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INDUSTRIAL PLATS

Chapter eleven:

Material handling – first part

DOUBLE DEGREE MASTER IN

“PRODUCTION ENGINNERRING AND MANAGEMENT”

SEAT OF PORDENONE

UNIVERSITY OF TRIESTE

Generality

The **handling and storage of materials** in an industrial reality has the purpose of:

- make available the correct amount of the right material in the right place, through the use of suitable methods and tools;
- respect the times, sequences, and conditions;
- minimize the cost.

The material handling includes all activities related to material flows in manufacturing facilities and storage, and is the tool of integration between the various production areas.

Generality

The **material handling** is characterized by the following operations:

- transport;
- storage;
- picking;
- sorting;
- dispatcing;
- feeling;
- positioning;
- orientation.







Generality

The handling of materials can be divided by:

a) ***type of activity***:

- handling;
- storage;
- control;

b) ***management level***:

- handling of the working station;
- handling of department;
- handling of the production system,

c) ***type of material treated***:

- gaseous materials;
- liquid materials;
- bulk materials;
- units load.

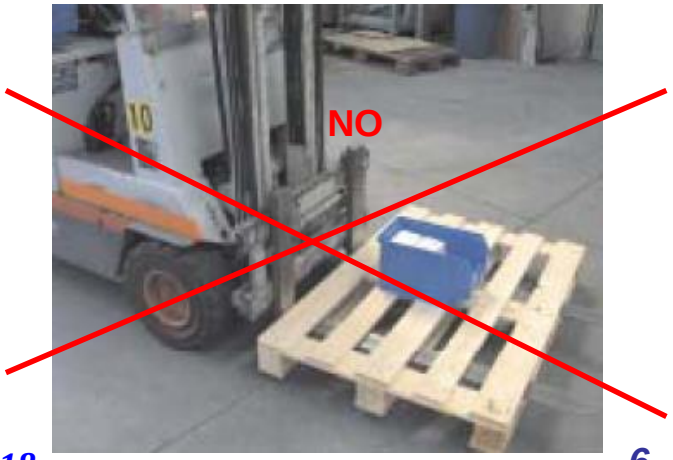
Internal transports

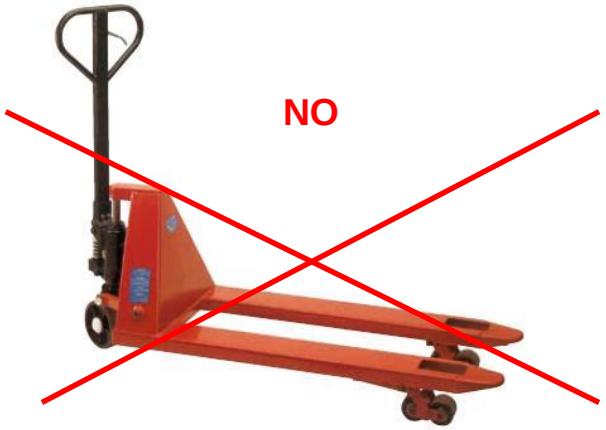
The internal transports in an industry are critical to handling activities and are defined as **material handling**, of **any type and form**, **carried out within the plants** from purchasing materials to shipping finished products.
Material handling operations, therefore, concerns:

- unloading of incoming raw of the materials or semi-finished;
- transfer of materials in the production departments and moving them at the workplace;
- loading of finished products in suitable vehicles to be shipped.

Internal transports

As part of Lean manufacturing, transport is a waste from the point of view of the customer; waste that he is not willing to pay. In fact, the operations of handling within the productive activity in the finished product do not bring added value. Every movement of the material is a waste that can not be completely eliminated, but can be appropriately reduced over time through studies of layout and study of management and materials handling. These tools help reduce the throughput time of a product, to eliminate non optimal paths, obstacles or constraints to the recognition and handling of materials, etc.





Internal transports

In short, the transport does not increase the value of the finished product, but still generates a production cost. So the specific objective, as well as eliminating other activities that not generate added value, therefore is to slide the value stream with minimal handling (processing and resumed) of the materials. In this way you can avoid congestion, delays and unnecessary transportation.

Internal transports

The **internal transports** influence:

- the plant layout and the building of the establishment;
- the costs of production;
- the safety and regulatory compliance;
- the productivity;
- the use of space;
- the external transport of the company;
- the technical level of the company.

Internal transports

The **general criteria for choice of transport** must meet the following basic principles of movement:

- ***principle of the unit loadary***: the individual materials to be handled should be aggregated into appropriate "base units of load", which should be of standard size (elements set on pallets or containers of standard size);
- ***avoid of the partial loads***: carrying whole units and fill the vehicle with the maximum security;
- ***principle of the minimum distance***: the distance of transport must be as small as possible as it does not have add value to the flow of materials;
- ***rule of the linearity of the flow***: the path of the transport system must be as linear as possible;

Internal transports

The **general criteria for choice of transport** must meet the following basic principles of movement:

- ***principle of the minimum end time***: the time of movement of the unit load includes the time for transport, loading and unloading, and spent on other activities that do not concern the actual transport of the material;
- ***principle of gravity***: it is convenient to exploit the most of the force of gravity, taking into account security and risk to cause harm to people and materials;
- ***bidirectionality***: the transportation systems must be designed and programmed to avoid having a stroke return at empty;
- ***principle of mechanization***: the handling system must be as much as possible mechanized or automated as to increase the efficiency and cost of the service;

Internal transports

The **general criteria for choice of transport** must meet the following basic principles of movement:

- ***principle of integrated systems***: they must integrate this service with those of receiving, shipping, inspection, storage, production, packaging, shipping, etc.;
- ***principle of flow of the systems***: it must integrate the flow of the handling system with the flow of information (identification and traceability of the material moved);
- ***principle of orientation of the parts***: the orientation of the machined part must be maintained in movement especially in automated systems.

Classification of internal transports

The **internal transports** can be classified by:

a) ***the type of material to be transported***:

- solid:
  - · in the form of unit load;
  - · in the form of packages (sacks, parcels, various containers etc.);
  - · at bulk (sand, earth, granules, powders etc.).
- liquids (water, oil etc.);
- gases (air, methane, nitrogen, oxygen etc.);

b) ***the type of operation***:

- continuous (roller conveyors, belt conveyors, pneumatic conveyors etc.);
- discontinuous (hoists, cranes, forklifts etc.);

c) ***the type of energy used***:

- at manual movement (lift trucks, roller conveyors, etc.);
- motorized (overhead cranes, chain conveyors, pneumatic conveyors etc.);

Classification of internal transports

The **internal transports** can be classified by:

d) ***the type of movement***:

- vertical lift:
  - · discontinuously (fixed hoists, hoists etc.);
  - · continuous (bucket elevators, pneumatic conveyors etc.);
- horizontal transport:
  - · discontinuous (roller conveyors, conveyor at puch, tractors etc.);
  - · continuous (roller conveyors, horizontal belts conveyor etc.);
- lift and transport:
  - · discontinuous (gantries, cranes, forklifts etc.);
  - · continuous (belts conveyor, pneumatic conveyors etc.);
- vibratory movement:
  - · continuous (conveyor at shook, vibrating screens etc.);
- rotary motion:
  - · continuous (augers, rotary drum etc.);

Classification of internal transports

The **internal transports** can be classified by:

e) ***the type of command***:

- with operator on board (overhead cranes, forklifts, cranes, tractors, etc.);
- with operator on the ground (overhead cranes, hoists, fork etc.);
- without operators (chain conveyors and belt conveyors etc.);
- automatic (hoists sliding monorail etc.).

Classification of internal transports

The **internal transport in extreme** summary:

TYPE OF MOVEMENT	TYPE OF OPERATION CONTINUOUS	TYPE OF OPERATION DISCONTINUOUS
Vertical lift	Bucket elevators, pmeumatic conveyors	Fixed hoists, elevatori
Horizontal transport	Roller conveyors, horizontal bents conveyor	Roller conveyors, conveyor drive, tractor
Lifting and transport	Belts conveyor, slat conveyors, pneumatic conveyorsi	Overhead cranes, cranes, forklifts-builds, overhead chain
Vibratory movement	Conveyors in shocks, vibrating screeni	
Rotary movement	Augers, rotary drume	

Classification of internal transports

A very important parameter for the means of transport is the determination of the productivity P (UdC/h), which can be defined by:

$$P = \frac{Q}{T}$$

where:

Q = quantity of material transported per cycle (UdC/cycle);

T = duration of the transport per cycle (h/cycle).

A generic transport cycle is normally broken down into five phases: loading, transfer, discharge, returning and waiting times.

A difference of the means of transport of the continuous type (belt conveyors, chain conveyors etc.), in which the five phases occur simultaneously and engage different components of the system.

Unit load

The **unit load** (UdC) is a grouping of materials arranged in such a way as to be easily handled and transported by means of mechanical means of transport. For example through the use of containers of various kinds, or on pallets made of wood, plastic or metal.

Containers

Drums on plastic pallets

Unit load

The **unit load** (UdC) is a grouping of materials arranged in such a way as to be easily handled and transported by means of mechanical means of transport. For example through the use of containers of various kinds, or on pallets made of wood, plastic or metal.

Containers of bulk parts – Boxes arrenged on a pallet – Gatherers for long materials

Unit load

The **sizing of the UdC** must take into account the following objectives:

- minimization of costs of transport;
- elimination of the manipulation and filming unnecessary;
- storage and handling in conditions of safety for the operators and for the materials;
- minimization of space.

Is hardly liable to the satisfaction of all the objectives simultaneously due to the onset of some trade-off (for example, the minimization and simplification of the movements often contrasts with the optimization of the space). The determination of the amount of materials to be transported Q (in weight, volume or number of packages) is defined by:

$$Q = q \cdot n$$

q = unit load (weight, volume or number of packages), n = number of trips required to make the transfer of the amount Q from one place to another.

Unit load

The objectives listed above, however, lead the search for technical solutions and operational. In particular, the sizing of the UdC occurs according to a process that considers three phases:

- ***primary packaging (for the sale)***

  Is designed so as to constitute, at the point of sale, a sales unit for the end user or the consumer (for example boxes, bags, bottles, cartons etc.);

Unit load

The objectives listed above, however, lead the search for technical solutions and operational. In particular, the sizing of the UdC occurs according to a process that considers three phases:

- ***secondary packaging***

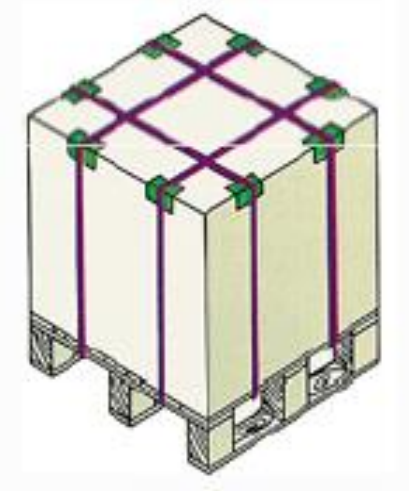
  Is designed to constitute, at the point of sale, the grouping of a number of sales units, regardless of whether it is sold as such to the end user or which has the purpose of facilitating the refueling of the shelves at the point of sale (for example, cartons, boxes, baskets etc.); it can be removed from the product without altering the characteristics

Unit load

The objectives listed above, however, lead the search for technical solutions and operational. In particular, the sizing of the UdC occurs according to a process that considers three phases:

- ***packaging for the transport or tertiary packaging***

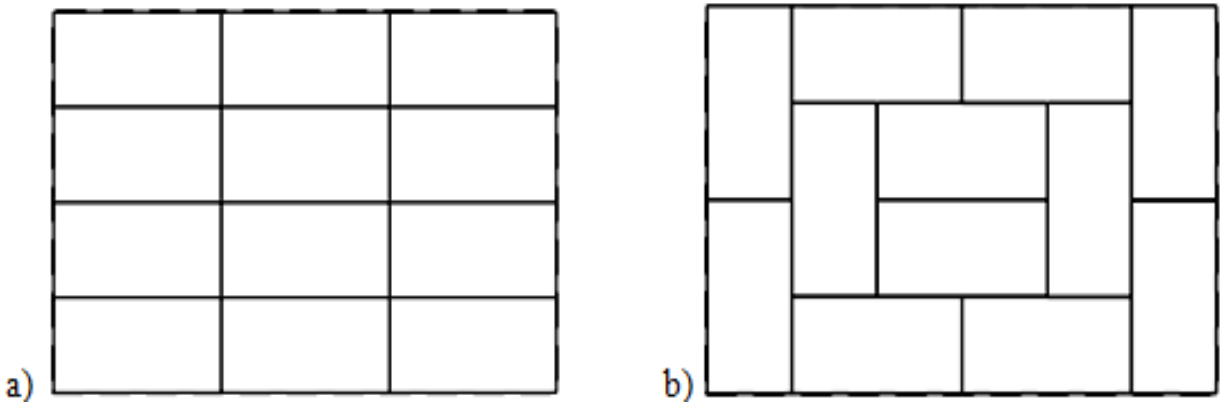
  Is designed to facilitate handling and transport of a number of sales units (primary packaging) or multiple packaging (secondary packaging) to avoid direct handling and transport damage. Perform this function, for example, pallets, crates, roll cages etc., but not the container.



Unit load

Packages must have the characteristics that:

- ***ensure the stability of the UdC (imbricating)***



UdC unstable (a) and stable (b), in the presence of alternating layers

- ***allow the stacking of the units load*** on each other, in order to allow the best use of space in height. Packages must therefore be strong enough to withstand the weight of several stacked layers or stacked UdC;

Unit load

Packages must have the characteristics that:

- ***possibly be forkable***

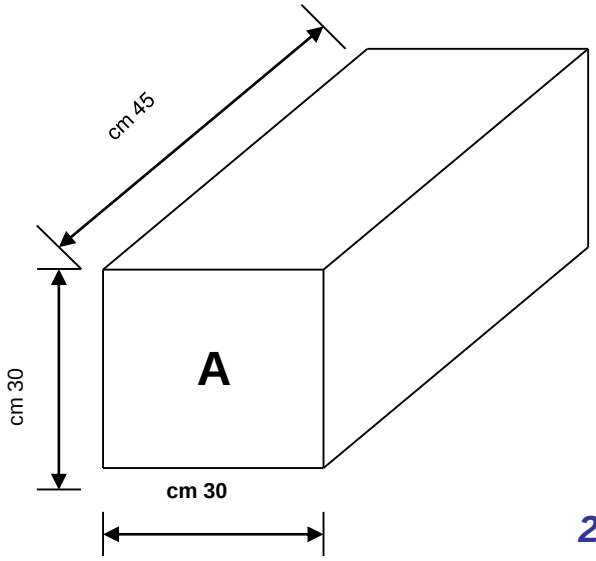
  Is an example of imbricating and packaging for UdC and consists of sacks of loose material (for example cement), which is stable, stackable and forkable.

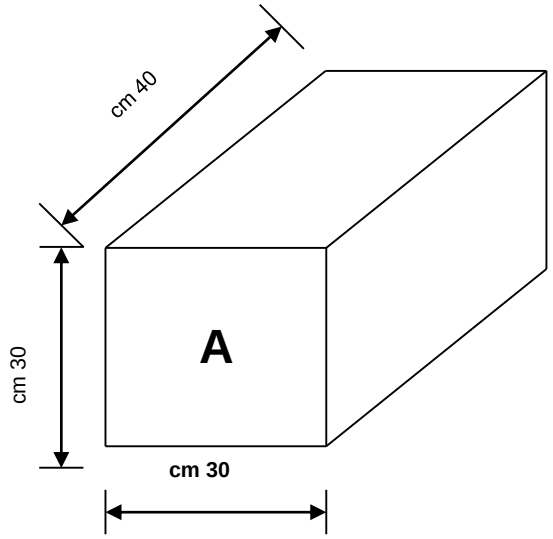
Unit load

To achieve functional packaging to facilitate handling, reduce costs and comply with safety standards (both to preserve the product's safety personnel), you must have a thorough knowledge of the logistics system and regulations of standardization applicable

Example

- is the packaging A: 300 x 450 x 300 mm
- is the packaging B: 300 x 400 x 300 mm

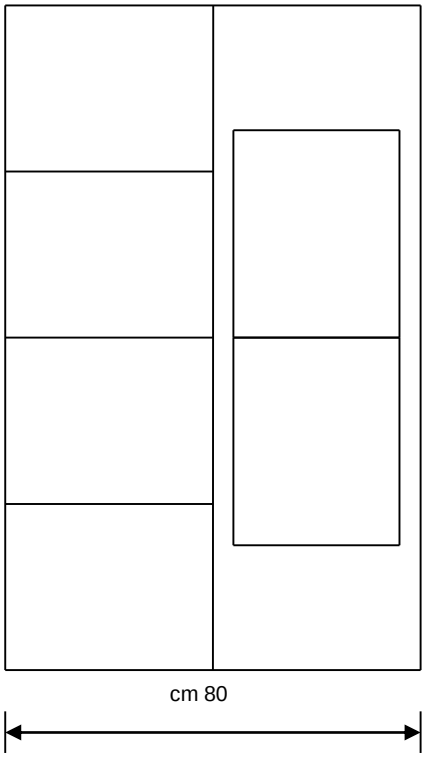




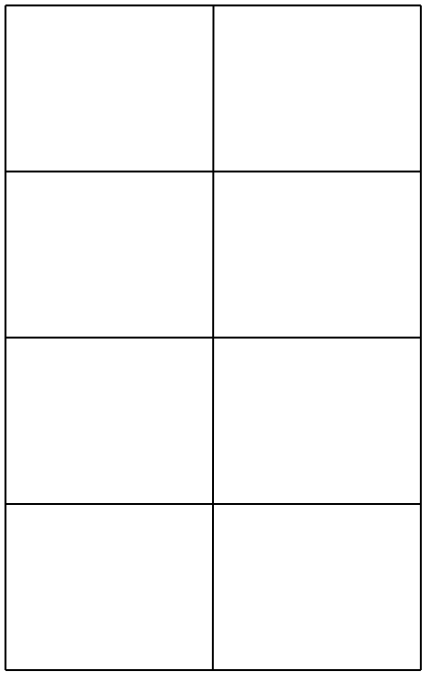
Unit load

Both are two types of packaging loaded on pallets 800 x 1200 mm, without going beyond the surface of the latter.

The comparison of the two solutions is as follows:



Load floorwith packing A



Load floorwith packing B

Unit load

The comparison of the two solutions is as follows:

	PACKAGING A	PACKAGING B
No. of packaging for floor	6	8
No of packaging positioned in height.	4	4
No. of packaging for UdC	24	32
% utilization of the surface	87,5	100

Considering to move always the same product and to use only the two types of proposed packaging, we obtain that:

	PACKAGING A	PACKAGING B
No. of packages handled/day	1000	1000
No. of working days/year	220	220
No. of packages handled/year	220000	220000
No. of pallets handled/year	9167	6875
Total times for material handling pallets [min]	7	7
Total time for material handling pallets/year [min]	64169	48125
Total time for material handling pallets/year [hours]	1069	802
No. of pallets loaded on vehicle	40	40
No. Of trips/year	230	172

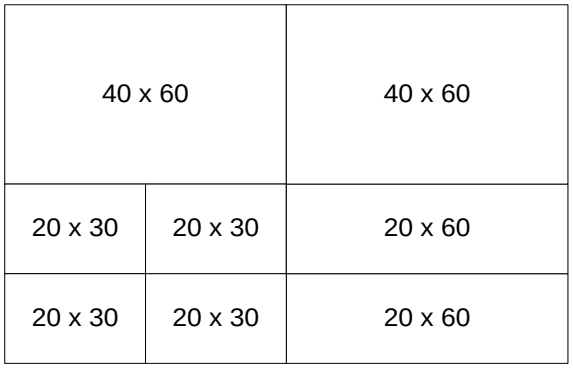
Unit load

It is noted that with the packaging B reduces the number of trips by about 25% compared to A. This reduction is particularly significant if it results in terms of cost savings. Also note that, always using a pallet, additional economic benefits can be introduced when using packaging with the following dimensions.

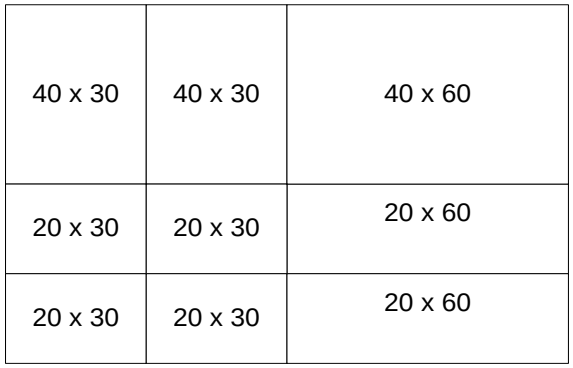
BASE SIZE	MULTIPLE	SUBMULPILE	
600 x 400	800 x 600	300 x 400	600 x 133
	1200 x 1000	200 x 400	300 x 133
	1200 x 1200	150 x 400	200 x 133
		120 x 400	130 x 133
			120 x 133
		600 x 200	600 x 100
		300 x 200	300 x 100
		200 x 200	200 x 100
		150 x 200	150 x 100
		120 x 200	120 x 100

Unit load

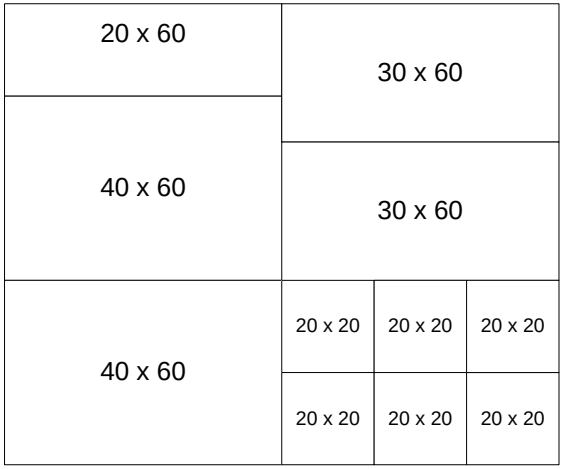
If it is assumed to have a pallet of 1200 x 800 mm, packages of different sizes correspond to those reported in the table above, you can obtain the following cases:



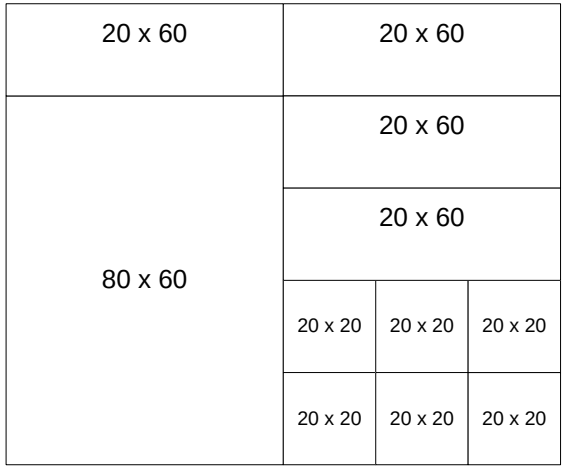
Example of packaging on pallets 80 x 120 cm



Example of packaging on pallets 80 x 120 cm



Example of packaging on pallets 100 x 120 cm

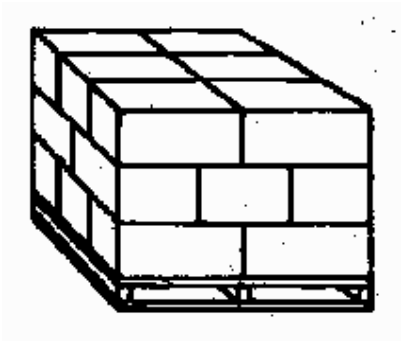


Example of packaging on pallets 100 x 120 cm

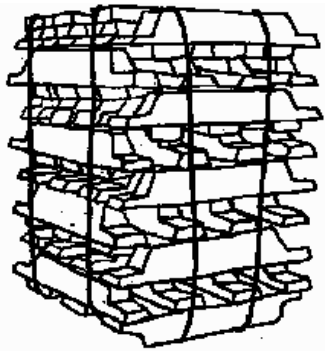
Unit load

The **establishment of the UdC** can be done by:

- pallets (a);
- alone the strapping without the use of pallets (b);
- use of disposable accessories (boxes, boards etc.) (c);
- use of various accessories to recall (frames, rulers etc.) (d).



a)



b)

c)

d)

Unit load

Careful selection of UdC helps to minimize transportation costs, shooting and handling of materials, space required for storage of materials, the routes stored in warehouses or in other areas of the plant (such as loading bays) and storage costs.

The objective is to overpower the space available for transport is constrained by:

- characteristics of the final package to be delivered to the client (size, shape, stiffness etc.);
- characteristics of means of transport used.