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INDUSTRIAL PLATS

Chapter eleven:

Material handling – second part

DOUBLE DEGREE MASTER IN
"PRODUCTION ENGINNERRING AND MANAGEMENT"

SEAT OF PORDENONE
UNIVERSITY OF TRIESTE

Unit load

The **phases for the dimensioning effective** of the UdC provides:

- the choice of primary sales package (boxes, bags, bottles, cartons etc.);
- the choice of the secondary packaging (boxes, drawers, baskets etc.);
- the choice of the packaging sector (pallet, box etc.);
- the choice of the scheme palletizing pattern;
- the determination of load plans.

Unit load

The **choice of primary packaging of sale** derived, with regard to finished goods, from appropriate marketing strategies to consider:

- the amount of product purchased by the customer;
- the manageability;
- the preservation of the product;
- the manner of use;
- the ecological aspects;
- etc.

Unit load

The **primary packagings** are for the most part oriented to the conservation and inexpensiveness.

The choice of **secondary packaging** you can choose the number and arrangement of primary packaging, which must be contained and the result must be easily movable and storable.

The choice of **tertiary packaging** you must determine the characteristics of the pallets or containers, which will affect the handling characteristics inside and outside of industrial buildings.

Unit load

The pallets are of the supports used for grouping into a single UdC of one or more secondary UdC (in some cases primary) in order to facilitate handling. They can be made of different materials (wood, plastic, steel etc.). Especially in relation to the stresses to which predictably the UdC will be subjected.

The UNI EN ISO 445 of October 2009 defines a pallet as: a rigid horizontal platform of minimum height, compatible with the operation of trucks and/or forklift trucks and other equipment for the handling of the case, used a basis for assembling, loading, storage, handling, stacking, transportation or display of goods and loads.

Unit load

The pallets can be divided into new and used. The new ones can be in:

- **new wood**, are constructed with raw wood which has never been used;
- **wood of a second mounting**, are constructed with reclaimed wood, cut out to the lengths, widths and thicknesses constant.

The pallets used have had at least one cycle of use and, before being reused, require the selection and/or repair. They comprise:

- **refurbished A** (white pallet), pallets are reused in perfect condition with no defects, which have already made more rotations (the wood is clear);
- **refurbished B**, are pallets that have been used and some of whose elements may have been replaced. These pallets are refurbished according to the rules in force (the wood can be gray).

Unit load

The pallet in pressed wooden are composed of particles made of wood, obtained by crushing by-products from sawmill, assembled from a synthetic resin. The shape is obtained by compression in a mold at high temperature. They fit into each other.

Unit load

The lumber for pallets can be obtained from:
- **poplar**: the wood is lighter, less resistant and mechanically with structural efficiency rather high;
- **fir**: provides, in relation to the lower volumetric mass, the structural efficiency higher, in particular as regards the bending.

Depending on the humidity, it can have:
- dry to 18% maximum (16% to 18%) where the pallet remains dry even if it is placed in a moist environment;
- dry to 22%, the pallet gets the moisture, but it remains dry. The dry wood may be wet outside, but inside is still dry.
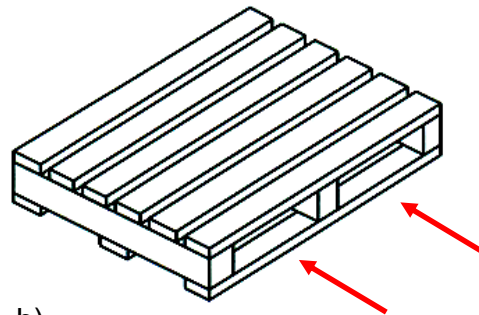
Unit load

The **load platform** can be at one or two floors resting on sleepers or blocks, suitable to be transported or stacked, equipped with free spaces to allow carriage with forklift trucks. Can be divided into:

a) **plan pallet**: is a pallet with an upper deck, without a raised superstructure (the plan is intended to receive the load (a));

b) **pallets at two way**: this is a pallet that allows the entry of the forks of the forklift and transpallet of only the two opposite sides (b);

c) **pallet at four way**: is a pallet that allows the entry of the forks of the forklift and transpallet from all four sides (c);

d) **pallet at two levels**: it is a pallet having an upper floor is intended to receive the load and a lower working as a support (b) (c);
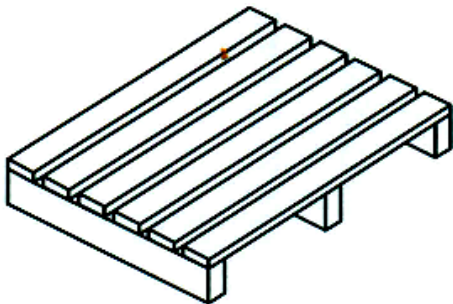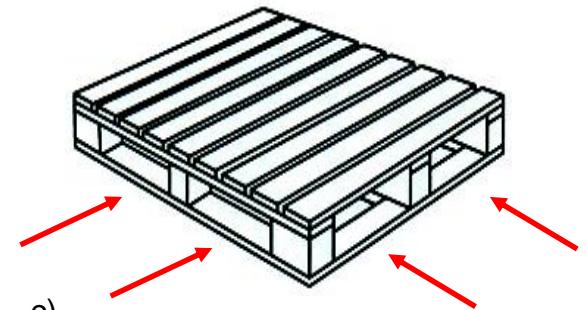
a)　　　　　　　　　　　b)　　　　　　　　　　　c)

Unit load

The **load platform** can be at one or two floors resting on sleepers or blocks, suitable to be transported or stacked, equipped with free spaces to allow carriage with forklift trucks. Can be divided into:

e)   **pallet reversible**: it is a pallet having two identical floors, both able to carry the load and the other the support (d);

f)   **pallet with superstructure** (**uprights**): is a pallet fitted with uprights with or without current reinforcement (e).
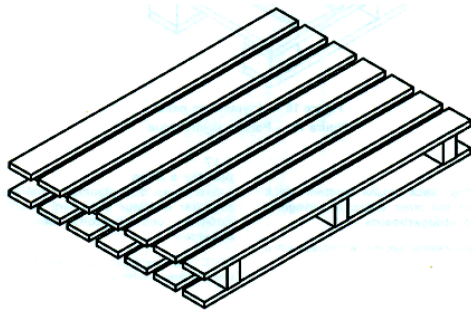
e)
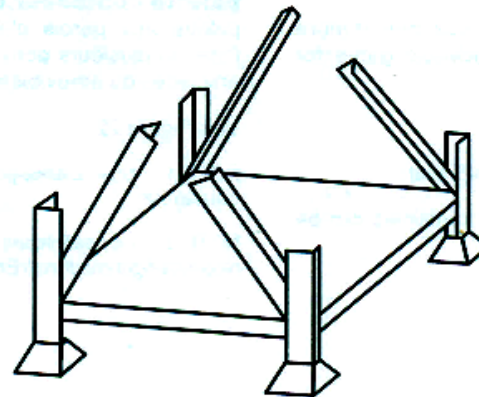
f)

Unit load

The **size of the pallets** for handling and transportation of goods within the European plan forward the measures of 800 x 1000 mm (EUR pallets), 800 x 1200 m (pallet), 1000 x 1200 mm (pallet Philips) and 1200 x 1200 mm. All have in common the height from the ground and the conformation of the base with the presence of 9 feet (100 to 145 mm from the side), joined below one another in groups of three through lists of wood with a thickness of 22 mm placed in the sense of greater extent. This type of pallet is forkable mounted on each side (pallet at four way).
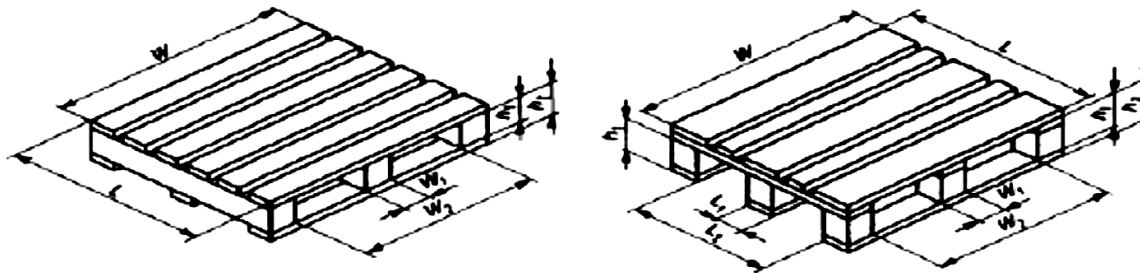

| Length L or width W	L_1 max. o W_1 max.	L_2 min. o W_2 min.	h_1 min.	h_2 max.		h_3 min.
				1 floor	2 floors	
800	150	560	98*	127	155	98*
1 000	150	560	98*	127	155	98*
1 200	180	750	98*	127	155	98*
For reversible pallets at two way are allowed heights h1 minimum and h2 minimum of 80 mm						

Unit load

The European Pallet Association (EPAL) has defined the characteristics of interchangeability of equipment for pallets 800 x 1200 mm, set out below.

PALETTE EUR-EPAL©

(EPAL) (EUR)
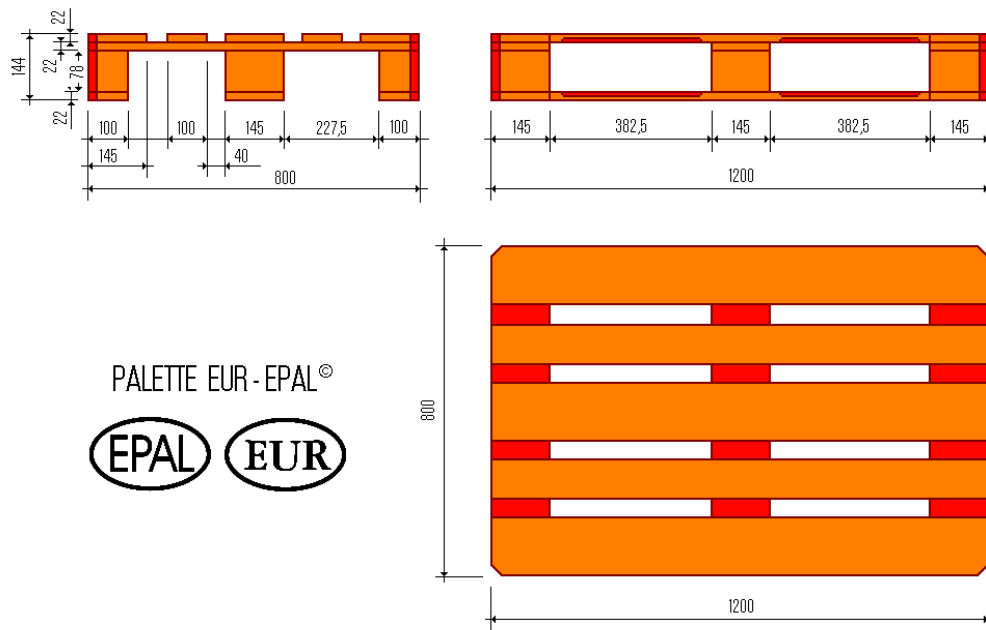
Unit load

Three brands EPAL with its size and the coding table for the code of Nations.
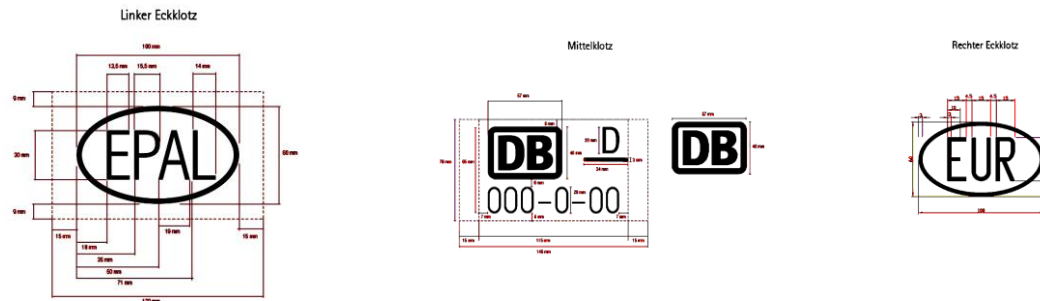
A	Austria	B	Belgium
BG	Bulgaria	BIH	Bosnia Herzegovina
BY	Belarus	CH	Schwitzerland
E	Spain	F	France
GB	Great Britain	GR	Greek
GUS	Belarus	H	Hungary
I	Italy	IRL	Ireland
LT	Lithuania	LV	Latvia
NL	Netherlands	PL	Poland
PT	Portugal	RO	Romania
RUS	Russia	SK	Slovakia
SI	Slovenia	TR	Turkey
UA	Ukraine		

Unit load

Example of pallets produced in Germany. If it had it been produced in Italy, in the middle part would be found next to the mark FS with at side the initials I.

1. Branding of the European Pallet Association EPAL
2. Branding of a European Railway
3. Branding of the European Pallet Pool EUR
4. Standardised nailing pattern
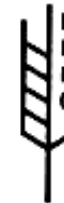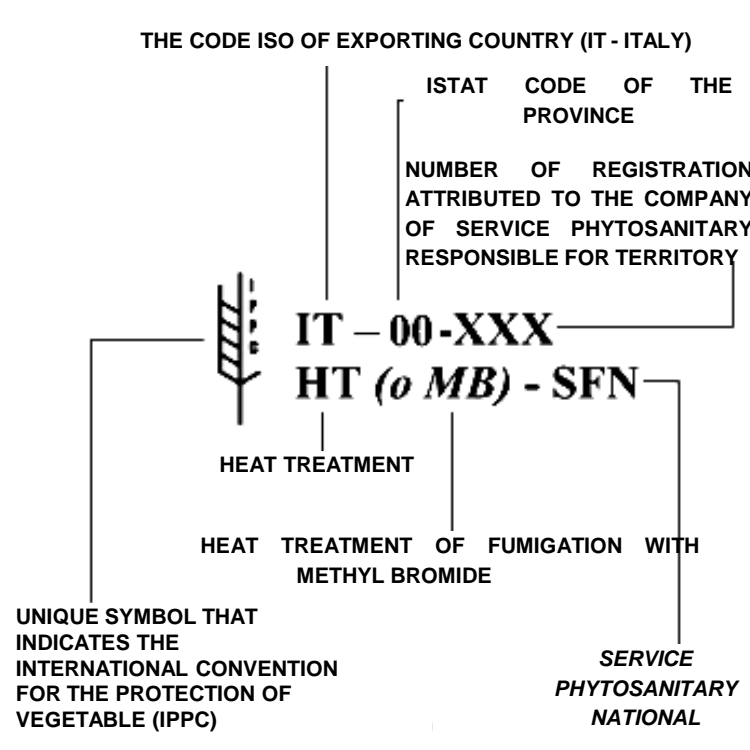5. Chamfered bottom boards
6. No moulds
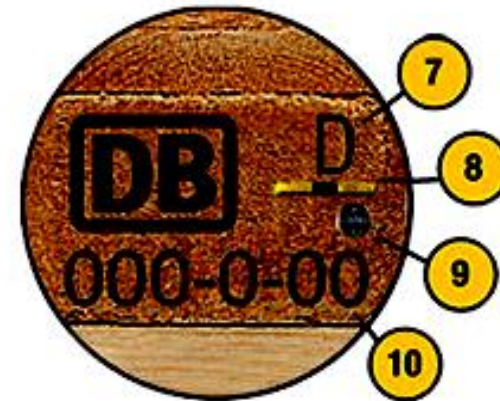
7. country code
8. EPAL control quality staple
9. EPAL repair marking nail
10. manufacturer code – year – month

We use the nails:

Unit load

The specific trademark on pallets shipped abroad:

THE CODE ISO OF EXPORTING COUNTRY (IT - ITALY)

ISTAT CODE OF THE PROVINCE

NUMBER OF REGISTRATION ATTRIBUTED TO THE COMPANY OF SERVICE PHYTOSANITARY RESPONSIBLE FOR TERRITORY

IT – 00-XXX

HT *(o MB)* - SFN

HEAT TREATMENT

HEAT TREATMENT OF FUMIGATION WITH METHYL BROMIDE

UNIQUE SYMBOL THAT INDICATES THE INTERNATIONAL CONVENTION FOR THE PROTECTION OF VEGETABLE (IPPC)

SERVICE PHYTOSANITARY NATIONAL

Unit load

The stabilization of the load can be made according to some methods:

a) **winding with stretch film**

Using thin films of polyethylene, exploiting the flexibility to cover and compact the load, so as to protect and stabilize it. The film is stretched cold and wrapped around the load and the final section is fixed by welding or making it adhere to itself.

The compaction force exerted by the film is proportional to the force of winding and decreases immediately after application to stabilize after about 40 hours.

Unit load

The stabilization of the load can be made according to some methods:

a) **winding with stretch film**

We use the following systems:

- *multilayer winding with rotary table*

Unit load

The stabilization of the load can be made according to some methods:

a) **<u>winding with stretch film</u>**

   We use the following systems:

   - *multilayer winding with rotating coil*
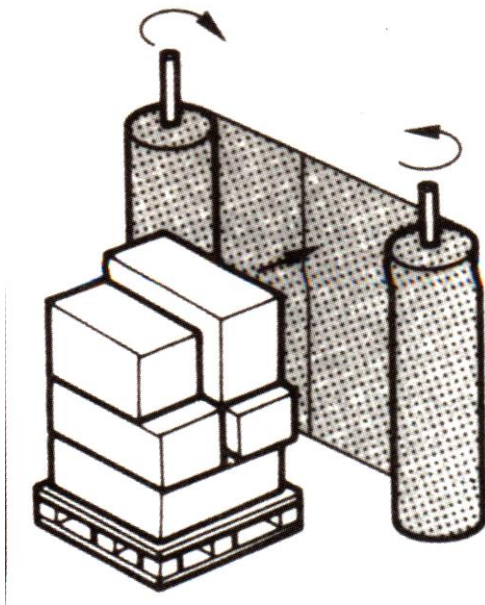
Unit load

The stabilization of the load can be made according to some methods:

a) **winding with stretch film**

We use the following systems:

- *monolayer winding with sleeve*

Unit load

The stabilization of the load can be made according to some methods:

b) **apparatus for heat-shrinking**

The ovens in general at tunnel with forced air circulation allow to maintain temperatures of 200-250°C with a power between 72 to 120 kW. The residence time ranges between 30 ÷ 45 s.

Unit load

The stabilization of the load can be made according to some methods:

b) **<u>apparatus for heat-shrinking</u>**

Heating rings to vertical movement: distributing the heat around the entire load, with a cycle time variable depending on the height of the load and the film thickness between 45 and 60 s. Allows a greater regularity of the retraction, an excellent anchorage of the film to the pallet and a reduction in the thickness of the film.

Unit load

The stabilization of the load can be made according to some methods:

c) **stabilization with mass at the net and tying**

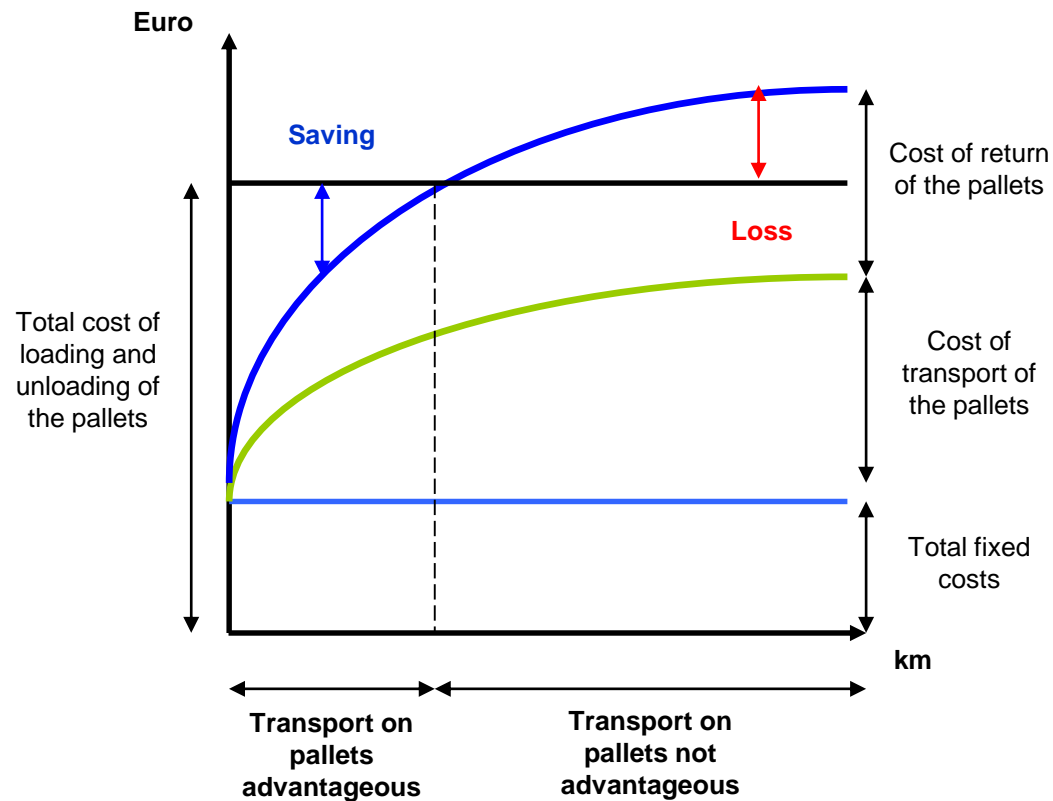 The mass at the net is done manually. The networks provide good ventilation.

  With regard to the ligation, the materials used to ensure the load vary depending on the type of ligation to be performed:

  - horizontal: performed using strings, straps etc.;

  - vertical: used other than strapping in metal or plastic.

Unit load

In the case of palletizing for shipment of product outside the industrial reality, the problem of the return of empty pallets plays a decisive role in determining whether agrees or not it palletized materials.

Euro

Saving

Cost of return of the pallets

Loss

Total cost of loading and unloading of the pallets

Cost of transport of the pallets

Total fixed costs

km

Transport on pallets advantageous

Transport on pallets not advantageous

Unit load

For the formation of the UdC made with parallelepipeds necks arranged on a pallet, you should consider:

- height of the UdC should not exceed, including pallets, the 2 m;
- surface of the pallet not covered by the loads should be minimal, with no limit;
- you must have the necks by resting them on the face of the larger;
- it must define the number and arrangement of the secondary packaging for each layer and number of layers;
- necks shall be prepared using the criteria of alternating of cross layers.

Unit load

Example of a robotic palletizing cell.

Unit load

These choices allow you to:

- the saturation of the pallet;
- the standardization of size of the UdC;
- the stackability, in order to unify the size of the cells for the storage;
- the stability of the UdC;
- the dimensional regularity of the UdC for automated warehouses.

Unit load

The optimum arrangement of necks on pallets parallelepipeds on pallet is obtained by applying the **method Palett-o-graf**.

Indicating with *a* and *b* the plan dimensions of the necks, and with *A* and *B* the size of the pallet, the conditions for optimal utilization are as follows:

$$A = m \cdot a + n \cdot b \qquad B = r \cdot a + s \cdot b$$

If you are supposed to have the dimension of the pallet, the following:

- base *A* = 120 cm

- height *B* = 100 cm

and the size of the neck, the following:

- base *a* = 32 cm

- depth *b* = 19 cm

- height *h* = 25 cm

you can bring graphically the observed conditions. Considering the combinations of the union between the neck and pallets that are to the left of the lines and you can decide which alternative will allow for the greatest number of packages.

Unit load

The boundary conditions of the problem are indicated by lines A and B. The points that are located to the right of each of the two straight lines identify the positions of the necks that overflow respect to the pallet, while those on the left indicate that not the entire base of the palette is used. If a node is located on a straight line, it is in excellent condition, at least for that side, while the optimal solution of the system is that defined by the two nodes Q' and Q that are located on lines A and B.
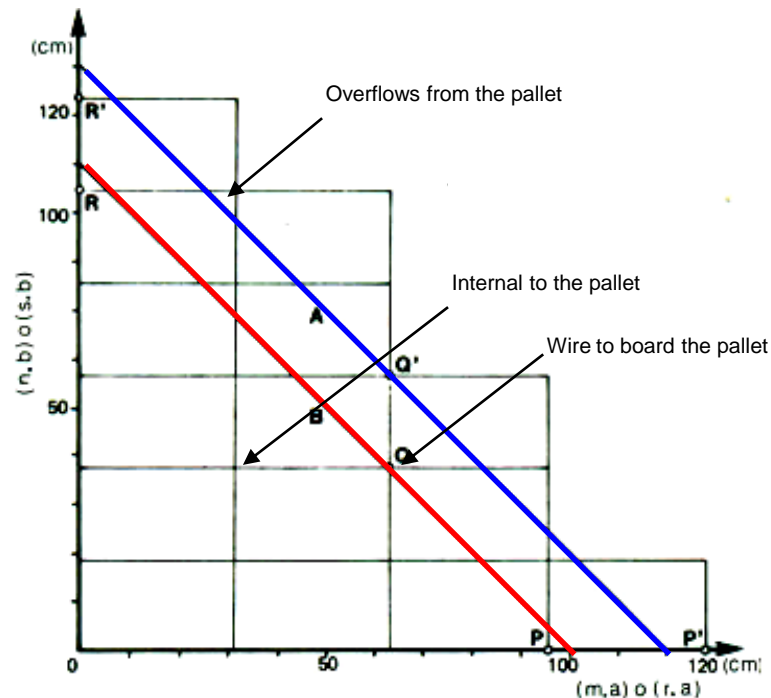
Unit load

As for containers, these are used for handling, storing and protecting materials and are important in moving between work center, departments, buildings and establishments in manufacturing.
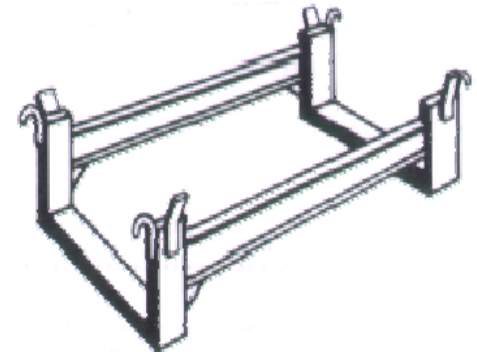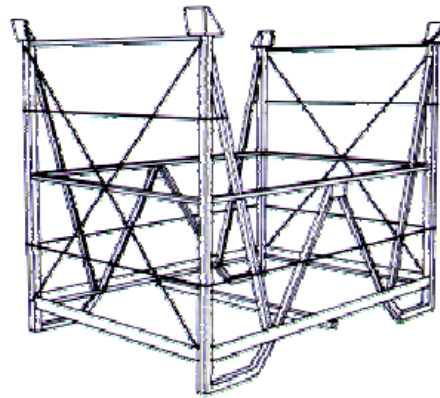
The containers are divided into:

- solid-wall or sheet metal;
- a network structure;
- in steel wire or at metal mesh;
- folding.

Unit load

The containers are divided into: wood, at reticular structure, foldable plastic, wire mesh, cardboard, collector equipped with hooks for lifting ropes and chains.
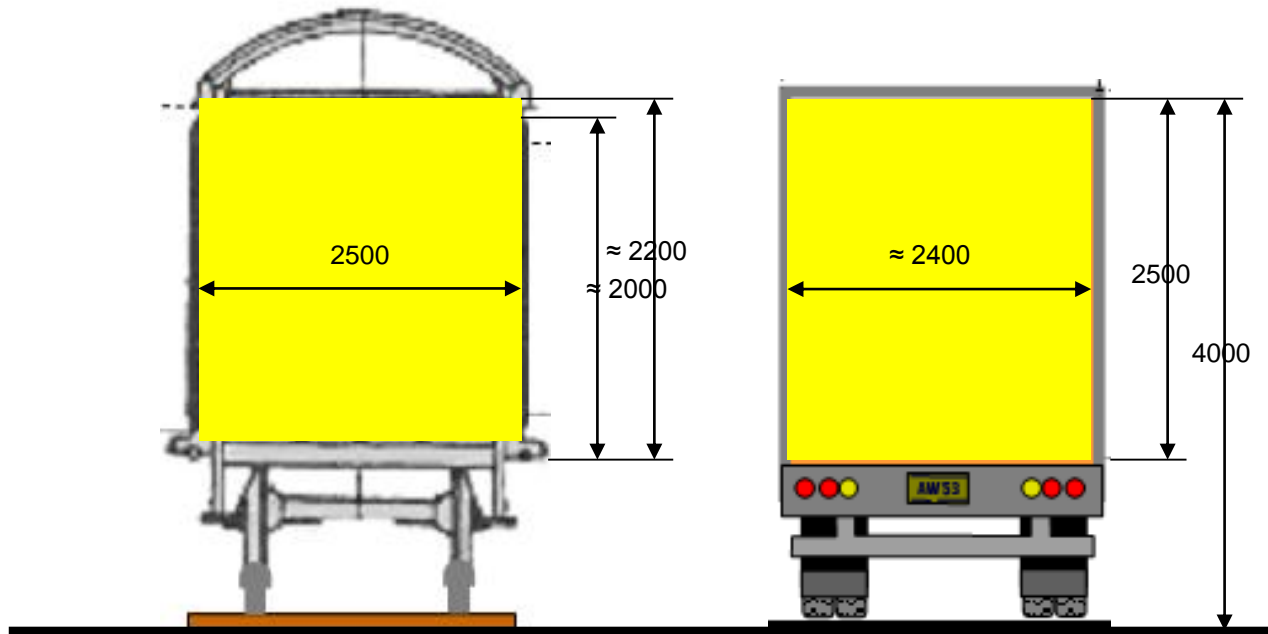
Unit load

An important problem is that of the plans of load as it must provide an effective positioning of the UdC in order to optimize the use of volumetric and surface means of transport.

One can choose the number and arrangement of the UdC, but it will be necessary to take account of the constraints that are imposed by the systems for loading and unloading of means.

In the case of a railway wagon of the effective length of 2500 mm, allows to pull 2 pallets 800 x 1200 mm with a play of safety of 100 mm. In the case of industrial vehicles, hardly the internal usable length is greater than 2450 mm, in which case it would be able to place two pallets that, taking into account the tolerances, one arrives at a length of 1220 mm, and then there would be a game security 60 mm but would bring problems in loading. These problems do not occur if the cartons not overflow and, in this case, one can think at automated loading.

Unit load

The cartons used more and better fill the euro pallets have dimensions of 600 x 400 mm (base module) and its submultiples (600 x 200, 600 x 100, 300 x 400 e 300 x 200).

Dimensions useful for internal rail wagons   Dimensions indoor/outdoor for vehicle

Unit load

Railway wagon and articulated trucks

Unit load

The **efficiency of packaging**, defined by the ratio between the volume of the "contained" and the volume of the container, is provided by the following parameters referred to:

- **primary packaging** RV1:

$$RV_1 = \frac{V_{net\ of\ product}}{V_{gross\ of\ primary\ packaging\ (package)}}$$

- **secondary packaging** RV2:

$$RV_2 = \frac{N_{of\ primary\ packaging\ in\ secondary\ packaging} \cdot V_{gross\ of\ primary\ packaging\ (package)}}{V_{gross\ of\ secondary\ packaging\ (cardboard)}}$$

- **tertiary packaging** RV3:

$$RV_3 = \frac{N_{of\ secondary\ packaging\ in\ tertiary\ packaging} \cdot V_{gross\ of\ secondary\ packaging\ (cardboard)}}{V_{nominal\ of\ tertiary\ packaging\ (pallet)}}$$

Unit load

The **efficiency of packaging**, defined by the ratio between the volume of the "contained" and the volume of the container, is provided by the following parameters referred to:

- **transport** RV4:

$$RV_4 = \frac{N_{of\ tertiary\ packaging\ on\ medium} \cdot V_{gross\ of\ tertiary\ packaging\ (pallet)}}{V_{useful\ of\ medium}}$$