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## **Pallets for materials handling — Repair of flat wooden pallets**

*Palettes pour la manutention et le transport des marchandises —  
Réparation des palettes plates en bois*





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# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Defects and damage criteria</b> .....	<b>2</b>
4.1 Overriding criterion.....	2
4.2 Nail joint strength.....	2
4.3 Inspection.....	2
4.4 General conditions identifying an unacceptable pallet.....	2
<b>5 Repair</b> .....	<b>2</b>
5.1 General.....	2
5.2 Repair of pallets of known specification.....	3
5.3 Repair of pallets of unknown specification.....	3
5.4 Marking.....	5
5.5 Final inspection of repaired pallets.....	5
<b>6 Recycling - disposal</b> .....	<b>5</b>
<b>Annex A (informative) Defects and damage which make a 4-way block pallet unacceptable for use</b> .....	<b>6</b>
<b>Annex B (informative) Defects and damage which make a perimeter base pallet unacceptable for use</b> .....	<b>8</b>
<b>Annex C (informative) Defects and damage which make a 2-way stringer (bearer) pallet unacceptable for use</b> .....	<b>10</b>
<b>Annex D (informative) Defects or damage which make a partial 4-way pallet unacceptable for use</b> .....	<b>11</b>
<b>Annex E (normative) Metal plates for repairing of notched stringers (bearers)</b> .....	<b>13</b>
<b>Annex F (informative) Action needed for the repair of pallets of unknown specification</b> .....	<b>15</b>
<b>Annex G (informative) Special accuracy and tolerance for repaired pallets (e.g. for use in certain automatic handling systems)</b> .....	<b>16</b>
<b>Bibliography</b> .....	<b>17</b>

## 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](http://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](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 51, *Pallets for unit load method of materials handling*.

This second edition cancels and replaces the first edition (ISO 18613:2003), which has been technically revised.

## Introduction

Mandatory requirements for recycling of packaging materials has led to an expansion of reuse, repair and recycling of wooden pallets. This International Standard is intended to assist this process, in that, through its implementation, the safety and longevity of repaired pallets will be maximised. This International Standard also refers particularly to new pallet standards and prescriptive pallet specifications in wide use.

There is no requirement in this International Standard for pallet repairers to undertake tests, since, if guidance given in this International Standard is followed and systematic repair and inspection systems are used, then a successful repair is assumed to follow.

There are four related International Standards:

- ISO 15629, *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 pallets*
- ISO 18613, *Pallets for materials handling — Repair of flat wooden pallets*



# Pallets for materials handling — Repair of flat wooden pallets

## 1 Scope

This International Standard specifies the maximum defects and damage allowed before a flat wooden pallet shall be repaired, and defines the minimum repair criteria that shall be used.

This International Standard is applicable to wooden flat pallets repaired with wood based components.

NOTE The maximum allowed defects and damage for pallets are described in this International Standard and the [Annexes A to D](#) show examples of defects and damage which make the widely used pallets unacceptable for use. For other pallet types similar criteria should be set up. The repair criteria for pool and rental pallets are controlled by their respective controlling operators/owners, and may be subject to a licence.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 15629, *Pallets for materials handling — Quality of fasteners for assembly of new and repair of used, flat, wooden pallets*

EN 1087-1:1994, *Particleboards — Determination of moisture resistance— Boil test*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 445 (some of which are repeated below for convenience) and the following apply.

### 3.1

#### **board**

top deck board, bottom deck board, or stringer board

### 3.2

#### **deckboard**

individual member of a top or bottom deck

### 3.3

#### **bottom deck board**

individual member of bottom deck

### 3.4

#### **stringerboard**

horizontal member linking the blocks and deckboards

### 3.5

#### **stringer or bearer**

continuous longitudinal member underneath the top deck or between the top and bottom decks, which provides space for the entry of fork-lift forks and pallet-truck fingers

## 4 Defects and damage criteria

### 4.1 Overriding criterion

The overriding criterion for an unacceptable pallet is if its condition is such that it cannot be regarded as safe and that handling the pallet might be dangerous for persons or goods (as illustrated in [Annexes A to D](#)).

### 4.2 Nail joint strength

Nail joint strength is particularly important for the performance of pallets.

### 4.3 Inspection

Inspection of a pallet shall take place before any handling, whether loaded or empty.

### 4.4 General conditions identifying an unacceptable pallet

The general conditions which make a pallet unacceptable for use are as follows.

- a) One deckboard missing or broken, either obliquely or across.
- b) Either one block, stringer (bearer) or stringerboard missing or broken.
- c) Missing wood on deckboards to such an extent that on one deckboard, two or more nail shanks are visible, or on more than two deckboards, one or more nail shanks are visible, or missing wood of more than 1/4 of the width of the board for 1/4 length. Missing wood on a deckboard between the blocks of more than 1/4 of the width of the deckboard.
- d) Splits on deckboards of more than 1/2 of the width or the length of the deckboard, which cannot be securely nailed.
- e) Wings on pallets may only have missing wood from inner deckboard ends for a maximum of 1/3 of projecting wing length.
- f) Missing wood on blocks, stringers (bearers) or stringerboards, if more than one nail shank is visible at any one joint.
- g) Depending on use, dirty or contaminated pallet. If any doubt exists as to the nature of the contamination, care shall be taken in its identification and subsequent disposal.
- h) Older pallets with a combination of minor damage or loose joints and with a poor appearance may have a combination of issues and be unacceptable when viewed as a whole.
- i) Pallets with bad workmanship. Pallets with materials or components that have been previously incorrectly applied.
- j) Components affected by decay which could affect their mechanical properties.
- k) Full width splits of any length in stringer (bearer) notches.

NOTE Attention is also drawn to publication UIC-Leaflet 435-4 (2010) 'Repair of EUR flat pallets and EUR box pallets'.

## 5 Repair

### 5.1 General

Components with unacceptable defects or damage shall be removed and replaced by new or re-used components of one piece.



### 5.1.1 Blocks of particleboard

If blocks of particleboard are used they shall conform to EN 1087-1. The density of the particle board shall be more than 580 kg per cubic metre.

### 5.1.2 Bottom deckboards

Bottom deckboards and the corners of the pallet shall be chamfered, if required.

### 5.1.3 Nail heads

Nail heads shall be countersunk so that the top of the head of the nail cannot be snagged above the surface.

## 5.2 Repair of pallets of known specification

Replacement components shall be from new or re-used materials. They shall be in accordance with the relevant specifications of the pallet and its repair requirements in the relevant standards. Re-used components shall conform to all the requirements of the new pallet component specifications. No missing wood or splits are allowed in these re-used components. The nails used and the final assembled pallet shall meet the requirements of the specifications for that pallet.

NOTE Repair requirements may differ from the new pallet specification. Details as agreed by contract.

Pallets which are unacceptable for use, shall be repaired or disposed of, and marking requirements met as defined in [5.4](#).

## 5.3 Repair of pallets of unknown specification

If the specification is not known or no specification exists, the replacement components shall have the same dimensions and quality as the removed components. Replacement components may be from new or re-used materials. Components shall meet the conditions given in [5.3.3](#). Too many nail holes may weaken the component.

### 5.3.1 Dimensional tolerances

The general maximum permitted tolerances from basic dimensions for pallets of unknown specifications shall be as in [Table 1](#).

**Table 1 — General maximum permitted tolerances from basic dimensions for pallets of unknown specifications**

Component	Tolerance
Length	+ 8 / – 8 mm
Width	+ 8 / – 8 mm
Overall height	+ 10/ – 10 mm
Diagonal difference	+ 10/ – 10 mm
Flatness	Within 10 mm
Block twist	No overhang
Top gaps	Max 65 mm
Lead board position from edge	+ 0 / – 5 mm
Inner deckboard position from centre line	+ 2,5 / – 2,5 mm
Stringerboard position from centre line	+ 2,5 / – 2,5 mm
Stringer (bearer) position from centre line	+ 5 / – 5 mm
Butted joints	Max 5 mm
Nail counter-sinking from the surface	– 1 / – 5 mm
NOTE The pallets should be flat on their top and bottom surfaces to within 6 mm maximum deviation from the corner-to-corner straight line. Other accuracy requirements may be specified. <a href="#">Annex G</a> shows one example of high accuracy requirements.	

## 5.3.2 Assembly

### 5.3.2.1 General

For assembly, the following fasteners having the physical characteristics described in ISO 15629, Annex A shall be used. The specification of the nails shall meet the requirements of the pallets concerned.

#### 5.3.2.2 Boards - blocks or stringers (bearers)

Twisted square wire, helically threaded, annular threaded nail (the length of the nail depends on the depth of the assembly). The nail penetration shall be at least 35 mm into the block or stringer (bearer).

#### 5.3.2.3 Deckboards - stringerboards

Twisted square wire, helically threaded, annular threaded nail (the length of the nail depends on the combined thickness of the stringerboards and deckboards). If the nail is not clinched, the nail shall not penetrate the underside of the stringer board. If the nail is clinched the clinch shall be 10 mm. Plain nails may also be used if the nail is clinched.

#### 5.3.2.4 Positioning and number of nails used in assembly

The number of nails per joint and the correct positioning shall repeat the pattern of the original pallet. Nails shall be positioned no closer than 15 mm from either the end or the edge of a board.

#### 5.3.2.5 Repair of notched stringers (bearers)

Full width splits in notched stringers (bearers) of partial four-way pallets shall be repaired using metal plates according to [Annex E](#).

## 5.3.3 Components

Components shall have maximum tolerances as shown on [Table 2](#).

**Table 2 — Maximum tolerances for components**

<b>Component</b>	<b>Maximum tolerance</b>
Thickness of stringerboards and deckboards	+ 2 / - 2 mm
Width of deckboards	+ 10 / - 10 mm
Length of stringerboards and deckboards	+ 5 / - 10 mm
Height of blocks or stringers (bearers)	+ 2 / - 2 mm
Length or width of blocks or stringers (bearers)	+ 5 / - 5 mm

## 5.4 Marking

The marking of repaired pallets shall be as defined by the competent authority and may be identified for example, by a pool mark or identification nail (or fastener).

Reference should be made to ISPM 15 for phytosanitary marking.

## 5.5 Final inspection of repaired pallets

The overall size accuracy of the pallet and the minimum dimensions of the openings shall be met and all joints shall be fixed with the relevant number of nails. The repaired pallets are required to conform to the physical requirements of the intended use. The inspection of pallets of known specification is controlled by the competent authority.

## 6 Recycling - disposal

Pallets which cannot be repaired for reuse in line with these specifications shall be discarded.

NOTE 1 After removing the markings, some pallets may be used as limited use pallets.

NOTE 2 Components of good condition can be used as replacement components.

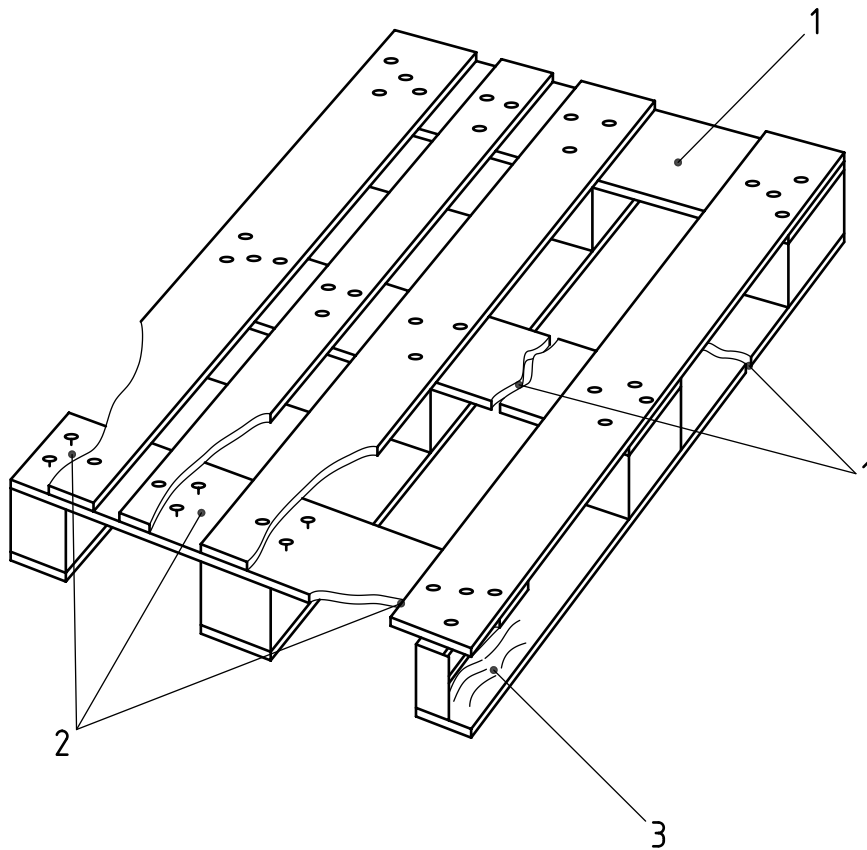
NOTE 3 Other methods for disposal include grinding, composting and burning.

## **Annex A** (informative)

### **Defects and damage which make a 4-way block pallet unacceptable for use**

#### **A.1 Criteria for when a 4-way block pallet cannot be reused (see Figure A.1)**

- 1) A top deck board or a bottom deck board or a stringerboard is missing or broken;
- 2) missing wood on lead top deck boards or lead bottom deck boards to such an extent that on one deckboard, two or more nail shanks are visible, or on more than two deckboards and stringerboards, one or more nail shanks are visible;
- 3) a block is missing, broken or split to such an extent that more than one nail shank is visible.



**Figure A.1 — Example of a 4-way block pallet unacceptable for use**

#### **A.2 Other defects and damage which make a 4-way block pallet unacceptable for use**

- i) Essential markings stipulated in a specification are missing or illegible;
- ii) inadequate components have been used (boards or blocks too thin, too narrow, too short);

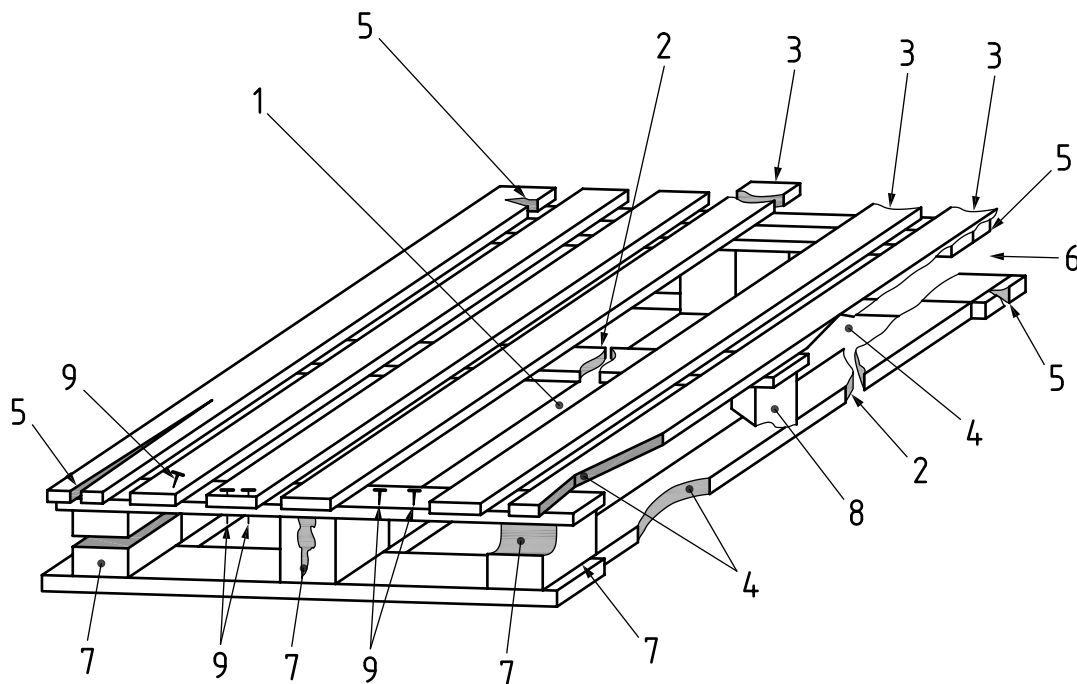
- iii) the general condition is so poor that the load-bearing capacity cannot be ensured (rotten boards or several splits in boards or blocks), the merchandise risks being damaged.

## Annex B (informative)

### Defects and damage which make a perimeter base pallet unacceptable for use

#### B.1 Criteria for when a 4-way perimeter base pallet cannot be reused (see Figure B.1)

- 1) A top deck board or a bottom deck board or a stringerboard is missing;
- 2) a top deck board or a bottom deck board or a stringerboard is broken;
- 3) missing wood on a top deck board or a bottom deck board or a stringerboard of more than 1/4 of the width of the board;
- 4) missing wood on a top deck board or a bottom deck board or a stringerboard between 2 blocks of more than 1/4 of the width of the board or if nails are visible;
- 5) splits on top deck boards or bottom deck boards of more than 1/2 of the width or the length of the board;
- 6) a block is missing;
- 7) missing wood or splits on a block of more than 1/2 of the width or height of the block;
- 8) a block is turned about more than 30°;
- 9) nail heads or nail points are protruding through the boards.



**Figure B.1 — 4-way perimeter base pallet, criteria for unacceptable use**

**B.2 Other defects and damage which make a 4-way perimeter base pallet unacceptable for use**

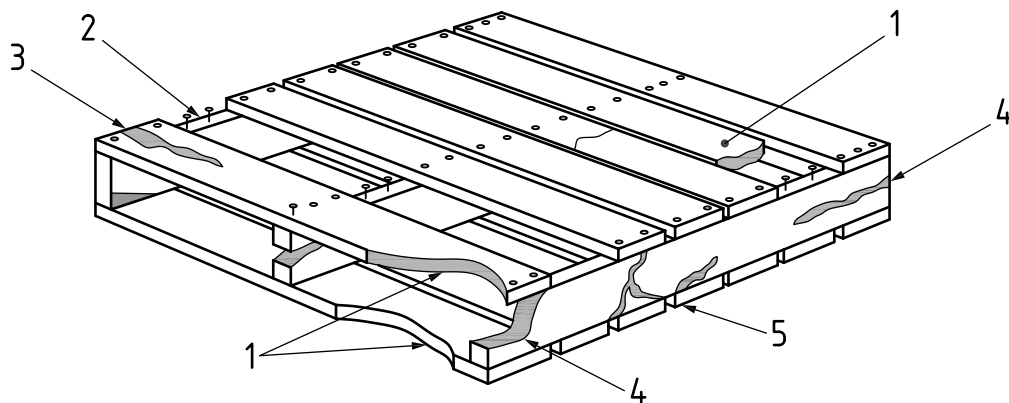
- i) Essential markings stipulated in a specification are missing or illegible;
- ii) inadequate components have been used (boards or blocks too thin, too narrow, too short);
- i) the general condition is so poor that the load-bearing capacity cannot be ensured (rotten boards or several splits in boards or blocks), the merchandise risks being damaged.

## Annex C (informative)

### Defects and damage which make a 2-way stringer (bearer) pallet unacceptable for use

#### C.1 Criteria for when a 2-way stringer (bearer) pallet cannot be reused (see Figure C.1)

- 1) A top deck board or a bottom deck board is missing or broken;
- 2) missing wood on lead top deck boards to such an extent that on one board two or more nail shanks are visible, or on more than two top deck boards, one or more nail shanks are visible. Or there is missing wood on a top or bottom deck board of more than 1/4 of the width of the board, for 1/4 length;
- 3) splits on top or bottom deck boards of more than 1/2 of the length or width of the board;
- 4) a stringer (bearer) is missing, broken or split to such an extent that more than one nail shank is visible;
- 5) missing wood or splits on a stringer (bearer) of more than 1/2 of the height of the stringer (bearer).



**Figure C.1 — Criteria for which a 2-way stringer (bearer) pallet cannot be reused**

#### C.2 Other defects and damage which make a 2-way stringer (bearer) pallet unacceptable for use

- i) A stringer (bearer) has splits across its full width;
- ii) nail heads or nail points are protruding the boards;
- iii) essential markings stipulated in a specification are missing or illegible;
- iv) inadequate components have been used (boards or stringers (bearers) too thin, too narrow, too short);
- v) the general condition is so poor that the load-bearing capacity cannot be ensured (rotten boards or several splits in boards or stringers (bearers), the merchandise risks being damaged).

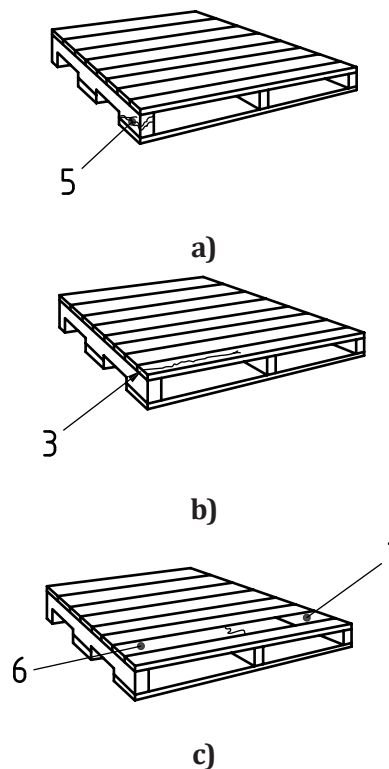


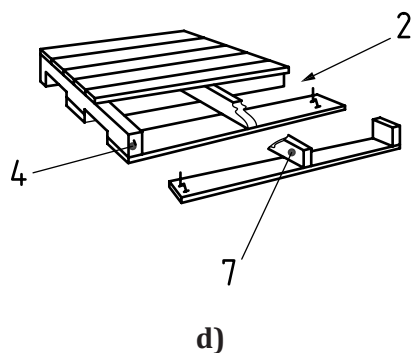
## Annex D (informative)

### Defects or damage which make a partial 4-way pallet unacceptable for use

#### D.1 Criteria for when a partial 4-way pallet cannot be reused (see Figure D.1)

- 1) A top deck board or a bottom deck board is missing or broken;
- 2) missing wood on lead top or bottom deck boards to such an extent that on one board two or more nail shanks are visible, or on more than 2 top or bottom deck boards, one or more nail shanks are visible. Or there is missing wood on a top or bottom deck board of more than 1/4 of the width of the board, for 1/4 length;
- 3) splits on top or bottom deck boards of more than 1/2 of the width or length of the board;
- 4) a stringer (bearer) is missing, broken or split to such an extent that more than one nail shank is visible;
- 5) missing wood or splits on a stringer (bearer) of more than 1/2 of the width or height of the stringer (bearer);
- 6) a notched stringer (bearer) has splits across full width at the inner end of the notch;
- 7) nail heads or nail points are protruding through the boards.





**Figure D.1 — Criteria for which a partial 4-way pallet cannot be reused**

## **D.2 Other defects and damage which make a partial 4-way pallet unacceptable for use**

- i) Essential markings stipulated in a specification are missing or illegible;
- ii) inadequate components have been used (deckboards or stringers (bearers) too thin, too narrow, too short);
- iii) the general condition is so poor that the load-bearing capacity cannot be ensured (rotten boards or several splits in boards or stringers (bearers), the merchandise risks being damaged).

## Annex E (normative)

### Metal plates for repairing of notched stringers (bearers)

#### E.1 General

##### E.1.1 Minimum plate specifications

Repairs using metal plates shall conform to the criteria given below for size, material, coating, teeth and application (see [Figure E.1](#)).

##### E.1.2 Size

The plates shall be a minimum of 70 mm in length or width and a minimum of 7100 mm<sup>2</sup> in area as determined by external plate dimensions.

##### E.1.3 Material

The material shall be of a 0,90 mm minimum target thickness with a tolerance of  $\pm 0,15$  mm, of uncoated, sheet steel.

##### E.1.4 Coating

The coating should be of Hot-Dip galvanized designation.

##### E.1.5 Teeth

There shall be at least four teeth per 645 mm<sup>2</sup> of plate area as determined by external dimensions. The length of teeth shall be at least 8,0 mm excluding plate thickness.

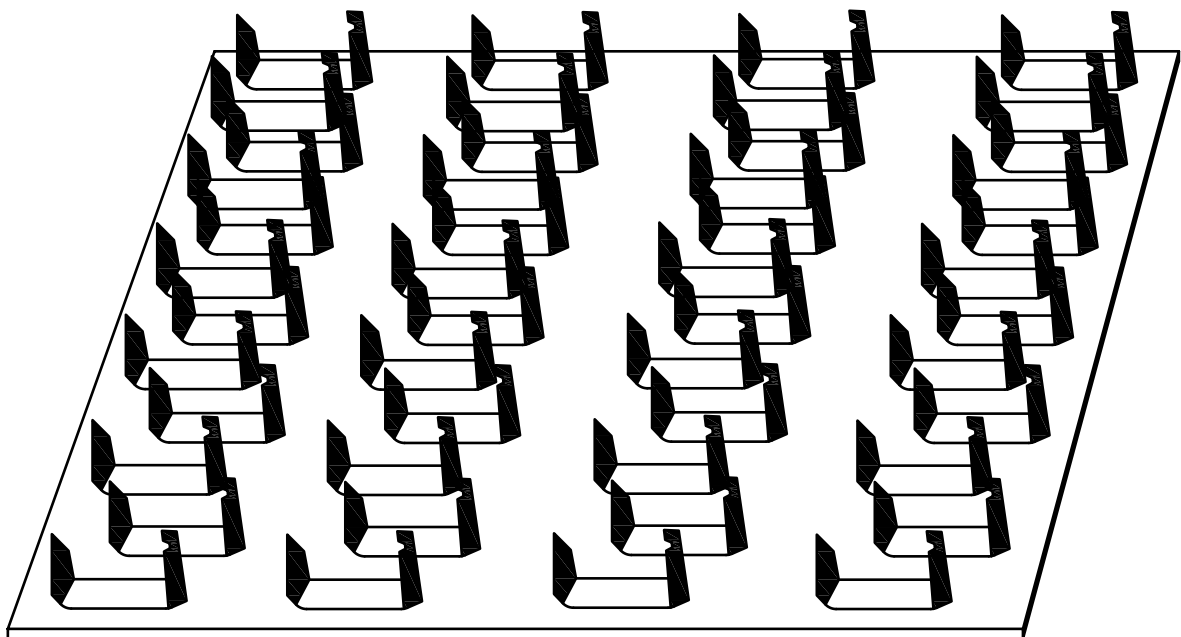


Figure E.1 — Metal plate

## E.2 Metal plate application

### E.2.1 General

Repairs to vertical splits of any kind and repair of damage (splits at large knots) above the stringer notches are not acceptable (see [Figure E.2](#)).

### E.2.2 Applying plates to a pallet

Apply plates with mechanical, hydraulic, or pneumatic power, using machinery designed and manufactured for this purpose.

### E.2.3 Minimum number of plates to be applied

A minimum of two plates shall be used per repair. The plates shall be applied opposite one another on each stringer side, flush with the wood surface. Plates shall then be aligned in such a way that they do not overhang the stringer (bearer) ends or edges and the plate's edges will be approximately parallel to the ends or edges of the stringer (bearer). All teeth of each plate are to be pressed into the wood. Splits longer than 200 mm shall be repaired with four plates.

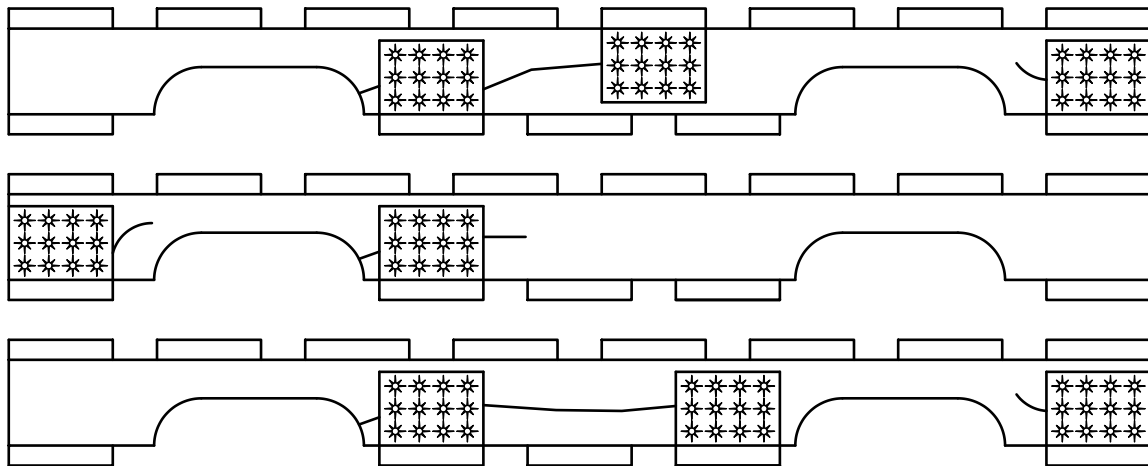


Figure E.2 — Metal plate application

## Annex F (informative)

### Action needed for the repair of pallets of unknown specification

#### F.1 Repair action

The repair action needed to carry out a repair of pallets of unknown specification should be as in [Table F.1](#).

**Table F.1 — Action needed for the repair for pallets of unknown specification**

Reference	Type of fault	Action
General	inadequate components	Change component
General	poor general condition	Not repairable
Boards	a deckboard is missing	replace component
Boards	a deckboard is broken obliquely or across	replace component
Boards	missing wood on boards end - on lead boards - on other deckboards	replace component keep component
Boards	missing wood - of more than 1/4 of the deckboard's width - less than 1/4 of the deckboard's width	replace component re-nailing if necessary
Blocks and bearers	a block or stringer (bearer) is missing	replace
Blocks and stringers (bearers)	- missing wood or splits on a block of more than 1/3 of blocks width or height - a stringer (bearer) is split across width	replace block replace or apply proper metal plates to both faces of stringer (bearer)
Blocks and stringers (bearers)	a block is turned about - more than 30° - less than 30 °	bring into line, re-nailing re-nailing
Nails	nail heads or nail points are protruding from the deckboards missing nails loose joints	bend back add nails renailing

## Annex G

### (informative)

## Special accuracy and tolerance for repaired pallets (e.g. for use in certain automatic handling systems)

### G.1 Tolerances

The general maximum permitted tolerances from basic dimensions and positions are given in [Table G.1](#).

**Table G.1 — General maximum permitted tolerances from basic dimensions and positions**

Reference position or dimension	Tolerance
Length	+ 3 / - 3 mm
Width	+ 3 / - 3 mm
Overall height	+ 7 / - 5 mm
Diagonal difference	+ 10 / - 10 mm
Flatness <sup>1</sup>	within 7 mm
Block twist	no overhang
Top gaps	max 50 mm
Lead deckboard position from edge	+ 0 / - 3 mm
Inner deckboard position from centre line	+ 2,5 / - 2,5 mm
Stringerboard position from centre line	+ 1,5 / - 1,5 mm
Stringer (bearer position from centre line	+ 1,5 / - 1,5 mm
Butted joints	no gap
Nail counter-sinking from surface	- 1 / - 5 mm
Marking	Level and centre
Wings	+ 5 / - 5 mm
Chamfers	Vertical at least 15 mm

<sup>1</sup> The pallets should be flat on their top and bottom surfaces to within 6 mm maximum deviation from the corner-to-corner straight line.

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