

The pallet, a key component of packaging systems



The vast majority of products that we find in stores are transported on a pallet at some point. Pallets are a key component of modern logistical processes and packaging systems. But what types of pallets exist today and how are they best geared to the products that need to be transported? How relevant is prevention in this field? And what are the latest trends? The current state of affairs is discussed below.

Pallets are transport plates used for many years to store and carry goods. The most common pallet size in use in Europe is the 80 x 120 cm format. This standardized size has fostered the existence of various reusable pallet systems in which pallets are exchanged between companies. However, many other formats also currently exist.

prevent **pack**

Wood, plastic, metal, etc.

Approximately 86% of reusable pallets are made of wood. The remainder is made of plastic (4%), chipboard (3%), or metal (3%). In the case of disposable pallets, the share of wood is 70%.

'One of the benefits of wood pallets is that they are easy to recycle,' states Maxence Wittebolle, General Manager of the Belgian Packaging Institute. 'They can also be easily repaired if they are damaged. This is not the case with plastic pallets for instance. The latter, however, are more hygienic because they resist fungus. That is why they are frequently used in the food sector, as well as the chemical and pharmaceutical sectors. Some types of plastic pallet materials integrate synthetic foam in order to make them lighter.'

As their name indicates, presswood pallets are made from wood residue pressed into shape under high pressure. Thanks to their pre-shaped form, they can be stacked very efficiently. As a result, they require less storage space and limit storage costs. Metal pallets are also used—primarily in the metallurgical industry—for the transportation of heavy objects and machine components.

As expected, metal pallets are the ones with the longest lifetime.



good to remember

Pallets must be chosen **according to the product** they are to transport as well as the primary and/or secondary packaging and means of transport.

Tests can indicate whether a pallet is properly designed and **built to meet the various functions** it must fulfill.

Companies continuously strive to **optimize pallet construction materials** as well as the loading pattern of the products they carry.

The pallet, a key component of packaging systems

Pallets are pillars of the logistical process

'A pallet must be seen as a fully-fledged component of a packaging system,' adds Wittebolle. 'The type and size of a pallet must be chosen according to the transported product and the primary and/or secondary packaging used. The conditions of transport and the various functions throughout the logistical process must also be considered. A badly chosen pallet at the bottom can entail considerable damage during transport as well as costly bills for companies, even though they may have chosen suitable packaging.'



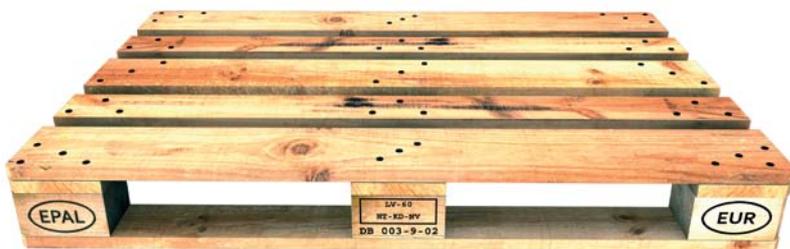
The type and size of a pallet must be adapted to the product in order to avoid damage during transport.

From load capacity to moisture-proofing

'Every situation is different; there is no universal solution,' stresses Wittebolle. 'That is why we always test pallets to ensure that they are sufficiently adapted to the product and the packaging that they must carry.' All tests at the Belgian Packaging Institute are carried out in line with the ISO 8611 reference standard. This enables the precise calculation of the load capacity of the pallets, among other things. The Belgian Packaging Institute also executes bending tests, forklift tests, compression tests, and stacking tests.

Moisture and temperature resistance also play an important role. A pallet that is perfectly suitable for use in Europe, for instance,

may not necessarily be appropriate for warm and humid countries such as India and China. 'For example, we recommend that companies avoid storing wooden pallets outdoors. Wood absorbs humidity, which can substantially weaken the load bearing capacity and encourage the growth of unwanted fungus,' says Wittebolle. 'In the case of products for which fungus must be avoided, presswood pallets are an interesting option. Because these are produced at high pressure, the necessity of chemical fumigation is eliminated.'



A pallet that is perfectly suitable for use in Europe is **not necessarily appropriate** for warm and humid countries such as India and China.

The pallet, a key component of packaging systems

Disposable pallets: not necessarily lost

Today, companies can choose either disposable or reusable pallets. The definitions for both are unequivocally established by federal authorities and can be viewed on www.ivcie.be.

Disposable pallets are often viewed as waste once they have been unloaded at the customer's premises or the site of a logistical services supplier. However, these pallets are not necessarily lost. Today, numerous specialized companies collect used pallets. Depending on the quality, type, and dimensions of the pallets, these companies can repair them and resell them. This process is called reconditioning.

If the pallets cannot be repaired, or if their specific shape or dimensions makes it impossible to find a new application for them, they can be recycled. Depending on their material, the pallets can be ground up, dismantled, or melted to serve as raw material for new products. The disposable pallets then start a new life in another application. This process is referred to as recycling. The majority of the wood packaging that is declared in the VAL-I-PAC system is comprised of pallets. Each year, more than 105,000 tons of wood pallets are recycled.

Reusable pallets in all types and sizes

Two types of reusable pallet systems currently exist: closed and open. In a **closed system**, a company buys and manages its own pallets. The company must see to it that the used pallets are always returned and takes care of their management, maintenance, and repair.

In an **open** or pooling system, pallets are shared among several companies. Management of the system is generally in the hands of specialized companies such as CHEP, LPR, and PRS. The benefit

of these pooling systems is that users do not need to answer for the pallets themselves nor do they need to worry about stocks, follow-up, or maintenance. You can read more about this system in the CHEP testimonial.

The Epal system is a pooling system for the reuse of Europallets. Every time a loaded pallet is delivered, an empty pallet – or a credit note – is handed in or credited to the carrier. It is not however part of an overall management system.

Regional and other limitations

The pallets used in pooling systems are often strictly standardized. Indeed, they must be usable by multiple companies. In some cases, this can be a drawback. Companies that require pallets with specific dimensions or characteristics must therefore rely on their own pallets.

In practice, the pooling of pallets is almost always limited to well-

defined areas, even though some pooling systems are available worldwide. In various parts of the world—such as America, the Far East, or in specific local regions—pallets have different dimensions or characteristics. In most cases, pooling will therefore only be possible within certain well-defined areas and almost never between continents.

The pallet, a key component of packaging systems

Prevention - caution is required

In order to optimize the use of pallets, companies often aim to make them lighter or try to place more products on a single pallet. This practice, however, requires caution. 'Saving on transport packaging can have substantial economic and environmental consequences; consider the potential product losses and the cleaning of spoilt containers in the event of a faulty pallet,'

observes Wittebolle. 'We therefore do not recommend the use of pallets that are too light when exporting to distant countries. They do not offer sufficient strength to resist the many movements that containers undergo at sea. As a result, there is a risk of them collapsing, entailing a whole string of risks and consequences.'

New materials, new alternatives

'A recent but limited trend is the development of paper pallets (see also the IKEA testimonial). The benefit of these cardboard pallets is that they are relatively easy to customize,' notes Wittebolle. 'Some distributors even use them as displays in their stores. These pallets are obviously light but this can be a drawback in terms of robustness. In addition, they are less resistant to humidity.' Another trend is the development of alternative handling systems to avoid the use of pallets altogether. The so-called slip sheets, for

instance, are sheets that are placed underneath loads to prevent goods from sliding during transport. Another example is loading ledges, i.e. support plates that can be placed on various sides of a transport load. The benefit of these systems is that they enable the optimal use of space inside a truck. The drawback is that they require other equipment for loading and unloading. 'A great deal of optimization still remains possible in this respect,' concludes Wittebolle.



For additional information

- The Belgian Packaging Institute promotes the rational use of packaging. It provides services to public authorities and companies in the areas of legislation, information, and education. www.ibebevi.be
- CHEP pooling system. www.chep.com
- LPR pooling system. www.lpr.eu
- Pallet Return System (PRS pooling system). www.palletreturnsystem.com
- Europallet system. www.epal-pallets.org

Transport packaging

Pooling optimizes the use of pallets



Many manufacturers use the blue CHEP pallets to transport their freight to retailers. CHEP offers a comprehensive pooling system: it purchases the pallets, maintains them, and puts them into circulation among a worldwide network of companies. Thanks to the sophisticated management of this pooling system, CHEP optimizes the use of pallets and avoids the transport of empty pallets.

..... prevent pack

Supply to producers, collect at retailers

CHEP is the world leader in pooling systems for transport packaging, particularly in regards to pallets and containers. The best known example is the striking blue wooden pallet, available in four sizes. (80 x 120, 100 x 120, 80 x 60, and 40 x 60). CHEP supplies the pallets to goods and food products manufacturing sites across the world. These manufacturers use the pallets to carry their goods to Belgian or foreign retailers. When doing so, they inform CHEP exactly where the pallets are being sent. Once the pallets have been unloaded at their destination, CHEP collects them and puts them into circulation again among local manufacturers.



Limited storage, few empty transports

'The system is beneficial for all parties involved,' says Olivier Legendre, Country General Manager at CHEP Benelux. 'The producers always receive quality pallets. In addition, they do not need a large storage space, given the fact that we supply them according to their needs. Likewise, retailers require only limited storage space, because we come to pick up the pallets as soon as possible. Furthermore, the entire cycle is managed

by CHEP, which means that companies do not need to take care of the administration related to the pallets. We also limit the transportation of empty pallets since these don't need to be sent back to the sender. A load of pallets from Spain, for instance, can be easily put back into circulation in any part of Europe.'

good to know

In the CHEP **pooling system**, the pallets are supplied to the manufacturers and collected at their point of destination.

The system is managed entirely by CHEP. Extra attention goes to **minimizing the transport** of empty pallets.

All of the pallets are **inspected, cleaned, maintained, and repaired** when necessary.

Transport packaging

Pooling optimizes the use of pallets



How does CHEP ensure a sustainable use of pallets?

Step 1: manufacturing from certified wood by local carpentry firms

All CHEP pallets are made from wood that is 100% FSC or PEFC certified. This guarantees that the wood comes from sustainable forestry. CHEP does not manufacture the pallets itself but contracts it out to local carpentry businesses across the globe. When completed, the pallets are also put in circulation locally. That way, CHEP avoids the expensive and environmentally costly transport of empty pallets.

Step 2: optimum use of the worldwide network

CHEP has 345,000 customers around the world and almost 300 million pallets in circulation. Its extensive network of manufacturers, wholesalers, and retailers is set up for maximum efficiency. CHEP maintains a precise registry of where the pallets are located and can thus carry out optimal collections. In the process, it also takes seasonal fluctuations into account, as well as other variables that influence demand.

Step 3: smart maintenance ensures a long pallet life

CHEP systematically maintains the pallets to ensure their quality and long lifetime. The company has 500 service centres worldwide, where the collected pallets are inspected, cleaned, and repaired when necessary. Damaged parts are replaced and preferably transported to the wood industry where they are processed into chipboards.

Olivier Legendre, Country General Manager
CHEP Benelux

'Pallets coming with a load from Spain are put into circulation again at their final destination, for instance at the other end of Europe. We thus avoid having to transport empty pallets.'

CHEP and the environment

Pooling, or the sharing of equipment, is by definition an **environmentally friendly concept** because the use of equipment is optimized. CHEP, which was founded in Australia under the name Commonwealth Handling Equipment Pool, has been active in the pooling of equipment since 1945. Even after its take-over by the Brambles Group in 1958, equipment pooling has remained its primary mission. In other areas too, CHEP pays considerable attention to the environment:

- All the wood that it uses comes from **sustainable forestry companies** certified by FSC or PEFC.
- CHEP has committed itself to a **20% reduction in its CO₂ emissions** by 2015 compared with 2010.
- In 2010, CHEP received the **Lean & Green Award** during the 'Rij Veilig, Vervoer Groen' Congress in Rosmalen (the Netherlands).
- In collaboration with the University of Leeds (Great Britain), CHEP has developed an **Environmental Calculator** to compute the environmental impact related to the use of CHEP pooling pallets. It reveals that a pooling system emits six times less CO₂ than the use of disposable pallets.

E-mail : sales.bnl@chep.com
Tel. : +32 (0)15 799 747
www.chep.com

Paper pallets - specific circumstances sometimes lead to alternative solutions



Companies often need to find solutions to certain specific circumstances. The result is that they develop alternatives for classic wood pallets that are better suited to the particularities of their products or their logistic system. Such alternatives may be required for long transport distances or difficult product sizes, among other things. IKEA specifically developed the paper pallet because it better suits its logistical needs and helps it to meet its sustainability targets. In addition, this project has enabled the company to offer its customers even more attractive prices. IKEA also relies upon loading ledges to use the available space inside trucks more efficiently. A life cycle analysis reveals that both innovations reduce CO₂ emissions as well as transportation costs.

prevent pack

IKEA products are manufactured in various countries – in Eastern and Western Europe as well as in Asia. 'All of our transportation of products from factories to distribution centres and stores used to be carried out on wood pallets,' explains Jerome Jansen, Packaging Requirements & Compliance Specialist at

IKEA. 'Returning these empty pallets to the factories was very costly and was responsible for considerable CO₂ emissions. On top of that, the limited number of times that we could reuse these wood pallets was insufficient. We therefore set out to find alternatives.'

90% lighter

IKEA's R&D centre developed a solution based entirely on corrugated cardboard, including nine supporting blocks. 'These so-called paper pallets are fully recyclable,' states Vincent Hody, Environmental Coordinator at IKEA. 'Paper pallets are also considerably lighter than wood pallets; they weigh 2.5 kg instead of 23 kg. This 90% weight saving is directly related to a reduction in fuel consumption as well as emissions.'

Paper pallets can carry up to 750 kg and are available in

three basic formats. However, other formats can also be readily developed to fit the specific dimensions of a product. Furniture, for instance, does not take into account the standard dimensions of pallets. 'Approximately 90% of our transport of products between factories and distribution centres already use paper pallets,' underlines Jansen. 'This has enabled us to avoid between 50,000 and 100,000 transport movements a year.'

Avoiding empty spaces

'Thanks to the paper pallets, we can also make better use of the available space within the trucks,' observes Cees de Jong, Logistics Manager Retail at IKEA Belgium. 'When we place bookshelves with a width of 60 cm on a standard 80 cm Europallet, we lose 20 cm space every time. These empty

spaces also affect the quality of the support, which increases the risk of product damage. The use of paper pallets enables us to employ more of the available space inside trucks. Paper pallets have a height of only 5 cm, whereas classic pallets measure 15 cm in height. These so-called flat paper pallets

good to remember

The use of paper pallets and loading ledges provides IKEA with **more flexibility to optimally load trucks and avoids empty spaces**. As a result, the number of transports between factories and stores is substantially reduced.

By using **paper pallets** and loading ledges, IKEA avoids having to transport wood pallets to and from production sites. In addition, the **weight** of the pallets is **considerably lower**, as are the resulting CO₂ emissions.

Paper pallets - specific circumstances sometimes lead to alternative solutions

are also perfectly in line with the strategy IKEA adopted at its inception: make a product and its packaging as flat as possible in order to maintain transport efficiency all the way to the end customer. We can thus carry an entire additional layer of products because we use so many flat packs.'

IKEA also developed the loading ledge – a small support device

made out of polypropylene that can be flexibly placed wherever needed on various sides of transport packaging. Loading ledges enable the transport of products without pallets, which is extremely practical for large packages. 'Instead of only three rows of pallets, we can often transport four by using loading ledges.'

Less product damage

IKEA has the advantage that it manages its entire logistics chain—from manufacturing to in-store display. The introduction of the paper pallet has demanded numerous adaptations to the infrastructure: pallet shelves, forklift trucks in manufacturing

plants, logistic centres, and stores. In addition, the company has invested heavily in training its personnel to correctly handle the new pallets. The result of these various efforts is that IKEA now records less product damage than previously with classic pallets.



How IKEA developed the paper pallet

Step 1: prototype

For many years, IKEA has invested in developing its own expertise centre for cardboard packaging. The centre designed the initial prototype of the paper pallet. Which type of cardboard provides the most resistance? How can the supporting blocks best be crafted and placed? IKEA eventually opted for pallets that are made entirely of corrugated cardboard.

Step 2: available in three basic formats

IKEA decided to develop the paper pallet on the basis of its product range. There are currently three basic formats; two are in line with the dimensions of the Euro pallet (80 x 120 cm) and half Euro pallet (80 x 60 cm), and the third is the IKEA pallet (80 x 200 cm).

Step 3: plan for flexibility

On top of the three basic formats for the load surface of the pallets and the placement of supporting blocks, the pallets can also be tailored to specific dimensions. In addition, IKEA developed the loading ledge to be able to support very long products during transport. As a result, every load can be optimally adapted to the products.

Life cycle analysis reveals environmental gain

IKEA had a life cycle analysis (LCA) carried out to compare the sustainability of its various transport packages. This LCA clearly revealed that the **paper pallets** and **loading ledges** achieve the best scores. In order to be reused, wood pallets must be transported back to factories. This weighs heavily in terms of **CO₂ emissions**. Paper pallets are up to **90% lighter**, which positively impacts the fuel consumption and number of transport movements. Moreover, the paper pallet and loading ledge materials can be **recycled after use**. Some of them even end up in new IKEA products.

Optimizing transport packaging

Making the most of the available space within trucks

Moving products with a minimum of waste and at the least possible cost to the environment and the company – that is what optimizing transport packaging is all about. The choice of transport packaging material as well as how the products are loaded into the truck all play important roles. According to the Packaging Centre of the XIOS Institute in Limburg, Belgium, there is still plenty of room for improvement.

'Typical problem areas are the ever heavier pallet loads, as well as products that either extend past the edge of the pallet or that leave too much margin between the products and the edges of a pallet,' observes Philip De Schepper, Technical Manager at the Packaging Centre. 'We also encounter a lot of over-packaging. Understandably, companies often prefer to use excess packaging rather than risk product loss. That being said, this is clearly better than not enough packaging. In many cases, however, it is easy to achieve savings without increasing the risk of damage.'

prevent pack

Ensure piling strength

The quest for optimal transport packaging depends on each individual company and is strongly linked to the processes within a specific company. In addition, primary, secondary, and tertiary packaging strongly influence each other. For instance, the size of cardboard packaging is best chosen as a function of its possibilities for palletization. This is the only approach that leads to the optimal filling of both the pallet and the truck.

'It is also essential to avoid products sticking out past the edge of a pallet or with excessive inner margins between the load and the edges of the pallet,' adds De Schepper. 'When this occurs, there is a considerable impact on both the piling strength and stability. When cardboard boxes containing products extend past the edges of a pallet, they lose a large part of their support,

substantially increasing the risk of toppling and product damage.' For some loads, it is therefore best to pile the boxes like bricks in a wall. That is the best way to ensure sufficient strength and stability.

Overloading a pallet is not ideal either. 'We encourage companies to load pallets in an optimal configuration; this is not the same as loading them to the maximum,' points out De Schepper. 'We strongly advise, for example, that there should not be any empty spaces between products and that there should be as little room as possible between the load and the edges of a pallet. Experience has taught us that minimum room is ideal so as to avoid having products sticking out of a pallet and prevent load movement.'

Software helps improve palletizing

A growing number of companies use palletization software to calculate how a pallet and a truck can be optimally loaded. This employs a large number of criteria—the product, the packaging, the length and type of transport, et cetera. The software indicates which factors influence the palletization scheme and how these factors can be optimized one by one.

'Many companies already use such software tools yet still experience

problems. This often has to do with the fact that not all parameters are known or taken into account. Factors such as temperature, humidity, and transport distance are often overlooked,' points out Gudrun Nowicki, Project Engineer at the Packaging Centre. 'We can help companies make better use of their software, highlight where the issues are, or make the calculations for them.'

good to remember

Various product and transport related **parameters** must be taken into account in order to **optimize transport packaging**.

Palletization software can help companies in this respect.

Optimal transport packaging and palletization begins at the design phase of the product as well as its packaging.

Optimizing transport packaging

Testing the quality of pallets

It is relatively easy to test the quality of a pallet load. 'Companies can call upon our Packaging Centre for such tests,' adds Nowicki. 'Vibration tests, for instance, are essential to verify whether the goods and/or the packaging do not break, or to make sure that the products won't move or fall while inside the vehicle, which complicates unloading. We use a large vibration table to check this. We also simulate changes in temperature and humidity in order to measure their influence. All of these tests can be carried out on a broad array of secondary and tertiary packaging.'



Palletization software employs numerous criteria to calculate and optimize the stacking pattern, height, and location of boxes.

Include transport packaging in the design stage

'Few companies consider factors involved in transport packaging during the development stage of their product and its packaging,' explains Nowicki. 'However, doing so can avoid a great deal of over-packaging, given the fact that the various levels of

packaging strongly influence each other. The specifications and materials of the secondary and tertiary packaging are important points of focus, as is their role throughout the logistical process – including handling and storage.'

Points to pay attention to:

- Plan extra strengthening under the lower pallets when stacking loaded pallets.
- Ensure that the cling film used to stabilize the load on a pallet is sufficiently strong. Cling films lose a great deal of their tension and holding power at high temperatures. Avoid letting cling film wrapped pallets stand in the sun too long.
- Consider the time and the distance over which the products must be transported. Transport packaging for European-wide shipping must be twice as strong on average as packaging for internal transport within Belgium. Transport packaging that is sent overseas must be up to seven times stronger.

For additional information

The XIOS Packaging Centre in Limburg, Belgium, carries out research on many types of packaging. In addition, this research institution also helps companies solve packaging problems and develop new packaging solutions.

Packaging Centre (VerpakkingsCentrum)
XIOS Hogeschool Limburg
Universitaire Campus,
Agoralaan, bâtiment H
3590 Diepenbeek
www.verpakkingscentrum.be

Free packaging diagnosis

XIOS offers a **tailored packaging diagnosis** in collaboration with Fost Plus and VAL-I-PAC. An expert visits your company for one day and then prepares a report with observations and recommendations. The report contains both structural modifications for the long term and quick wins enabling companies to rapidly achieve savings.