



Effective Packaging

IUMI Webinar

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Agenda

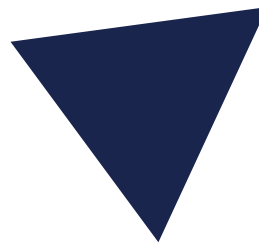
1. Regulations
2. Types of Packaging
3. Methods of corrosion protection
4. Transport strains
5. Summary

Regulations



There is no universal packaging regulation!

- Manufacturers' requirements
- Shipping line requirements



- HPE
- Eurocode 5
- DIN 55473 & DIN 55474
- US MIL Standards

- IMO/ILO/UNECE CTU CODE
- *CSS CODE*

Regulations Example: RoRo Shipping lines

Cargo labels are handling instructions for the stevedores and vessel's crew.
The following marks are mandatory:

Cargo ≤ 10 tons

- Inner cargo is to be secured inside of the case.
- The cargo should be secured to the bottom of the case.
- Case should withstand handling by crane/forklifts and strains from lashing material

Cargo > 10 tons

- Direct lashing is mandatory for standard shipments.
- Lashing points must be attached to the cargo.

Exemption possible if:

- Photos of construction process of packaging are provided
- Technical drawings provided
- Technical assessment of the transport packing

Polling question no. 2

What is effective packaging?

Fit for purpose packaging...



...is multifaceted

Fit for purpose packaging

Packaging is fit purpose if it can ensure that cargo remains intact during transport. The following factors are to be taken into account:

- Shipping route
- Transit time
- Means of transport
- Destination
- Transshipment operations
- Weather & climate
- Storage prior to, during or after transport



There is no such thing as **the one** fit for purpose packaging, just like there is not the one seaworthy packaging.

Types of packaging

There are three general types of packaging:

1. Accompanying
2. Load-bearing
3. *Load-bearing packaging with direct access to lashing/lifting points*



The choice of the type of packaging depends of the requirements of the **cargo** and **transport route** as well as **means of transport** and **transit time**.

Accompanying packaging

Characteristics:

Direct lifting and securing via accessible lifting and lashing points.



Accompanying packaging



Tight connection between cargo and packaging must be ensured.

Careful:

Nylon belts tend to elongate by 4% – 7%!



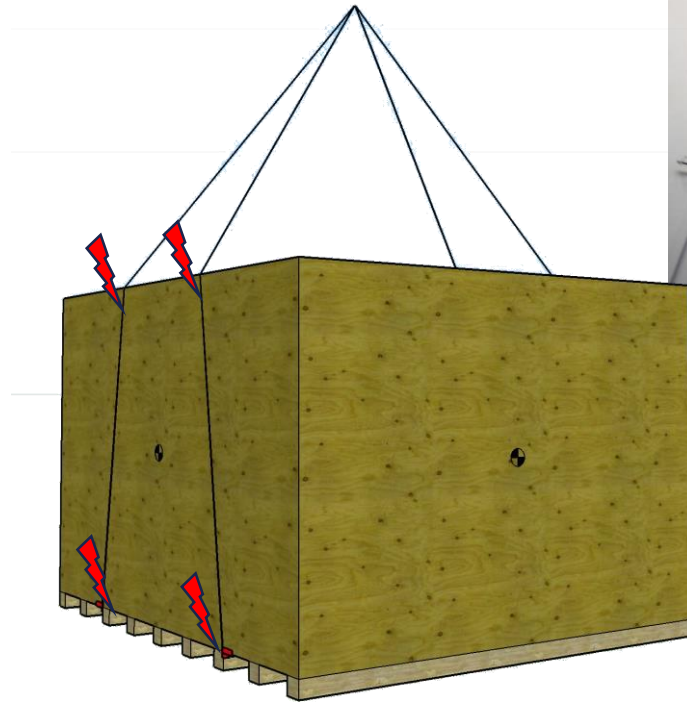
- + Mechanical strains on the packaging are reduced
- + Sources of errors with regard to insufficient lifting and securing are reduced

- Packaging film for protection against climatic strains is cut/penetrated

Load bearing packaging

Characteristics:

The packaging and not the cargo itself is lifted and secured.



Load bearing packaging

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The cargo is to be secured sufficiently within the case, e.g. by bolting or bracing against sturdy packaging components.

- + Optimal protection of cargo against climatic and mechanical strains.
- Considerable strains in the course of lifting and due to absorption of acceleration forces.
- The cargo securing within the case is usually not evident for third parties.



Load bearing packaging

Load bearing packaging with direct access to lashing points:

- + Risk of water ingress via the top is minimised
- + Advantages for securing
- Considerable strains in the course of lifting and due to absorption of acceleration forces.
- Packaging film for protection against climatic strains is cut/penetrated



Packaging material - Wood



The stability of a wooden construction largely depends on the type of wood and its quality.

- Subject to compression and shrinking
- Loses strength when wet
- + Relatively low weight
- + Good strength/weight ratio



Plywood and OSB cladding must not be included in durability calculations.



Plywood



Conifer wood



Oriented strand board

Excursion – ISPM 15

ISPM 15 stands for the **International Standards for Phytosanitary Measures No.15 (ISPM No.15)**.

They are a set of regulations which are intended to help prevent the spread of pests and diseases by means of wooden packaging in international trade.



For further details please check out the latest IUMI Eye edition or the following link to the Battermann + Tillery Website:



[IUMI-Website](#)

[Battermann + Tillery - Website](#)

Packaging materials - Steel

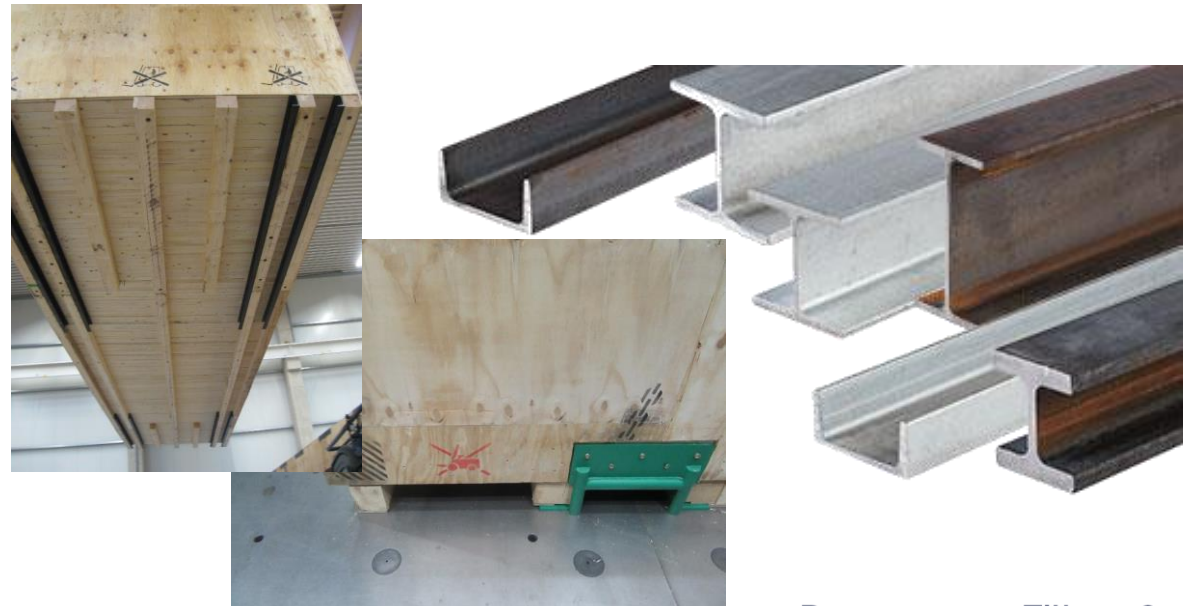


A combination of steel and wood considerably increases the stability of the packaging at reasonable costs.



The use of steel is recommended particularly for RoRo Transport, in order to render load-bearing packaging capable of being lashed.

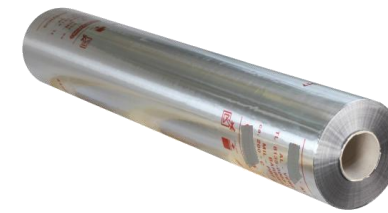
- Heavy/difficult to handle
- Less friction
- + High strength



Packaging materials - Film



A major characteristic of film is its water vapor permeability, which for example has an affect on the required number of water-absorbing bags within a packaging.



Aluminium compound foil



Shrink wrap film



VCI

Markings and handling instructions



Markings and handling instructions allow third parties to clearly identify a packing unit and to handle it safely.

Markings have to contain (DIN EN 55 402):

- Package No.
- Destination
- Dimension
- Gross weight

Most important handling instructions (DIN EN ISO 780):



Heavy project cargo can often be stored only in the open! In case sheltered storage is key, same must be mentioned in the transport documents.

Best practice:

Photograph attached to the outside of a case that shows the mounting of the cargo inside



Best practice:

Marked strong points of a packaging which allows safe installation of blockings or welded stoppers



Methods of corrosion protection

- Active corrosion protection (e.g. corrosion-resistant alloys)
- Passive corrosion protection (mechanical separation of the cargo from the corrosive medium)
- Permanent corrosion protection (varnish, galvanising, etc.)
- Temporary corrosion protection

Polling question no. 3

What are the three main temporary corrosion inhibiting methods?

Temporary corrosion protection

There are three temporary methods of corrosion protection :

1. Barrier method
2. Desiccant method
3. VCI method



The choice of corrosion protection method depends on the requirements of the **cargo**, the **destination**, the **transit time** and **storage duration** as well as on the **type of packaging**.

Barrier method

How it works: The cargo is to be protected from corrosion by creating a water-repelling layer.

- Solvent-based anticorrosives
- Water-based anticorrosives
- Anticorrosive oil without solvents
- Dip wax



Barrier method



After the protective agent is applied to the cargo, the solvent has to evaporate in order to allow the required protective layer to develop.

- + Good protection
- Difficult to remove
- Surfaces which require protection must be accessible



Desiccant method

“Bags of drying agent are to protect the cargo from humidity during transport and storage in order or prevent corrosion, mould formation, etc.”

DIN 55 473

How it works: Generating an atmosphere which prevents the formation of corrosion < 40% relative humidity

- Drying agents with different capacities for absorption
- Barrier foil



Desiccant method

Direct contact of the drying agent with the cargo is to be strictly avoided as any moist drying agent would facilitate corrosion.

The drying agent should be hung into the top area of the packaging in order to ensure sufficient air circulation around it.

In order to ensure the longest possible protection, the barrier foil is to be sealed immediately after the bags of drying agent have been placed inside.

- + Optimum corrosion protection for metallic as well as non-metallic cargo
- + Easy to remove. The cargo becomes available immediately.

- Considerable effort involved
- Even minimal damage to the barrier can nullify the effectiveness of the corrosion protection.

Excursion: Desiccant method + load bearing packaging

- If cargo is secured by means of form-fit bracing, there is the risk of the foil wearing through.
- Friction is decreased by foil



Foil can wear through

VCI – Volatile Corrosion Inhibitor Method

How it works: A tight protective layer is created as a result of the stronger attraction of VCI molecules as compared to water molecules.



VCI – Volatile Corrosion Inhibitor Method

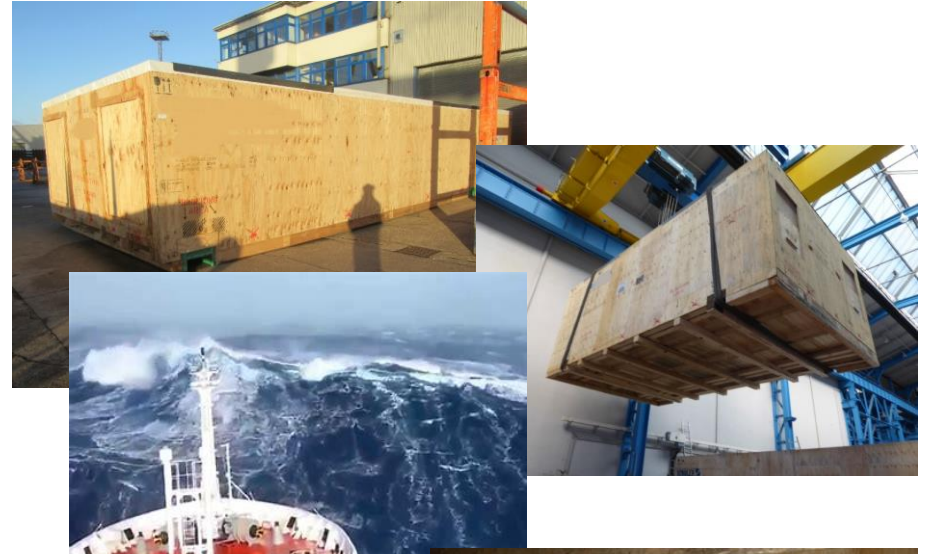
- + VCI-carrier material evaporates until the atmosphere is saturated
- + VCI-molecules can also penetrate existing films of water on metal surfaces
- + Protective layer evaporates after the packaging is opened
- + Packaging does not have to be air-tight
- No standardisation
- **Reciprocity of the carrier material and inhibitor with other substances (oils)**
- Success depends on the diligence during packaging of the cargo
- Questionable scope/range of the inhibitor evaporating from the carrier material
- Aging-related limits of usability of VCI-carrier material
- Suitability of carrier material and inhibitor

Transport strains



Mechanical strains result from:

- Storage
- Lifting and setting down
- Accelerations during transport



Weather and climatic strains result from:

- Change from day to night
- Transport through different climatic zones

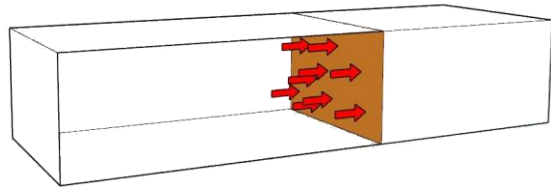


Climatic and mechanical strains can interact:

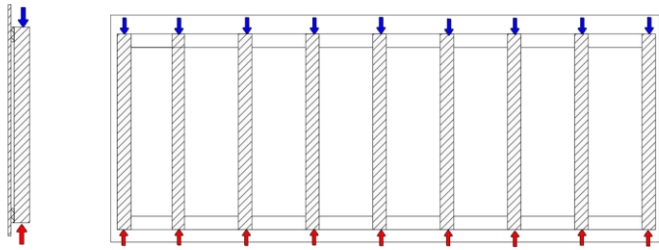
Moisture is absorbed by hygroscopic material which reduces stability.

Stresses on packaging material

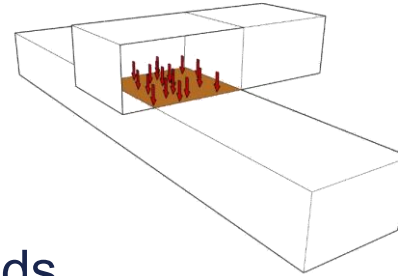
Pressure - longitudinally



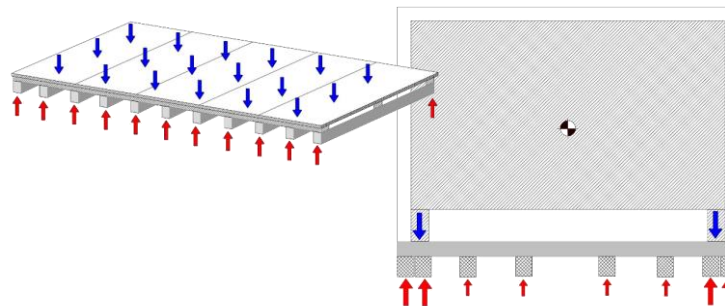
- Stanchions (sidewalls)
- Lid supports



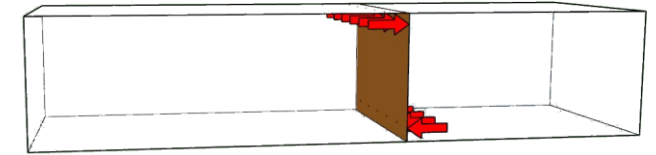
Pressure - transversally



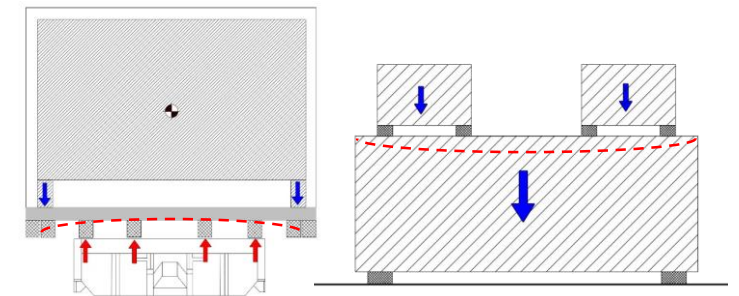
- Skids
- Lid supports



Bending



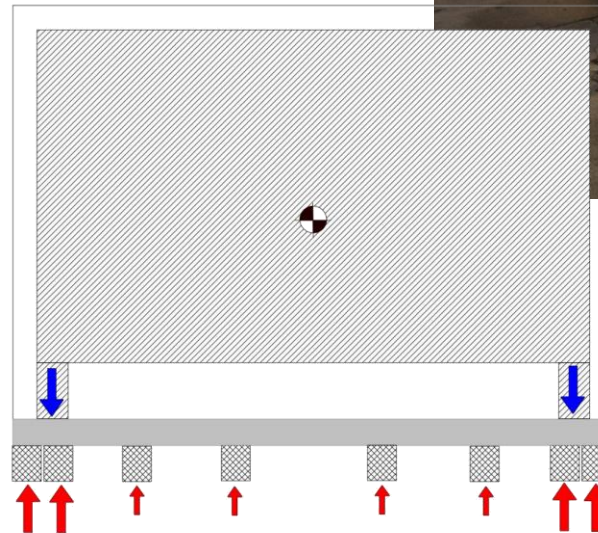
- Skids
- Lid supports
- Stanchions (sidewalls)



Mechanical strains – Example: Storage



Pressure strains emerge in the bottom area in the course of storage. In order to prevent excessive strains, cargo should be stored on an even surface with due regard to strong points at the base such as lifting areas/points



Mechanical strains - Example: Stackloads

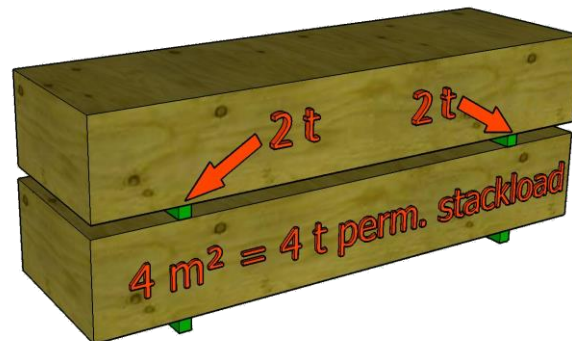
Cargo should be stacked only to the extent that the additional load can be diverted into the ground via the load-bearing elements (lid girders and supports).



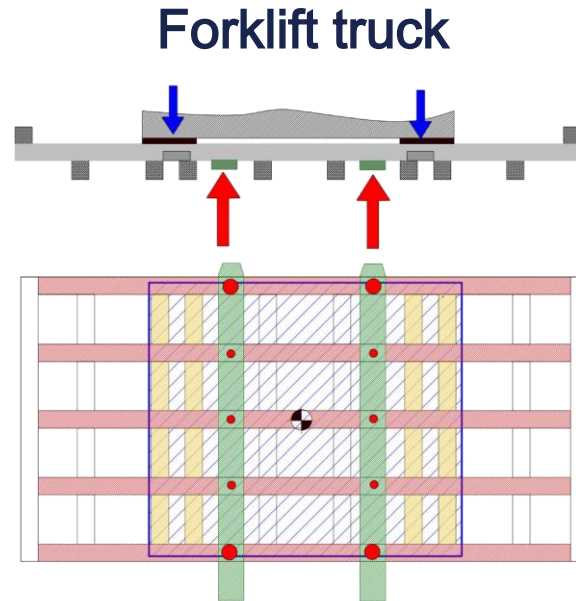
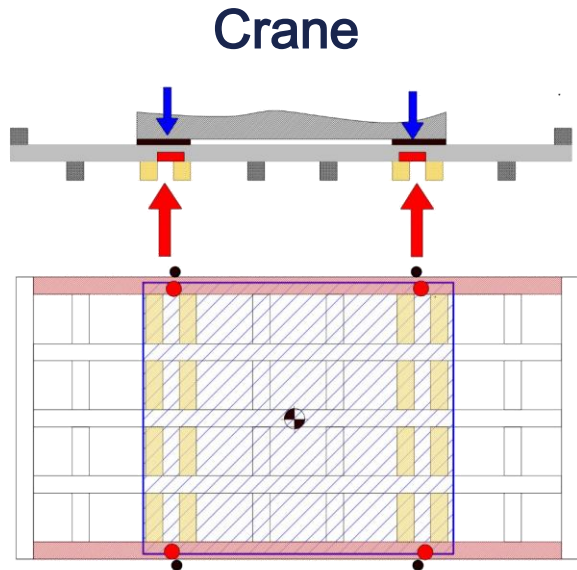
Rule of thumb: Max. permissible stackload = 10 kN/m^2 , i.e. $1,000 \text{ kg/m}^2$



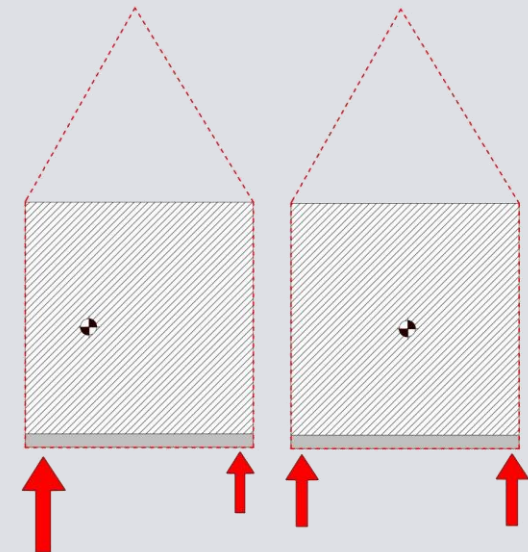
Sea transport: Virtual increase of weight due to vertical accelerations



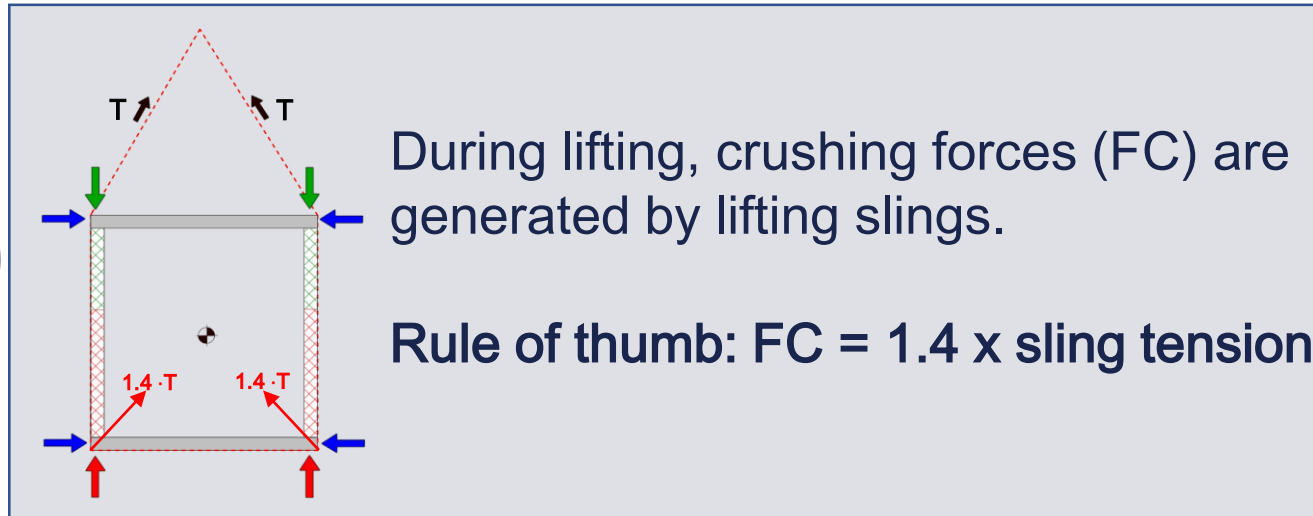
Mechanical strains – Example: Lifting and setting down



Off-centre centre of gravity
=
greater strains on one side



Mechanical strains – Example: Lifting



Edge protectors must be sufficiently large and thick (stiff) to distribute the load across a sufficient area. All cases with a weight ≥ 5 tons should be equipped with edge protectors



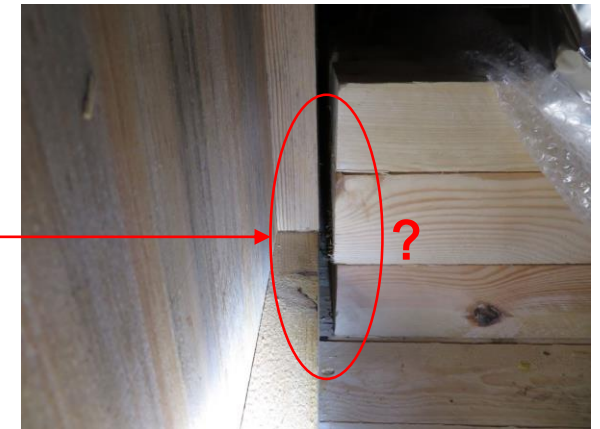
Mechanical strains – Example: form-fit stowage



Lashings must be led around the packaging in range of its strong points only, e.g. lifting areas and base



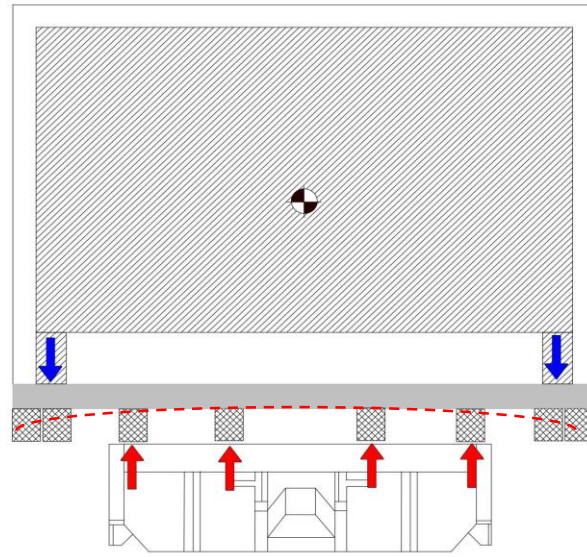
In case of form-fit stowage it must be confirmed that the forces are derived inside the case via suitable strong points.



Mechanical strains – Example: Accelerations



Considerable bending moments can develop if cargo is protruding or projecting.



Climatic strains – Example: Storage at open yard

Strains as a result of atmospheric influences such as surrounding weather and climate (temperature, moisture and radiation) on the packaging and cargo in the course of transport and handling operations can lead to substantial decrease of packaging strength.



A wood moisture content of 20 % should not be exceeded, as wood-destroying fungi can develop.

Climatic strains – Example: Airhumidity



Cargo shall be packed in dry conditions, e.g. as far as possible away from open doors in order to reduce the amount of humidity inside the packaging.

Start: South East Asia

Temp.: 35°

Rel. humidity: 90%

Amount of water in air: 35.6 g/m³



Stop: Northern Europe

Temp.: 5°

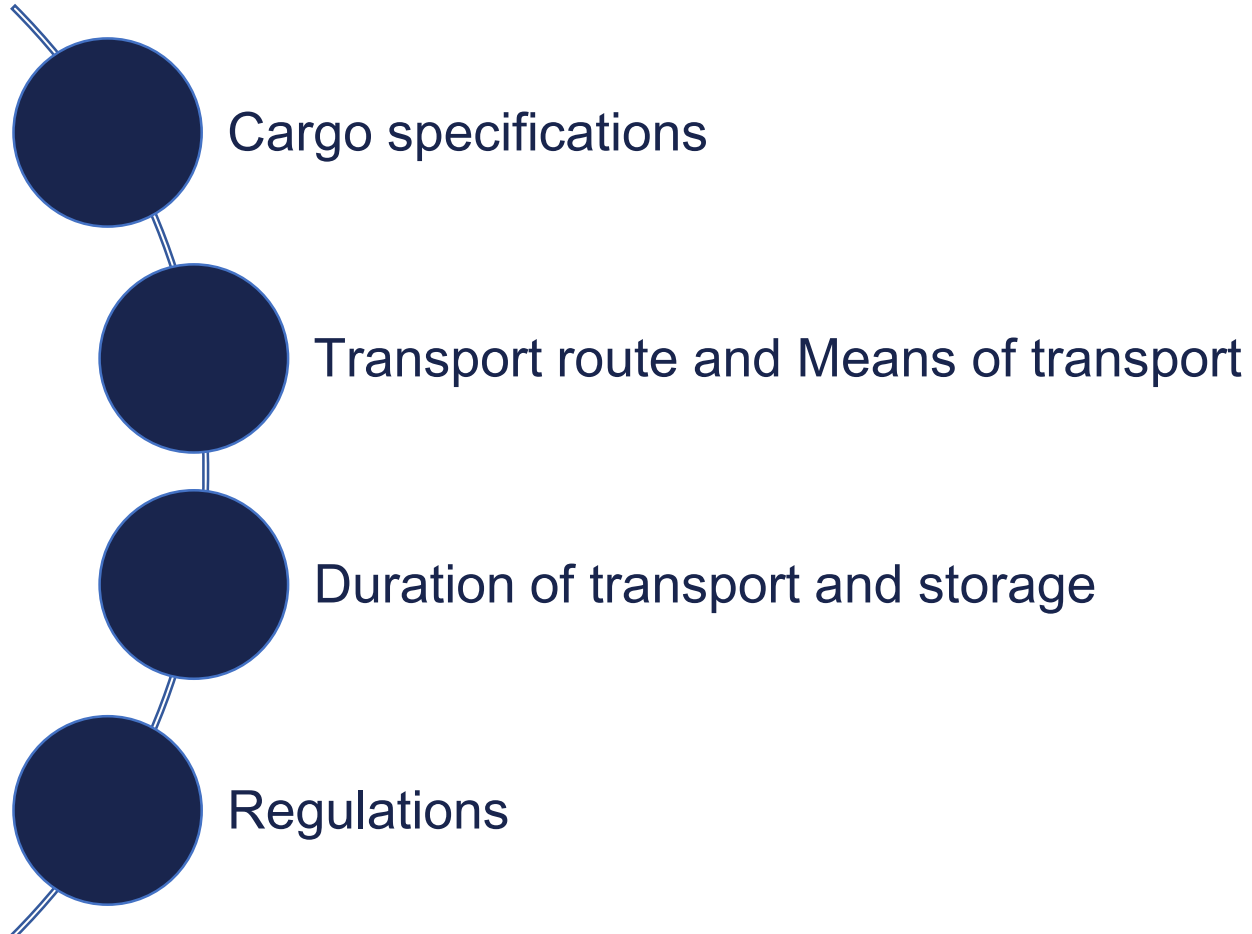
Amount of water in saturated air: 6.8 g/m³



28.8 g/m³ water is released into the packaging air and has to be absorbed by desiccant or must be prevented from direct contact with cargo

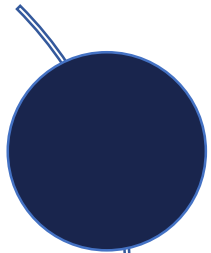
Summary

Fit for purpose packaging takes into account...

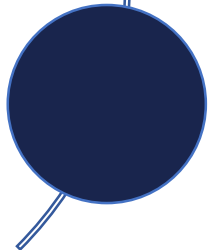


Summary

Key factors for effective packaging...



Timely review of requirements and transport details



Close cooperation between construction and packaging company



Packaging = Quality assurance for the cargo from the manufacturer to the consignee.

Thank you !

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