread length	Thread length	—	—	—
—	Thread-crest diameter	Thread-crest diameter	Flute-crest diameter	—	—
—	Number of helixes	Number of rings	Number of helixes	—	—
—	Number of flutes	—	Number of flutes	—	—
Type of point	Type of point	Type of point	Type of point	Type of point	Type of point
Bending resistance	Bending resistance	Bending resistance	Bending resistance	Bending resistance	Bending resistance

[a] The nail (wire) diameter is the thread crest diameter.

4.2 Measurement of physical characteristics

Methods of measuring the physical characteristics of nails and staples are described in annex A. When a complete assessment of fastener quality is required, separation resistance in accordance with ISO 12777-2 shall be determined by measuring both fastener shank withdrawal and head or crown pull-through. These tests shall include using wood specimens and specimen conditioning typical of those which occur during pallet use.

4.3 Minimum acceptable performance

The recommended minimum acceptable performance levels for nails and staples are specified in Table 2. Annex B is a correlation between the static bending resistance values reported in Table 2 and the MIBANT impact bend test as described in ISO 12777-1.

NOTE 1 Tests of joints containing multiple fasteners are described in ISO 12777-3.

NOTE 2 Pallet fasteners are sometimes coated. These coatings are intended to:

— increase corrosion resistance;

— improve separation resistance;

— improve drivability.

The effect of coatings on fastener performance shall be evaluated using tests described in ISO 12777-2.

Table 2 — Recommended minimum quality of staples and nails[a]

	Minimum separation resistance[b] per fastener			Minimum bending resistance[c] per fastener			Minimum ratio of nail head/nail (wire) diameter	Minimum staple crown length
Performance level[d]	1	2	3	1	2	3		
Block or stringer fasteners	2 000 N	1 000 N	600 N	6,0 N·m	5,4 N·m	3,5 N·m	2,00	9,5 mm + 2 × (leg width or diameter)
Clinched mat fasteners	1 000 N	500 N	250 N	2,5 N·m	2,2 N·m	1,6 N·m	2,00	9,5 mm + 2 × (leg width or diameter)

[a] The quality levels represent those of pallet fasteners successfully used. It is the responsibility of the pallet specifier to determine the appropriate fastener quality necessary for use.

[b] Determined in accordance with ISO 12777-2 by measuring both fastener shank withdrawal and head or crown pull-through resistance.

[c] Determined in accordance with ISO 12777-1.

[d] Performance level refers to relative levels of pallet structural durability or resistance to rough handling during pallet use. Levels 1, 2, and 3 refer to fastener quality levels for use in reusable pallets of respectively high, medium and low levels of structural durability.

Annex A
(informative)

Methods of measuring pallet nail and staple physical characteristics

A.1 Sampling

A random sample of at least twelve (12) specimens per “lot” of fasteners is recommended. Average values and an appropriate measure of statistical dispersion should be reported.

NOTE A “lot” consists of fasteners of a single shipment of the same specification and produced during a single continuous production run.

A.2 Fastener length

A.2.1 Nails

The nail length (l) is the distance, measured parallel to the nail-shank axis, from the top of the head to the tip of the point, as shown in Figure A.1. For this measurement, a caliper or ruler is used to measure to the nearest 0,5 mm.

Figure A.1 — Schematic diagram of nail length measurement

A.2.2 Staples

The staple length (L) is the distance, measured parallel to the staple-leg axis, from the bottom of the crown to the tip of the point, as shown in Figure A.2. For this measurement, a caliper or ruler is used to measure to the nearest 0,5 mm.

A.3 Thread length

The thread length (L_T) is the continuous distance from the top end of the thread along the nail shank to the top of the point or the bottom end of the thread, as shown in Figure A.3. If the thread is not continuous, i.e. interrupted, the thread length is the length of the threaded portions of the nail shank penetrating the nailing member to the required depth. The thread length is measured with a caliper or ruler to the nearest 0,5 mm.

A.4 Nail or staple wire diameter

A.4.1 Plain, helical barbed and annular round-wire nails

The wire diameter (d) is the distance across the non-threaded portion of the nail shank away from the gripper marks, as shown in Figure A.4. The wire diameter is measured using a micrometer to the nearest 0,025 mm. If the nail is coated, the coating should be carefully removed where the measurement is to be made.

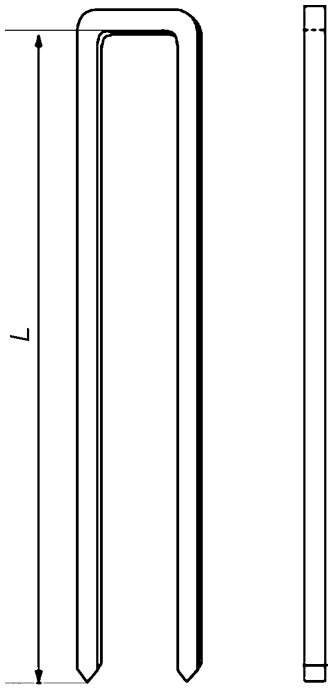


Figure A.2 — Schematic diagram of the staple length measurement

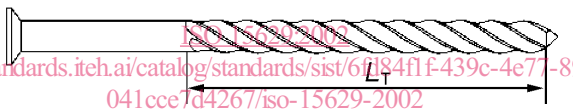
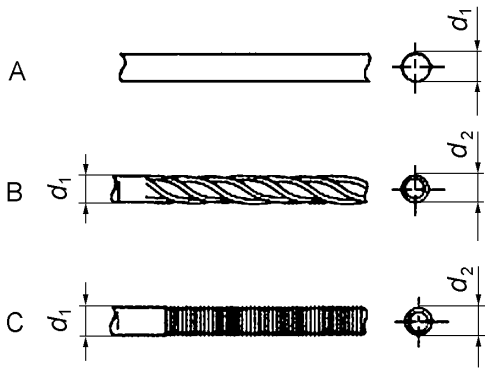


Figure A.3 — Schematic diagram of the thread length measurement



Key

A	Plain shank
B	Helically threaded
C	Annularly threaded
d_1	Wire diameter
d_2	Thread diameter

Figure A.4 — Schematic diagram of nail wire diameter (d) measurements

A.4.2 Staples

The wire diameter of both staple legs is the same. For round-wire bulk staples, it is the distance across one of the staple legs. For flattened-wire staples, usually having a rectangular cross-section, the corresponding measurements are the thickness (T) and the width (W) of the staple leg, as shown in Figure A.5. The thickness is the wire dimension in the direction perpendicular to the staple crown. The thickness is normally the largest cross-sectional leg dimension. The width is the wire dimension in the direction parallel to the staple crown. Both thickness and width are measured to the nearest 0,025 mm, along the uncoated portion of the staple leg, using a micrometer.

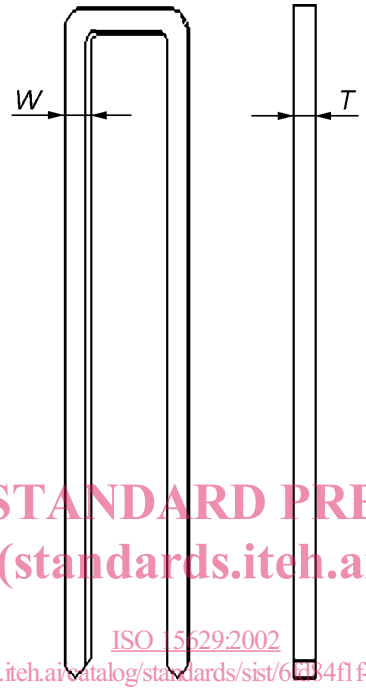
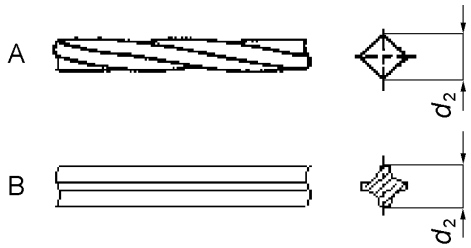


Figure A.5 — Schematic diagram of the measurement of staple width and thickness

A.4.3 Fluted or twisted square shank nails

For fluted or twisted square shank nails, the nail wire diameter (d) is to be the thread crest diameter, as shown in Figure A.6. Fluted nails are formed by drawing round wire through a threading die.



Key

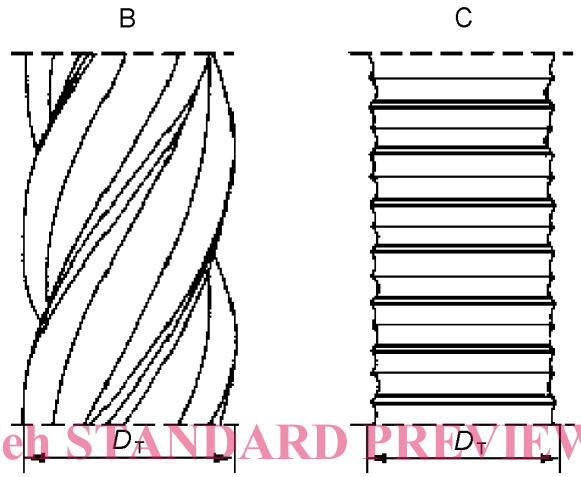
A	Square wire twisted shank
B	Square wire fluted shank
d_2	Diameter

Figure A.6 — Schematic diagram of the wire diameter measurement for fluted or twisted square shank nails

A.5 Thread-crest diameter

A.5.1 Fluted, twisted and threaded nails

The thread-crest diameter (D_T) of fluted, twisted, and threaded nails is the distance from crest to crest along the deformed portion of the nail shank, as shown in Figure A.7. It is measured in the direction perpendicular to the nail axis, to the nearest 0,025 mm, using a flat-spindle micrometer. To account for any non-uniformity or taper of the shank deformations, measurements should be made at least at three locations, that is near the two ends and along the centre of the flutes or threads while rotating the nail. Thread crests should be sharp and not rounded.



Key

B	Helically threaded shank
C	Annularly threaded shank
D_T	Thread-crest diameter

Figure A.7 — Schematic diagram of the thread crest diameter measurement

A.5.2 Individual nail

The thread-crest diameter (D_T) of an individual nail is the average of at least three measurements. This diameter may vary considerably for nails taken from a single sample or from a lot of nails as well as from several lots of nails of the same shipment.

A.6 Thread helixes

A.6.1 Helically threaded round-wire nails

For helically threaded round-wire nails, the number of helixes of helically threaded round-wire nails is the number of major thread crossings along the full thread length. Major threads are those threads in double thread-crest nails where the major and minor threads are located close and parallel to each other. Using a nail with a thread diameter equal to the average thread diameter of the sample and placing a ruler along the thread parallel to the nail axis, as shown in Figure A.8, count the number of thread crests (or projected thread crests in the case of a tapered thread). The number of helixes can be obtained by dividing the number of thread contacts by the exact length over which they were counted and multiplying the resulting value by the total thread length. This value should be rounded off to the nearest 0,1 helix.