

Foreword

The European chemical industry is using a large amount of wooden pallets for the distribution of goods. For environmental reasons there is a strong need to organise the re-use of these pallets.

Two associations, the Verband der chemischen Industrie in Germany [VCI] and the Association of Plastics Manufacturers in Europe [APME], have provided to their member companies the forum to develop a standard for wooden pallets and a system to re-use them.

Given this limited role, VCI and APME cannot be held responsible for any problems or liabilities, which may result from the use of the CP system [CP means Chemical industry Pallets].

A team of experts from various chemicals and plastics producing companies, consulted by timber and pallet specialists, has drafted the manufacturing and reconditioning specifications of the Chemical industry Pallets [CP].

Special attention has been paid to quality, safety and environmental aspects.

Although Chemical industry Pallets have been designed for specific packages commonly used within the chemical industry, they are also suitable for other loads.

Tests performed by various companies and testing institutes and experience from the use and re-use of millions of CP's since 1991 have demonstrated that they conform to the needs of the chemical industry and their customers.

Scope

This document describes the pallet supplier registration and the system to collect used CP's. It defines the CP manufacturing, reconditioning and quality assurance criteria. It informs about the safe working load of CP's.

It is established in English. Versions in Dutch, German and French made by translation are also available.

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Note: The content of this document is not essentially different from the previous edition, but has been completed with clarifications and with new useful information.

No new manufacturing and reconditioning criteria been introduced, only the position of the top deck boards of CP4 has been changed.

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Attachments [27]

- Design drawings CP1 to CP9;
- Fastening patterns CP1 to CP9;
- Inspection reports CP1 to CP9.

A. Supplier registration

Suppliers of CP's shall ask APME for registration. A registration fee of 80,00 EURO will be charged by APME.

The supplier code that APME will adjudge is unique and shall be used for the marking of all newly manufactured or reconditioned CP's.

Registered suppliers are committed to respect the manufacturing and reconditioning specifications and to comply with the collection conditions of used CP's [see relevant chapters about the manufacturing & reconditioning specifications and about the collection of used CP's hereafter].

APME is only in charge of the administration of the registered data. Given this limited role, APME cannot be held responsible for any problems or liabilities, which may result from the use of the supplier code.

B. Manufacturing specification

1. Scope

This part of the standard specifies the manufacturing of nine four-way pallets – five skid pallets and four full perimeter base pallets.

They have been designed taking into account the specific requirements of commonly used packages in the chemical industry. Some examples of applied pallet loads are mentioned in table 1.

CP-design	Pallet dimensions	Examples of applied pallet loads
1	1000 x 1200 mm	Sacks, cardboard boxes, Flexible Intermediate Bulk Containers
2	800 x 1200 mm	Cardboard boxes, fibre drums, cans
3	1140 x 1140 mm	Drums, Flexible Intermediate Bulk Containers, octabins
4	1100 x 1300 mm	Sacks
5	760 x 1140 mm	Cardboard boxes
6	1200 x 1000 mm	Sacks
7	1300 x 1100 mm	Sacks
8	1140 x 1140 mm	Octabins with bottom discharge facility
9	1140 x 1140 mm	Drums, Flexible Intermediate Bulk Containers, octabins

Table 1

2. Normative references

This specification is based on following international standards:

ENV 717-1: 1998	Wood based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by chamber method.
EN 844-6: 1997	Round and sawn timber – Terminology – Part 6: Terms relating to dimensions of sawn timber.
EN 844-7: 1997	Round and sawn timber – Terminology – Part 7: Terms relating to anatomical structure of timber.
EN 844-8: 1997	Round and sawn timber – Terminology – Part 8: Terms relating to features of round timber.
EN 844-9: 1997	Round and sawn timber – Terminology – Part 9: Terms relating to features of sawn timber.
EN 844-10: 1998	Round and sawn timber – Terminology – Part 10: Terms relating to stain and fungal attack.
EN 1087-1: 1995	Particleboards – Determination of moisture resistance – Part 1: Boil test.
EN 1310: 1997	Round and sawn timber – Measurement of features.
EN 12246: 1999	Quality classification of timber used in pallets and packaging.
ISO 445: 1998	Pallets for materials handling – Vocabulary.
ISO 3130: 1975	Wood – Determination of moisture content for physical and mechanical tests.
ISO 3133: 1975	Wood – Determination of ultimate strength in static bending.
ISO 6780: 1988	General-purpose flat pallets for through transit of goods - Principal dimensions and tolerances.
ISO 8611: 1991	General purpose flat pallets for through transit of goods – Test methods.

3. Construction

3.1. Materials requirements

3.1.1. Sawn timber

3.1.1.1. Wood species

CP's shall be constructed from wood species listed in tables 2 & 3¹.

European grown conifers	Botanical name
Douglas fir	Pseudotsuga ssp.
Fir	Abies ssp.
Larch	Larix ssp.
Pine	Pinus ssp.
Redwood	Pinus sylvestris
Spruce	Picea ssp.

Table 2

European grown deciduous woods	Botanical name
Acacia	Robinia ssp.
Alder ²	Alnus ssp.
Ash	Faxinus excelsior
Beech	Fagus sylvatica
Birch	Betula ssp.
Chestnut [-Horse]	Aesculus hippocastanum
Elm	Ulmus ssp.
Maple	Acer ssp.
Oak	Quercus ssp.
Plane	Platanus ssp.
Poplar ³	Populus ssp.

Table 3

Other species or species grown elsewhere with an ultimate strength in static bending of at least 42 N/mm², measured on samples with a moisture content of 20 % and in accordance with ISO 3133, may be used.

3.1.1.2. Quality

The timber quality⁴ shall conform to the following criteria:

- Bark & bark pockets are not permitted;
- Sound sapwood is permitted;
- Wane [measured according to EN 1310, clause 4.8]:
 - Is only permitted at the underside of intermediate deck boards up to $\frac{1}{3}$ of the thickness of the board;
 - Is not permitted at other components.

¹ The use of weak species affects the Safe Working Load of the pallet. For safety reasons, the respect of the specified species is critical.

² May only be used for deck boards and blocks.

³ May only be used for deck boards and blocks.

⁴ Poor timber quality affects the Safe Working Load of the pallet. For safety reasons, the respect of the quality criteria is critical.

- Knots [measured according to EN 1310, clause 4.1.2]:
 - Inter-grown or dead knots < 30 mm are permitted;
 - Loose knots & unsound knots < 20 mm are permitted;
 - Branched knots are not permitted.
- Fissures [measured according to EN 1310, clause 4.9]:
 - Splits from one surface to the other in boards or blocks are not permitted;
 - Drying checks are permitted.
- Grain:
 - Significant slope of grain or spiral grain is not permitted.
- Preservatives:
 - No chemical treatment is permitted.
- Deterioration:
 - Mould⁵ or rot⁶ are not permitted;
 - Active insect infestation is not permitted;
 - Some blue stain⁷ is permitted.

3.1.1.3. Moisture content

The maximum moisture content⁸ of timber is not defined in this document. CP's may be constructed from green timber. If not specified differently by the user, CP's will be supplied without any drying. The moisture content of green timber is normally higher than 30 %.

3.1.1.4. Packaging issues related to wet timber [informative]

For some packages such as, cardboard boxes and paper sacks and for hygroscope products the moisture content of green timber might be unacceptable.

If only migration of moisture from the timber into the packaging material has to be avoided, limitation of the moisture content of the deck boards is in most cases sufficient.

A good practice is, as they are drying slower than intermediate deck boards, to check the moisture content of the lead & central deck boards.

An achievable value in Middle-European climate, avoiding artificial drying is 25 % moisture content.

If on the other hand the presence of moisture is very critical, the moisture content of all timber components shall be checked.

In that case values of moisture content below 20 % are required and in most seasons pallets have to be dried artificially.

⁵ Mould is an infestation of timber by fungi that penetrate into wet wood.

⁶ Rot is an infestation by fungi or other micro organisms, showing a brown coloured and cubic-segmented structure or zones composed of soft decomposed fibres without strength. Rot affects the Safe Working Load of the pallet.

⁷ Blue stain is a blue to black discoloration, caused by fungi, of the sapwood of conifers and some deciduous woods. As chemical treatment is not permitted, blue stain cannot be completely avoided in certain seasons, but does not affect the strength of the timber.

⁸ Moisture content can be determined using portable battery operated moisture meters.

3.1.2. Particleboard blocks [optional]

High density, moisture resistant particleboard conforming to the following criteria may be used for blocks:

- Made exclusively from timber particles without any wood preservative;
- The mean weight per unit volume shall be minimum 0,580 g/cm³;
- The moisture content shall be between 7 and 13 %;
- The material shall produce a formaldehyde emission less than 0,1 ml per cubic meter of air, when determined in accordance with ENV 717-1;
- The bonding shall ensure, that the material is permanently bonded; the efficiency of the bonding process shall be determined in accordance with EN 1087-1;
- Retention of material strength, absence of splits, no loss of cohesion after test cycle in accordance with EN 1087-1 involving:
 - A two-hour immersion in water at 100 °C under ambient pressure;
 - Two hours drying in the oven at 65 °C [\pm 3 %].

3.1.3. Plastic blocks [optional]

Plastic conforming to the following criteria may be used for blocks:

- Composition:
 - Made of post consumer mixed plastics;
 - Minimum density \geq 0,800 g/cm³;
 - Specific shares to be met [in weight percentages]:
 - Polyolefin > 50 %;
 - Paper, wood flour, aluminium film < 5%;
 - Glass, stones, metals < 0,05 %.
- Design:
 - Square profile; round vertical corners up to a radius of 5 mm are permitted;
 - Vacuoles < 5 mm are permitted;
 - Concavity or convexity of the nailing surface shall be limited to 1 mm;
 - Hollow spaces and depressions, if present, shall be positioned at a minimum distance of 10 mm from the nailing position.
- The minimum weight shall conform to the values shown in table 4;

Block dimension	Minimum weight
135 mm x 80 mm x 80 mm	0,550 kg
120 mm x 80 mm x 80 mm	0,480 kg
100 mm x 80 mm x 80 mm	0,400 kg

Table 4

- The colour shall be dark grey to black;
- Unpleasant smelling is not permitted.

3.1.4. Fasteners

Depending on their position, different types of fasteners are needed to manufacture CP's [see also attached fastening patterns CP1 to CP9].

Nails shall conform to the criteria of table 5.

Nails	Type N1	Type N2	Type N3
Shank	Square twisted, spiral rolled or annular ring rolled	Plain	Square twisted, spiral rolled or annular ring rolled
Wire Ø	Minimum 3,4 mm	Minimum 2,5 mm	Minimum 3,4 mm
Length	Minimum 90 mm	Minimum 45 mm	Minimum 70 mm
Head Ø	Minimum 8,0 mm	Minimum 6,0 mm	Minimum 8,0 mm
Point	Diamond or chisel	Diamond or diamond offset ⁹	Diamond or chisel
Material	Steel	Steel	Steel
Tensile strength	Minimum 700 N/mm ²	Minimum 800 N/mm ²	Minimum 650 N/mm ²

Table 5

Optionally also staples may be used. They shall conform to the criteria of table 6.

Staples	Type N1	Type N2	Type N3
Wire Ø	Minimum 2,5 mm	Minimum 1,8 mm	Minimum 2,5 mm
Length	Minimum 2 × 90 mm	Minimum 2 × 45 mm	Minimum 2 × 70 mm
Material	Steel	Steel	Steel
Tensile strength	Minimum 650 N/mm ²	Minimum 750 N/mm ²	Minimum 600 N/mm ²

Table 6

3.2. Dimensions

3.2.1. Pallet dimensions & permitted deviations

Pallet dimensions and permitted deviations shall be as shown in the attached design drawings CP1 - 9. The permitted length & width deviation is ± 3 mm. The permitted height deviation is $+ 5 / - 2$ mm.

Pallets shall be square. The difference between diagonals shall not exceed 10 mm.

3.2.2. Permitted deviations of component parts made of sawn green timber

The permitted deviations of the component parts are mentioned in table 7 [see also attached design drawings CP1 to CP9].

Component	Dimension	Permitted deviations
Board	Length	+ 0 / - 3 mm
	Width	+ 3 / - 0 mm
	Thickness	+ 2 / - 0 mm
Block	Length	+ 2 / - 2 mm
	Width	+ 2 / - 2 mm
	Height	+ 2 / - 2 mm

Table 7

⁹ Diamond points shall be used if the nailing bar is movable, diamond offset points if the nailing bar is fixed.

3.2.3. Permitted timber dimensions considering moisture content

The nominal dimensions & permitted deviations of the components in the attached design drawings are dimensions, which are intended to be achieved after the sawing process of green timber. These are the references for the pallet manufacturer when ordering timber.

The minimum dimensions¹⁰ of table 8, which take into account the shrinkage of timber when drying shall be respected.

Measure	Nominal dimension	Minimum dimension moisture content < 30 %
Board thickness	18 mm	17 mm
	22 mm	21 mm
	36 mm	34 mm
Board width	75 mm	71 mm
	80 mm	76 mm
	100 mm	95 mm
	120 mm	114 mm
	125 mm	119 mm
	135 mm	128 mm
Block height & width	80 mm	74 mm

Table 8

3.3. Manufacturing requirements

3.3.1. Component parts

All boards and natural timber blocks shall be of one piece.

Blocks shall be of natural timber, particleboard [see clause 3.1.2. Particleboard blocks] or plastic [see clause 3.1.3. Plastic blocks].

3.3.2. Assembly

The position of the components shall conform to the attached design drawings. The permitted deviations in the assembled pallet are +3 and –3 mm.

Unless specified differently in the attached design drawings, the top deck boards shall be equally spaced.

The fixation of natural timber blocks shall conform to the indications of table 9 & 10:

- The fixation of (=) indicated species shall be in parallel to the direction of the wood fibres;
- The fixation of (#) indicated species shall be square to the direction of the wood fibres.

European grown conifers	Botanical name	Fixation of blocks
Douglas fir	<i>Pseudotsuga</i> ssp.	#
Fir	<i>Abies</i> ssp.	#
Larch	<i>Larix</i> ssp.	#
Pine	<i>Pinus</i> ssp.	#
Redwood	<i>Pinus sylvestris</i>	#
Spruce	<i>Picea</i> ssp.	#

Table 9

¹⁰ For safety reasons the respect of minimum dimensions is critical.

European grown deciduous woods	Botanical name	Fixation of blocks
Acacia	Robinia ssp.	#
Alder ¹¹	Alnus ssp.	#
Ash	Faxinus excelsior	#
Beech	Fagus sylvatica	= or #
Birch	Betula ssp.	= or #
Chestnut [-Horse]	Aesculus hippocastanum	= or #
Elm	Ulmus ssp.	#
Maple	Acer ssp.	= or #
Oak	Quercus ssp.	= or #
Plane	Platanus ssp.	#
Poplar ¹²	Populus ssp.	#

Table 10

Missing components are not permitted.

3.3.3. Joints

All fasteners shall be driven in vertically.

They shall not be driven in the same wood fibre. The number, the type and the positioning of fasteners shall conform to the attached fastening patterns, both for nails and staples [one nail = one staple].

Fasteners shall not protrude above the surface of the board. Nail heads shall be countersunk between 2 and 4 mm below the surface of the board.

Points of fasteners type N2 protruding below the top or bottom stringer boards shall be bent back. Fasteners shall not pierce the sides of blocks¹³.

No splits resulting from assembling shall be visible on boards or blocks.

3.3.4. Bottom board chamfer [optional]

Bottom boards may be chamfered as shown in figure 1.

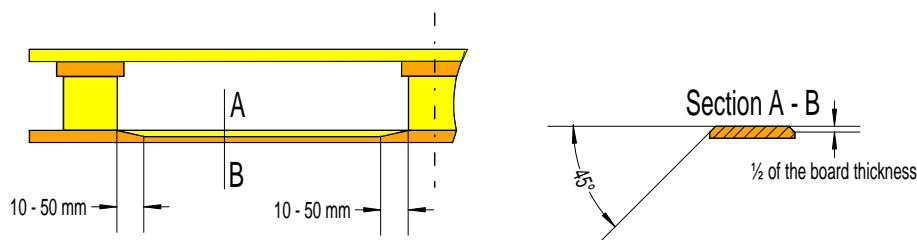


Figure 1

¹¹ May only be used for deck boards and blocks.

¹² May only be used for deck boards and blocks.

¹³ Protruding or piercing nails are dangerous. For safety reasons, the respect of the specified requirements is critical.

3.3.5. Finishing

All timber components shall be sawn squarely and have a clean cut.
The outer surfaces of the deck and bottom boards shall not be planed.

Except for CP5, the four corners of the pallets shall be chamfered as shown in the attached design drawings.

Pallets shall be clean.

3.3.6. Marking

CP's shall be marked on the outer side of the blocks as shown in figure 2.
Markings shall be clearly legible. Only following techniques shall be used:

- Natural timber and particleboard blocks, by hot strong burning;
- Plastic blocks, by hot strong burning or by hot film stamping in white.

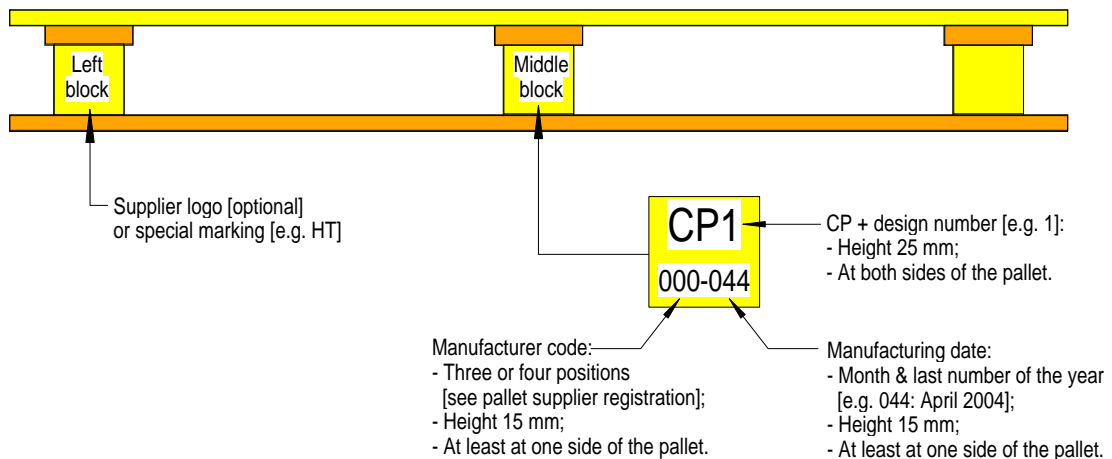


Figure 2

C. Collection of used CP's

When requested, the registered CP supplier [see chapter A. Pallet supplier registration] shall offer to owners of used CP's the free collection of pallets up to at least 50 km from his facilities and shall respect the lead times of table 9.

Number of pallets	Maximum collection lead time
> 400	2 weeks
100 – 400	4 weeks
20 - 100	3 months

Table 11

No free collection has to be offered if:

- More than 10 % of the pallets have unacceptable deficiencies [see chapter D. Reconditioning specification];
- Less than 20 pallets are offered; they shall be accepted without costs when delivered to the registered supplier or collected after payment of transport costs.

No collection shall be offered for pallets manufactured without respect of the manufacturing specifications [poor timber quality or thickness, missing manufacturing markings, etc.] or for pallets contaminated with chemical products.

D. Reconditioning specification

1. Scope

This part of the standard defines the unacceptable deficiencies of used CP's, and specifies the reconditioning criteria.

2. Unacceptable deficiencies

The following conditions make CP's unacceptable for re-use¹⁴ and acceptance for reconditioning is limited to 10 % of the total amount of offered pallets:

- Missing or broken components;
- Component damage such as:
 - Missing wood on boards > ¼ of the width of the board or making a fastener shank visible;
 - Splits on boards > ½ of the width of the board;
 - Warped boards > ½ of the thickness of the board;
 - Missing wood on blocks, making a fastener shank visible;
 - Splits on blocks.
- Loose components or fasteners;
- Twisted blocks;
- Protruding nail heads;
- Pallets with mould or rot;
- Dirty or contaminated pallets;
- Pallets with materials or components that have been previously incorrectly applied.

Minor damages as a result of normal use and discoloration due to the weathering are permitted.

Pallets, which are unacceptable for re-use, shall either be reconditioned or disposed of properly.

¹⁴ Unacceptable deficiencies make the pallet unsafe.

3. Reconditioning criteria

3.1. Repair

The acceptance of pallets for re-use is strongly influenced by the quality of the repair¹⁵.

Damaged components shall be removed and replaced.

The replacing components shall be from either new timber or re-used CP-timber.

New components or re-used CP-components and fasteners shall conform to the manufacturing specification [see clause 3.1. Materials requirements & clause 3.2. Dimensions].

The assembly shall conform to the manufacturing specification [see clause 3.3. Manufacturing requirements].

Loose components, split boards and twisted blocks shall be put back in the original position and fixed. Protruding nail heads shall be hammered flush to the surface of the board.

The number of fasteners per joint and the positioning shall repeat the original pattern [see attached fastening patterns CP1 to CP9].

If extra fasteners have to be used, they shall be positioned never closer than 15 mm either from the end or from the edge of a component.

Collated nails used in pneumatic tools shall meet the criteria of table 12.

Nails	Type N1	Type N2	Type N3
Shank	Square twisted, spiral rolled or annular ring rolled	Annular ring rolled	Square twisted, spiral rolled or annular ring rolled
Wire Ø	Minimum 3,1 mm	Minimum 2,0 mm	Minimum 2,5 mm
Length	Minimum 80 mm	Minimum 35 mm	Minimum 60 mm
Point	Diamond	Diamond or diamond offset	Diamond
Material	Steel	Steel	Steel
Tensile strength	Minimum 700 N/mm ²	Minimum 800 N/mm ²	Minimum 650 N/mm ²

Table 12

3.2. Cleaning

Dirt shall be removed. If any doubt exists as to the nature of the contamination, the pallets shall be disposed of properly.

¹⁵ For safety reasons, the respect of the specified repair criteria is critical.

3.3. Marking

Reconditioned CP's shall be marked on the outer side of the blocks as shown in figure 3 [see also attached design drawings CP1 to CP 9].

Markings shall be clearly legible. Only following techniques shall be used:

- Natural timber and particle board blocks, by hot strong burning or by ink stamping; paint is not allowed;
- Plastic blocks, by hot strong burning or by hot film stamping in white.

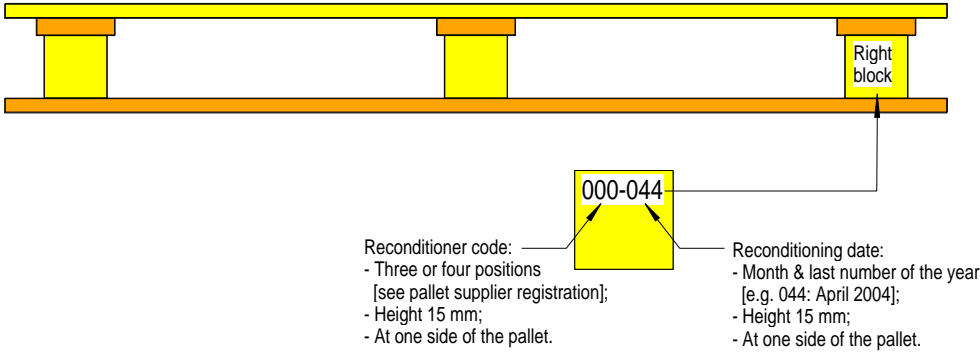


Figure 3

The first reconditioning shall be marked at the top of the block, the second reconditioning below, etc.

E. Conformity to environmental legislation

Both newly manufactured and reconditioned CP's shall conform to the current European Packaging and Packaging Waste Directive, 94/62/EC at the moment.

F. Quality assurance

Suppliers of non-conforming quality can be liable in case of damage or accident.

Visual inspection for quality can be done in accordance with the attached inspection reports.

G. Safe Working Load

Experience has demonstrated that the Safe Working Load of a given pallet is strongly influenced by the type of the applied load.

The effect of different types of load such as, centrally placed loads, interlocked or not-interlocked units, various patterns of sacks, Flexible or Rigid Intermediate Bulk Containers, etc., and the influence of securing or wrapping.

Besides the application of a loaded pallet is important. Pallet racking is considered as the most severe kind of application. The Safe Working Load of racked pallets can be defined by the method¹⁶ described hereafter.

The Safe Working Load defined this way is also valid for less severe kinds of application such as block stacking.

Method to define the Safe Working Load of racked pallets:

- Place 3 CP-replicates with the same applied load on pallet supports, parallel to the direction of the deck boards as shown in figure 4 [this is the weakest direction of all CP-designs];
- Measure the deflection at point A, B and C after 24 hours. In case of packed solids one testing hour is sufficient, as afterwards the deflection will not change significantly.

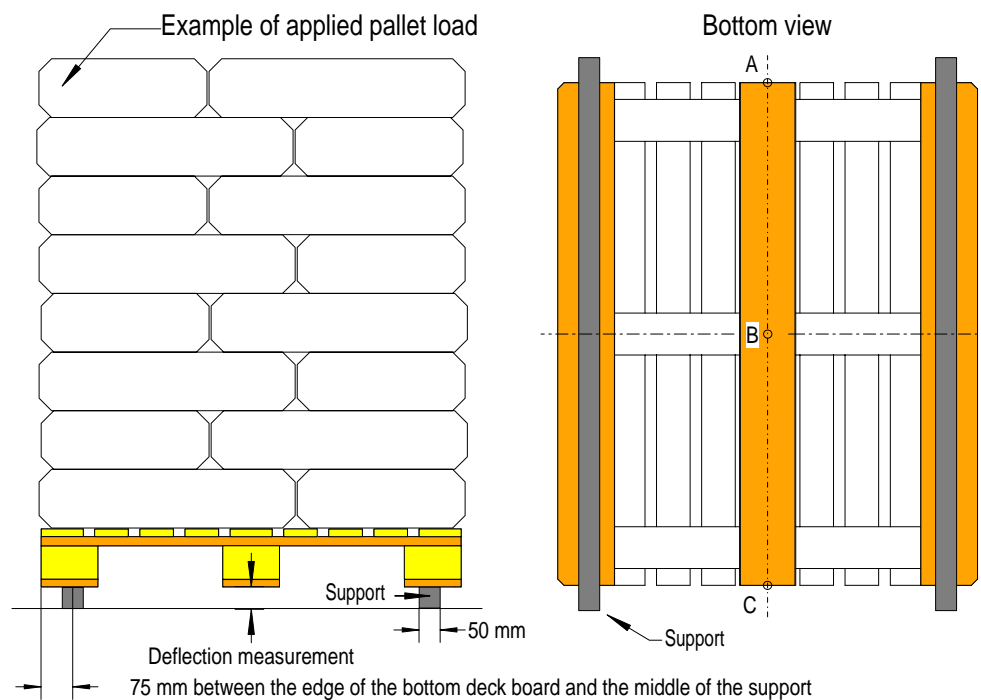


Figure 4

¹⁶ This method is accurate to the best of our knowledge. No liability whatsoever arising from the use of this method can be accepted.

The average deflection at point A, B & C of each pallet shall be lower than the maximum deflection values shown in table 11. If the average deflection exceeds those values, the Safe Working Load of racked pallets has been exceeded. The applied load has to be reduced and the test shall be repeated with less weight until no exceeding of the maximum deflection is measured.

CP-design	Maximum deflection	Average breaking load
1	12 mm	10,2 kN
2	12 mm	14,8 kN
3	19 mm	9,0 kN
4	14 mm	9,8 kN
5	12 mm	13,5 kN
6	16 mm	18,2 kN
7	17 mm	16,3 kN
8	18 mm	19,6 kN
9	17 mm	15,8 kN

Table 13

The values in table 13 have been defined with the bending test specified in ISO 8611. The maximum deflection corresponds to the value at 50 % of the breaking load, which means the rated load of the pallet with a safety factor of two. The average breaking load has been defined with 5 replicates constructed from a weak wood species but conforming to the specified timber quality with an ultimate strength in static bending of 42 N/mm². The test described here above should be performed with pallets of comparable quality.

Deflection tests are not necessary when the Safe Working Load has already been defined for similar applications.