Cargo securing to prevent cargo damages on road, **sea**, rail and air

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Cargo Securing at Sea Transport

General

Almost all seafarers have been exposed to and are very well aware of

- the impact and force of hard weather.
- if the cargo is not properly stowed and secured the consequences can be dramatic.
- the forces on the cargo can be large due to green sea on deck.

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Cargo Securing at Sea Transport

Typical Factors for Sea Transport

Typical factors for a sea transport are:

- The side forces can be large due to rolling
- The motions on sea can decrease the impact of the gravity force
- Large acting forces can occur over a long period of time
- A lot of heavy cargo is handled by sea transports
- A lot of cargo is handled on the same vessel

Heeling vessel

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Cargo Securing at Sea Transport
Consequences of Poor Cargo Securing

Insufficient cargo securing in one container can start a “chain reaction” which ends up in direct consequences like

- Loss of cargo and CTUs
- Damages to the vessel

and in worst case

- Loss of vessel
- Loss of lives

Photos of cargo shifting on Container vessel

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Cargo Securing at Sea Transport
Consequences of Poor Cargo Securing

Beside the direct consequences like damages on cargo and ship, poor cargo securing can also lead to indirect consequences like:

- Economic consequences
- Damage to the Environment
- Bad will

Photos of cargo shifting on RoRo vessel

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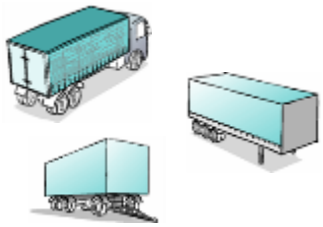
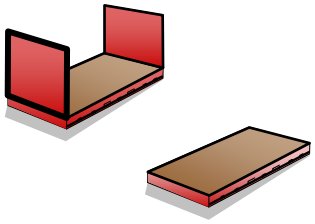
Cargo Securing at Sea Transport

Typical Cargo Transport Units and Cargoes

- Vehicles and trailers
  - General cargo
  - Pulp and paper
  - Steel products
- Freight containers
  - General cargo
  - Pulp and paper
  - Steel products
  - Machinery
- Flat racks
  - Machinery
  - Vehicles
  - Project cargoes





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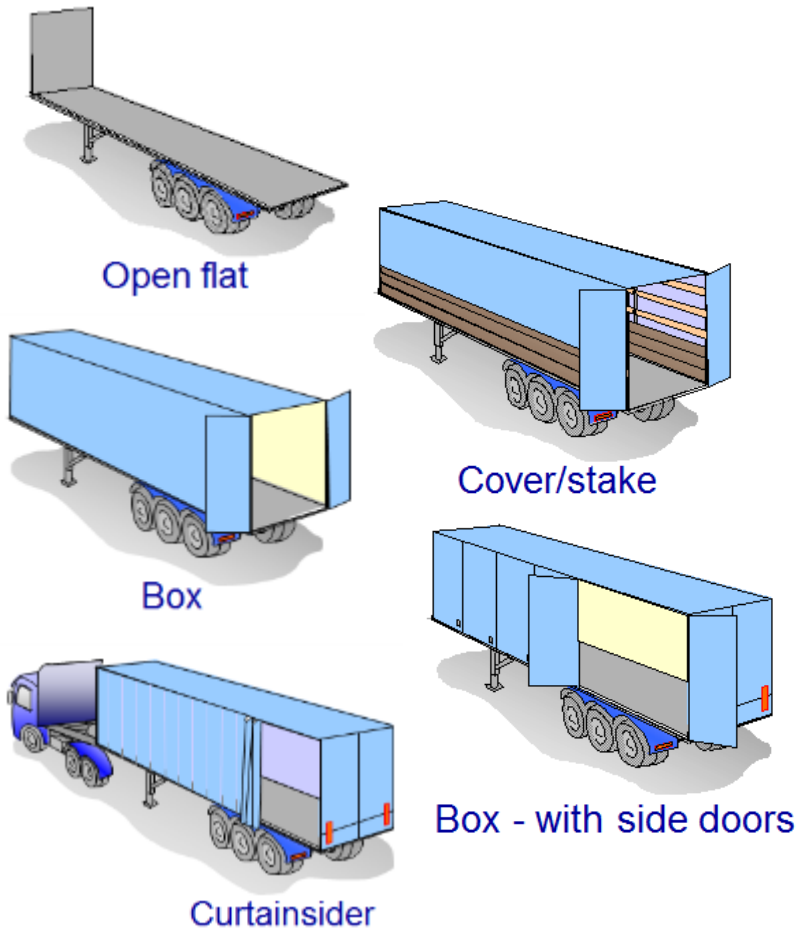
Cargo Securing at Sea Transport

Cargo Transport Units – Vehicle/Trailers

Vehicles and trailers are used for sea transports in the North and Baltic Sea, and the Mediterranean.

Different types of superstructures:

- Open flat
- Cover/stake
- Box with or without side doors
- Curtainsiders



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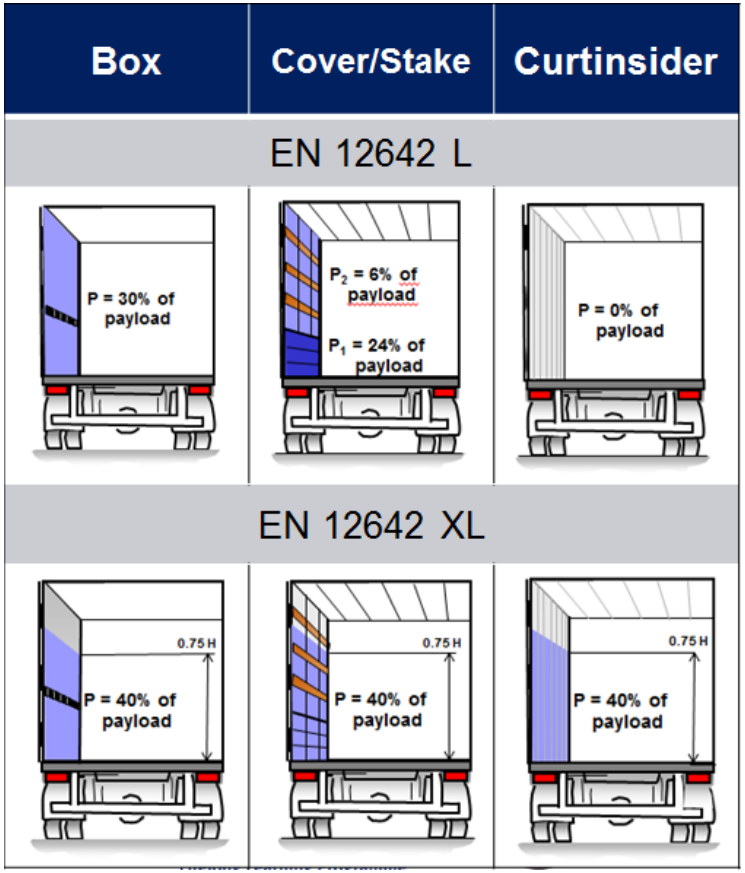
Cargo Securing at Sea Transport

Cargo Transport Units – Vehicle/Trailers

Strength Demand on Superstructure

Sideways Strength according to the European Standards

- EN 12642 L and
- EN 12642 XL



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Cargo Securing at Sea Transport

Cargo Transport Units – Freight Container

Freight containers constructed according to the ISO standard

+ Firm structure which can block cargo in all directions
+ Built for transportation in unrestricted areas
- Difficult to load with EUR-pallets

Containers

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Cargo Securing at Sea Transport

Cargo Transport Units – Freight Container

Lashing points can be a “weak link”.
According to the ISO standard:

- For general purpose containers, cargo securing devices are optional
- Anchor points: min. safe load of 1000 kg
- Lashing points: min. safe load of 500 kg

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Cargo Securing at Sea Transport

Cargo Transport Units – Flat Racks

Flat racks are usually built within the frame of ISO standard with

- No roof or side walls
- End walls normally same strength as a freight container
- Collapsible end walls
- Internal height often less than for an equivalent freight container
- Lashing points normally designed for a safe load of at least 5 ton

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Cargo Securing at Sea Transport
Liabilities

The master of a ship is responsible for the seaworthiness of his ship including the cargo securing

However, normally the master is not responsible for cargo breakage caused by insufficient securing of the cargo inside covered cargo transport units, unless bad cargo securing is suspected

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Cargo Securing at Sea Transport
Liabilities – Dangerous Goods

Regulations for transport of DG at sea are found in the IMDG-code

The consignor is responsible to

- Classify and identify the dangerous cargo
- Pack, mark and label the cargo
- Follow the segregation provisions when loading a CTU
- Provide the consignment with the following documents:
  - -Dangerous Goods Declaration
  - - Container/Vehicle Packing Certificate

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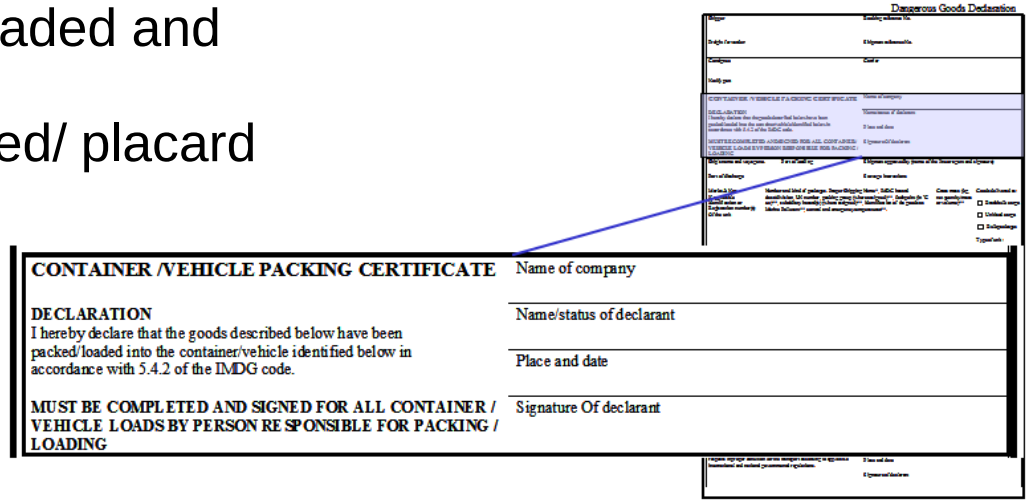
Cargo Securing at Sea Transport

Liabilities – Dangerous Goods

Container/Vehicle Packing Certificate (CPC)

Persons packing a container/ vehicle shall certify

- Drums securely stowed upright
- All goods is properly loaded and secured
- Properly marked/labelled/ placard
- Correct segregation



CONTAINER /VEHICLE PACKING CERTIFICATE

DECLARATION
I hereby declare that the goods described below have been packed/loaded into the container/vehicle identified below in accordance with 5.4.2 of the IMDG code.

MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER / VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING / LOADING

Name of company

Name/status of declarant

Place and date

Signature Of declarant

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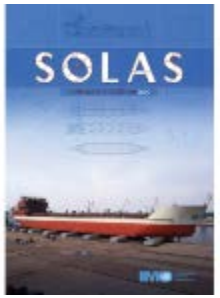
Cargo Securing at Sea Transport
Regulations and Standards

- Conventions: *SOLAS*
- Codes: *CSS-Code*
- Resolutions: *A.489, A.533, A.581*
- Circulars and guidelines: *IMO/ILO/UN ECE Guidelines for packing of cargo transport units*
- Rules and regulations of the Classification Society
- National regulations
- Cargo Securing Manual



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Cargo Securing at Sea Transport
Regulations and Standards

The most important rules and regulations for cargo securing in or on CTUs are:

- IMO/ILO/UN ECE Guidelines for packing of cargo transport units (CTUs)
- IMO Model Course 3.18 *"Safe packing of cargo transport units"*

IMO/ILO/ UN ECE Guidelines for Packing of Cargo Transport Units (CTU's)

IMO Model Course 3.18

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Cargo Securing at Sea Transport
Handling at the Port Terminal

The cargo securing on a Cargo Transport Unit (CTU) in an intermodal transport chain is only inspected at the port terminal if bad cargo securing is suspected.

Loading of containers

The stevedores are performing cargo securing on a CTU only if the CTU is stowed at the port facility.

Cargo securing performed at the port terminal on a roll trailer

The cargo securing of the CTUs on the sea vessel is done by the stevedores and/or the crew onboard the ship.

Ship personnel preparing securing of CTUs

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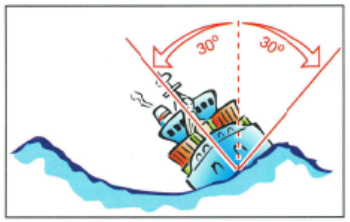
Cargo Securing at Sea Transport

Acting Forces

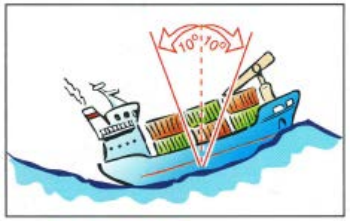
A vessel has the following six freedoms of motion:

- Roll
- Pitch
- Yaw
- Sway
- Surge
- Heave

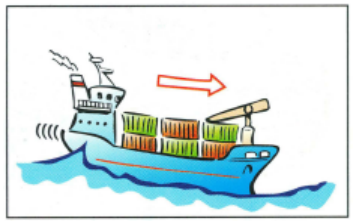


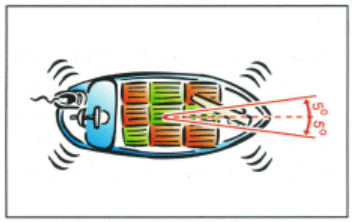
roll


sway



pitch


surge



yaw


heave

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Cargo Securing at Sea Transport

Acting Forces

Acting forces according to the IMO Guidelines for packing of CTUs

Sea Area	Forwards	Backward	Sideways
A: Baltic Sea	0.3g (a)	0.3g (a)	0.5g
B: North Sea	0.3g (b)	0.3g (b)	0.7g
C: Unrestricted	0.4g (c)	0.4g (c)	0.8g

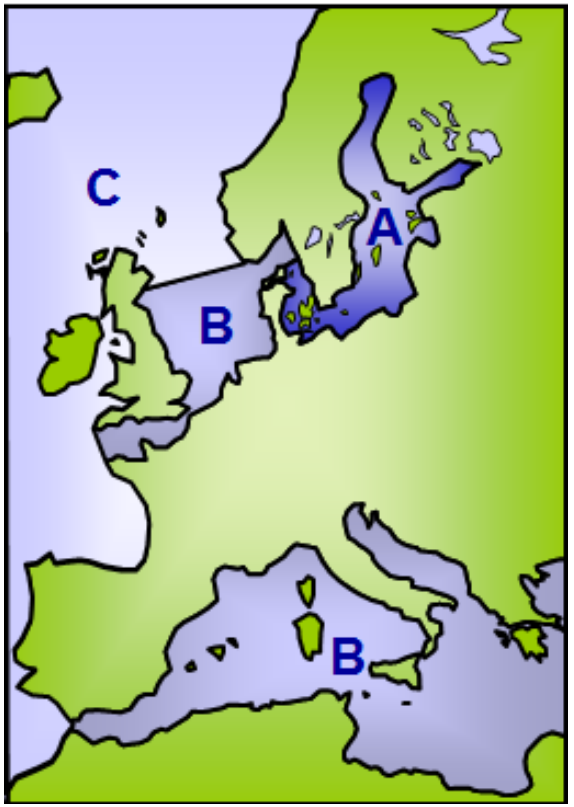
$1g = 9.81\ m/s^2$

Combined with static gravity force of 1.0g acting downwards and a dynamic variations of:

(a) ± 0.5g

(b) ± 0.7g

(c) ± 0.8g



Sea Areas

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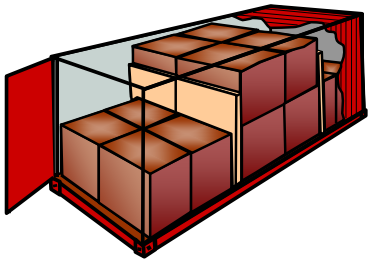
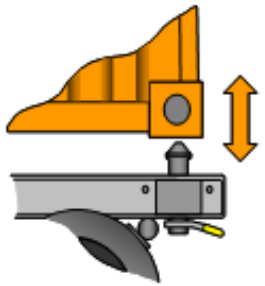
Cargo Securing at Sea Transport

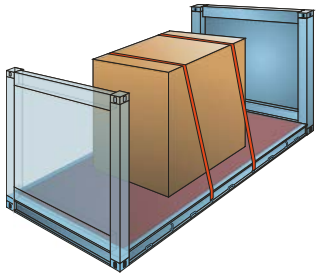
Securing in CTUs – Securing Methods

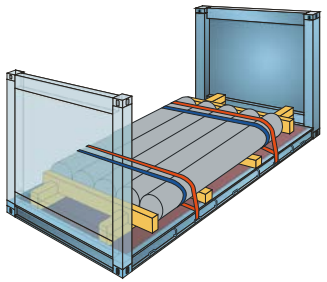
Securing methods of cargo in CTUs are

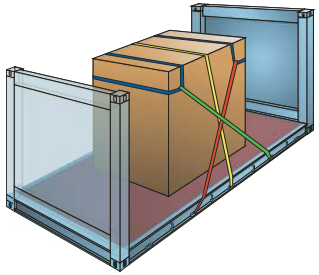
- Blocking
- Locking
- Top-over lashing
- Loop lashing
- Spring Lashing
- Straight/cross lashing

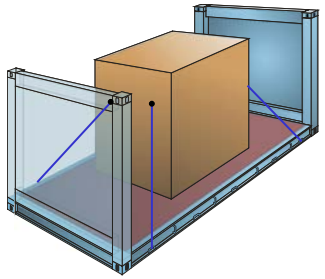












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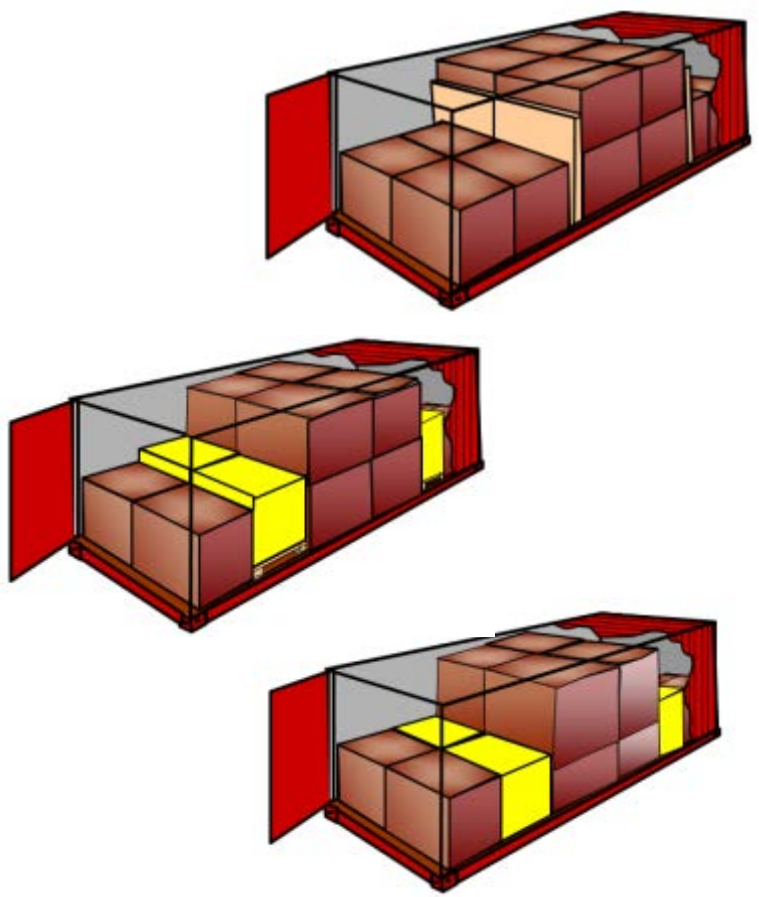
Cargo Securing at Sea Transport

Securing in Different Directions - Lengthways

If possible, block the cargo in lengthways directions against

- Firm structures of the CTU
- Boards
- Empty pallets
- Other cargo
- Threshold made of other packages
- H-bracing
- Wooden battens



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Cargo Securing at Sea Transport

Securing in Different Directions - Lengthways

Examples of securing by blocking in lengthways direction





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Cargo Securing at Sea Transport

Securing in Different Directions - Lengthways

If necessary use lashings in combination with blocking

Lashing methods:

- Top over lashing
- Spring lashing
- Straight/cross lashing

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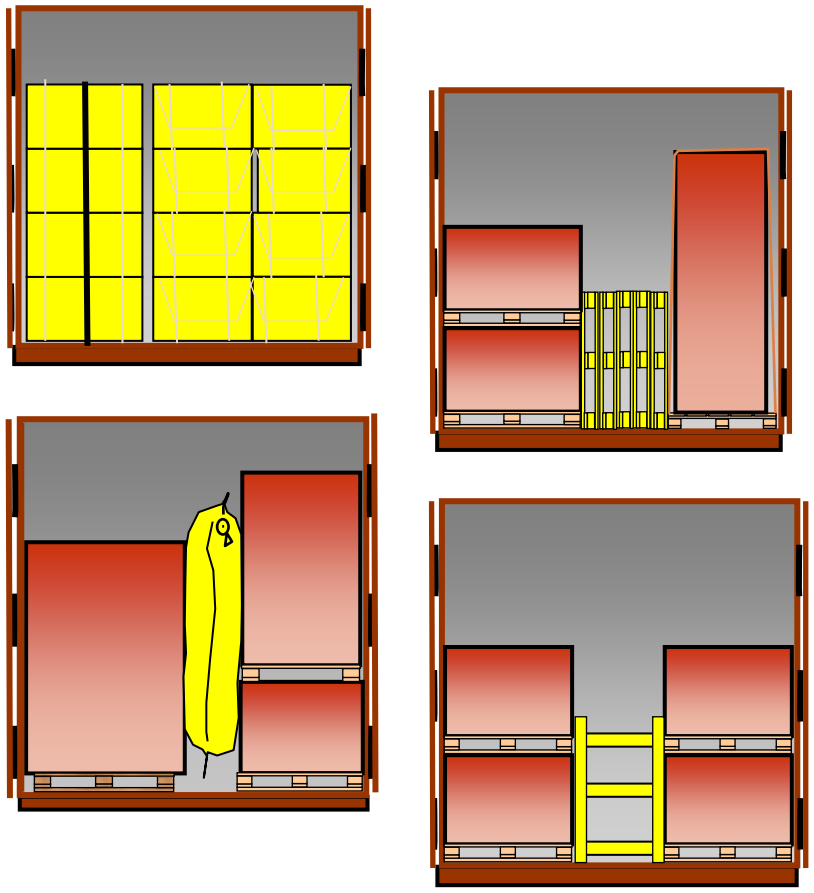
Cargo Securing at Sea Transport

Securing in Different Directions - Sideways

If possible, block the cargo in sideway directions against

- Firm structures of the CTU
- Other cargo
- Empty pallets
- Dunnage bags
- Wooden battens
- Stanchions



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Cargo Securing at Sea Transport

Securing in Different Directions - Sideways

Examples of securing by blocking in sideways direction






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Securing in Different Directions - Sideways

Use of dunnage bags in sideways direction

- Only in CTUs with firm side walls
- Follows the cargo well
- Protect the bag from sharp edges

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Securing in Different Directions - Sideways

If necessary use lashings in combination with blocking

Lashing methods:

- Top over lashing
- Loop lashing
- Straight/cross lashing

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Cargo Securing at Sea Transport

Securing in Different Directions – End Section

The end section of a load in a CTU has to be secured by

- Wooden battens or
- Boards or
- Empty pallets

Note – the result of bad securing of the last section could be fatal!

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Cargo Securing at Sea Transport

Securing in Different Directions – End Section

Note – Don't use dunnage bags directly against the container doors!

- Use wooden battens or
- Place the dunnage bags between the last and the second last section

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Load Distribution

In a container the distribution of cargo weight must be maximum 60% in one half of the container and minimum 40% in the second half.

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Cargo Securing at Sea Transport

Securing Steel Products

Steel products are often heavy and secured by blocking, if necessary by lashing.

Note:

- Loop lashing is often more efficient than top-over lashing
- Steel coils shall be transported in firm cradles
- Protect web lashing from sharp edges by edge protectors
- Use friction sheet to increase the friction

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Cargo Securing at Sea Transport
Securing Sawn Timber and Round Timber

Sawn timber

- Additional lashing required in sea Area B compared to a road transport
- Sawn timber has to be blocked in all directions when loaded in a freight container

Round timber

- Normally not transported in CTUs
- Special regulation for the securing on board the vessel

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Cargo Securing at Sea Transport

Securing Pulp and Paper

Pulp and paper secured by blocking and if necessary by lashing

Note:

- Supporting edge beams protect the paper and make the lashings more sufficient
- Protect the paper from damages by use of edge protectors
- Low friction between wooden pallets and plastic film
- Pulp not rigid in form may require additional lashing

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