Transport quality manual

Requirements for handling and transportation of general cargo

This manual is developed in cooperation between Volvo Group and MariTerm AB. The first edition of the manual was produced in July 2014 and the latest version was revised in October 2021.

Content

1. Introduction

These requirements are developed in cooperation between Volvo Group and MariTerm AB and are valid for loading and securing of Volvo cargo for transports by **road**, **rail** and at **sea** for all transporters, as well as subcontractors, involved in loading, unloading and transportation of Volvo products. The quality managers at the transport companies are responsible to make sure that all personnel involved have good knowledge regarding these requirements.

The purpose with these requirements is to achieve the following:

- Uniform systems for loading
- Uniform and secure systems for cargo securing
- Avoiding transport damages

Random inspections or planned audits will be made continuously within areas where loading/unloading takes place. This is regarding cargo securing in general but also securing of dangerous goods. The purpose is to make sure that all the transporters are following these requirements. Remarks will be reported to the actual transport company and to the purchaser of the transport.

These requirements are based on the international IMO/ILO/UN ECE Code of Practice for Packing of Cargo Transport Units (CTU Code) and are Volvo's minimum demands to be fulfilled by the personnel and transporters handling Volvo cargo.

Please note that these requirements do not in any way supersede regulations stipulated by various authorities. Where required by local legislation, national or regional regulations or standards shall also be complied with, in addition to these requirements. Some of the standards and regulations that may be applicable, as available on the date of publication of this document, are listed in Appendix 1 for information purposes.

In case of rail or air transports, each railway and air line operator has their own requirements, which must be complied with.

2. General requirements for cargo securing

Volvo cargo shall always be secured in accordance with applicable regulations as well as the requirements in this manual. Below the general requirements are stated for the different Cargo Transport Units (CTUs), trailer as well as container, and mode of transport, in particular road and sea transport.

Common requirements for cargo securing in general is that the cargo is to be prevented from sliding and tipping forward, backward and sideways and that the sum of void spaces in any horizontal direction shall not exceed 15 cm[1].

[1] IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code), Annex 7, Section 2.3.6

2.1 General requirements for cargo securing in trailers for road transport

During road transport the greatest forces arise during braking and thus more cargo securing is needed in forward direction than sideways and backwards. It is recommended to block the cargo in forward direction, i.e. by tight stowage against the headboard, stanchions, other cargo, etc.

If the sides of the trailer are strong and built according to the European standard EN 12642 XL it is possible to block the cargo against the sides. If the total void space sideways is less than 15 cm and the trailer has strong sides the cargo can be transported without lashings.

When loading a trailer it is important to ensure that a correct load distribution and axle load is obtained. It is also important to load the cargo so that it can be safely and simply unloaded upon arrival. The cargo must be secured so that there is no risk of it falling out when the doors are opened.

2.2 General requirements for cargo securing in containers for sea transport

The main principle for cargo securing in containers is to block the cargo against the frame-work of the container and to fill any void space with dunnage bags, empty pallets, battens, H-braces or other filling material. Due to the limited strength of the securing points in a container, see Appendix 9, lashing in containers is not recommended or should at least be avoided for securing of heavy cargo.

In containers, the centre of gravity of the load can not be displaced more than 5% of the container length from the container's half length. As a rule of thumb, this may be achieved by not loading more than 60 % of the cargo weight in one half and not less than 40 % in the other.

Weight distribution in a container

It is important to be properly prepared and to plan the loading in containers to get an optimal loading pattern, weight distribution and cargo securing. The doors may be used for blocking in most cases but the cargo must be prevented from falling out when the doors are opened. Note that dunnage bags must never be placed directly against the doors of the cargo transport unit because the doors then risk to be pushed up with a violent force. Also

note that, according to North America regulations, it is not permitted to use the doors for cargo securing during rail transport. Dunnage bags that are to fill void space longitudinally are therefore preferably placed inside the last section of the cargo transport unit.

3. Basic principles for cargo securing

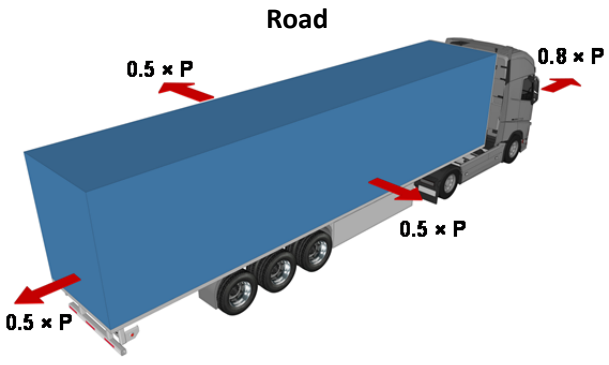
The cargo shall always be secured during transport to prevent sliding and tipping in all directions and in order to avoid accidents, injuries, cargo damages and delays. When dimensioning cargo securing arrangements, the following aspects shall be given due consideration:

- The mode of transport and the expected accelerations throughout the journey
- The weight of the cargo
- The friction between the cargo and the platform as well as between layers
- The cargo's dimensions and centre of gravity
- The rigidity of the cargo and the integrity of the packing material
- The strength of the cargo securing equipment
- The strength of the walls of the cargo transport unit

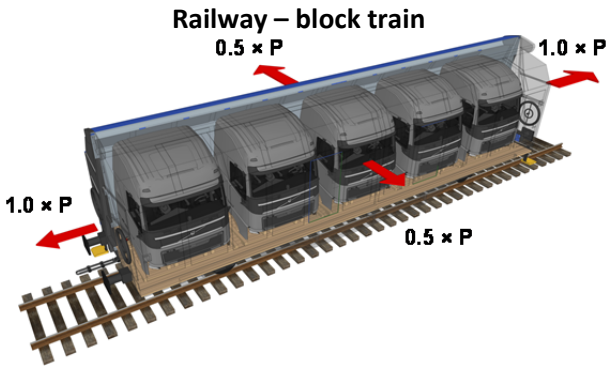
During transport, the cargo and the CTU are exposed to forces, which, depending on the transport, differ in magnitude in different directions. In case of a combined transport, the most critical combinations of horizontal and vertical acceleration in each direction for any leg of the journey must be observed.

3.1 Forces acting on the cargo during transport

Cargo securing arrangements shall be designed to at least withstand the accelerations given in the figures below[2], see Appendix 2 for further information. The accelerations in the figures are expressed in parts of the weight of the cargo, P.



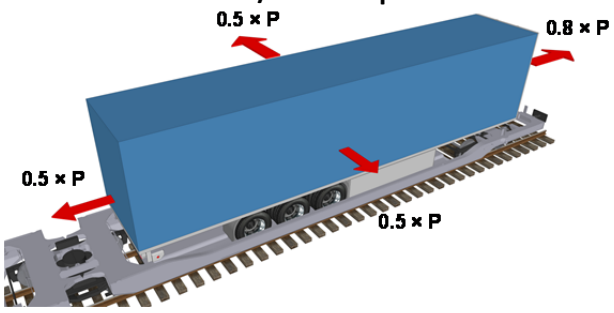
Forces in addition to the gravity force acting on cargo during road transport



Forces affecting the cargo during rail transport in wagons in block trains not gravity shunted

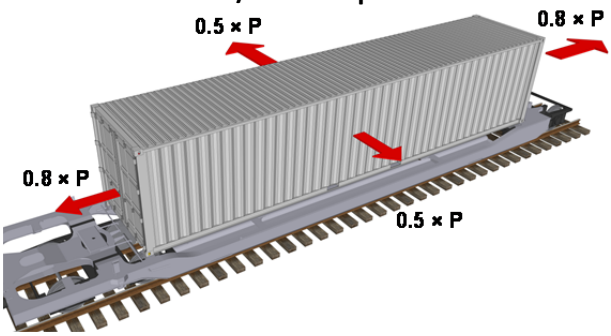
[2] IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code), chapter 5.3

Combined road/rail transport - trailer



Dimensioning accelerations for the transport of semi-trailers in combined transport

Combined road/rail transport - container

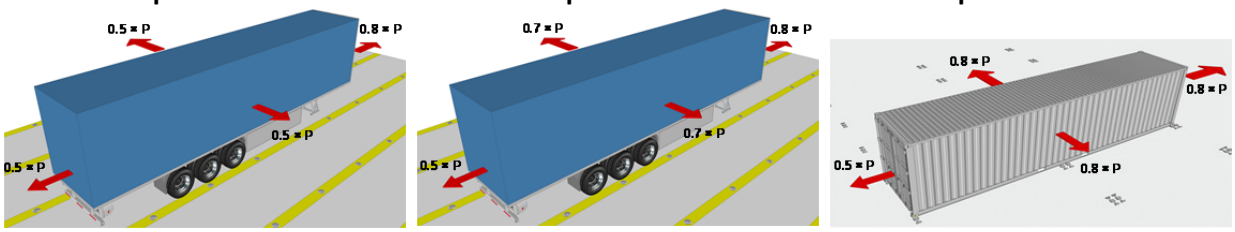


Dimensioning accelerations for the transport of containers and swap bodies in combined transport

Combined road/sea area A transport - trailer

Combined road/sea area B transport - trailer

Combined road/sea area C transport - container



Dimensioning accelerations for the transport of semi-trailers and swap bodies in combined road/sea area A and B transport and containers in combined road/sea area C transport

3.2 Friction

Good friction helps preventing the cargo from sliding and reduces the demand for other cargo securing measures. Thus, in order to achieve as high friction as possible, the following measures should, when practicable, be taken:

- Keep the platform dry and clean
- Avoid snow and ice on platform and cargo
- Avoid steel to steel contact surfaces
- Use, where feasible, friction enhancing material such as friction boards or rubber mats

Friction factors for different material combinations may be taken from the table in Appendix 3.

3.3 Cargo dimensions and centre of gravity

In order to avoid tipping, the dimensions of the cargo as well as its centre of gravity must be considered when deciding on the cargo securing method. High and narrow stows of cargo is more sensitive to tipping than low and wide ones.

Also, cargoes of irregular shape must be specially considered, since those may have a narrow base or a centre of gravity which is displaced towards the top or either side and therefore have an increased risk of tipping.

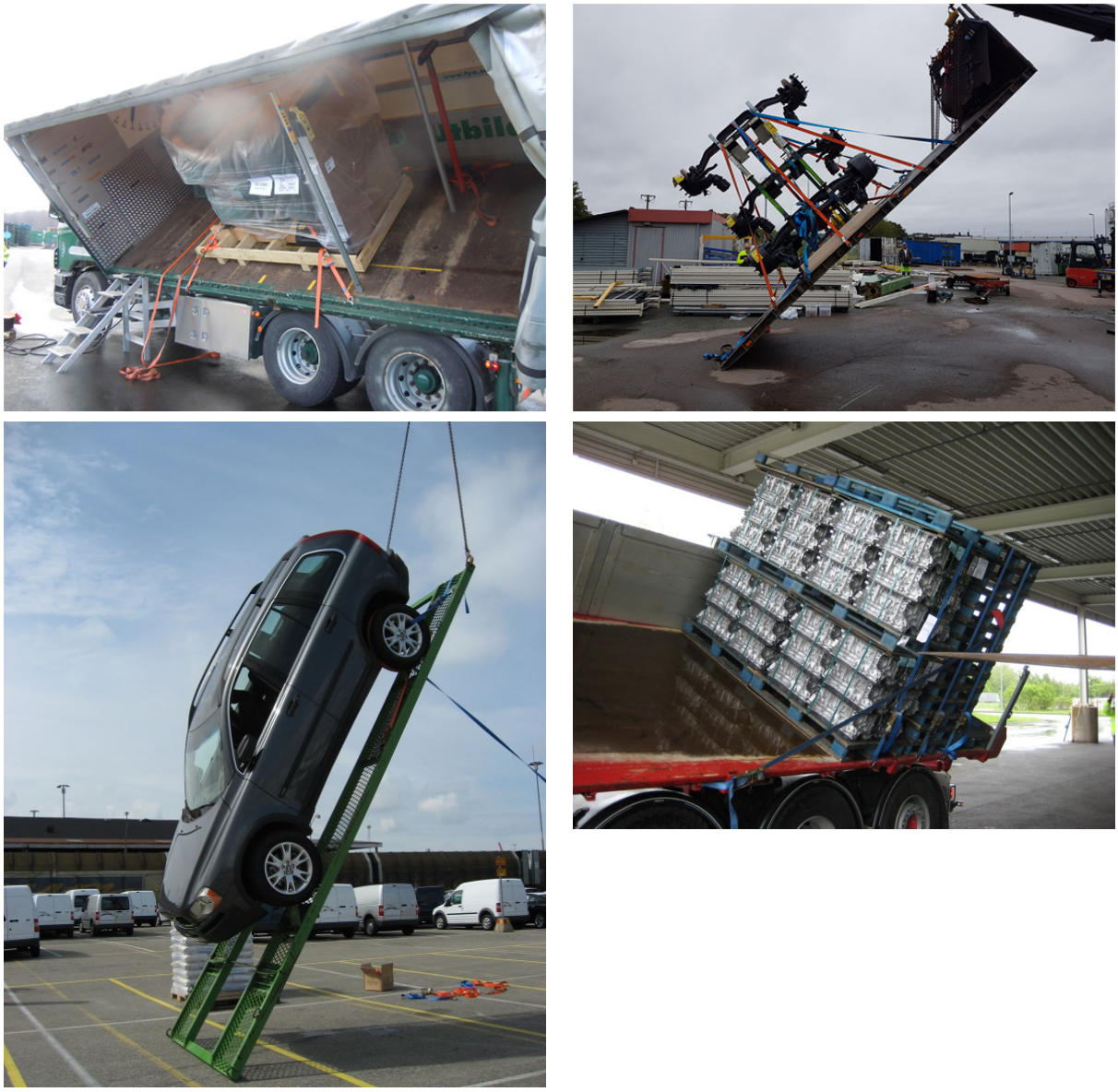
3.4 Transport stability of packages

The transport stability of packages is a vital part of transport safety and it dictates how the cargo must be secured on different types of CTUs.

A package means the complete product of the packing operation, consisting of the packaging and its contents prepared and appropriate for the actual transport. The stability and ability to withstand the forces the package is exposed to can be tested.

3.5 Practical tests

The transport stability of packages, the friction between surfaces and the efficiency of cargo securing arrangement can be tested with practical tests. The most common and simple method is to perform inclination tests, see photo examples of tests performed for Volvo.



Example of practical tests carried out for Volvo

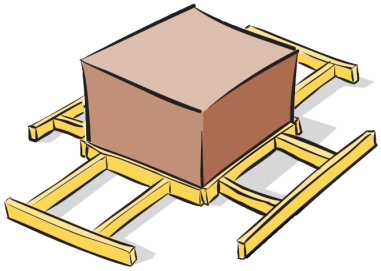
4. Principles for cargo securing in containers

As mentioned in chapter 2 the principles for cargo securing in containers differs from the principles in trailers. The main principle in containers is to use blocking against the frame-work of the container; the inner wall, side walls and doors and to use filling material for void spaces. If possible, lashing should be avoided.

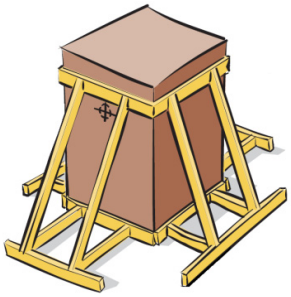
As a container normally is transported on road as well as on sea, and sometimes even on rail, the securing arrangement must be designed for accelerations, and corresponding forces that might arise during the actual combination of transports that is 0.8 × the weight of the cargo, both sideways and in longitudinal direction.

To prevent sliding the cargo may be bottom blocked by H-frames according to the principle in the figure below to the left. For strength in H-frames and required dimensions of the timber, see Appendix 7.

To prevent tipping in longitudinal and transverse direction, diagonal timber supports could be applied according to the principle in the figure below to the right. To save space, these supports could alternatively be horizontal and be placed between cargo and the corner posts of the container.



Bottom blocking by H-frames

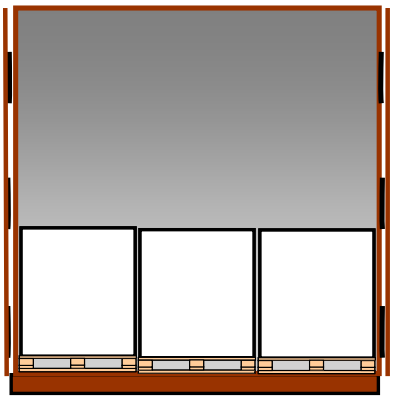


Diagonal timber supports to prevent tipping

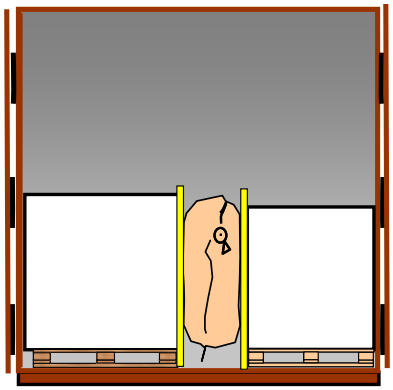
As an alternative to diagonal timber supports to prevent tipping sideways the void space between the container sides and the cargo can be filled. Note that vertical timbers must be placed from floor to roof against the container sides to avoid spot loads on the sides.

Accordingly, the best way of securing cargo in containers is to block it against the long sides and gables. Also the doors may be used for blocking (except for rail transport in North America) but note that the cargo must be prevented from falling out when the doors are opened.

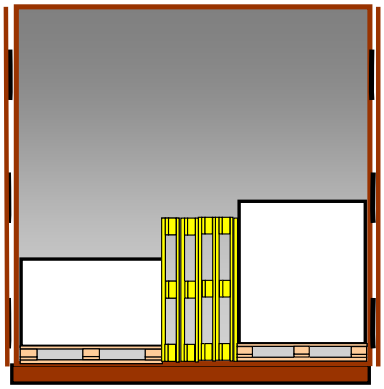
Blocking sideways: Void spaces are to be filled with dunnage bags, empty pallets or timber, or by a combination of these measures. Note that the filling material should be placed in the middle of the container so that the forces on the material are from the cargo on one side only. Below some principles are shown.



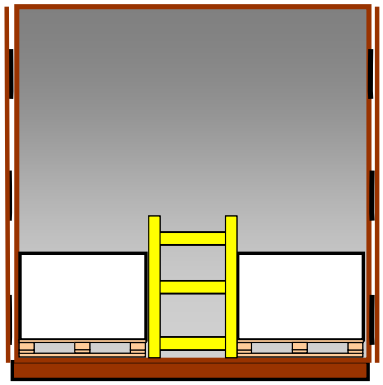
Totally blocked cargo



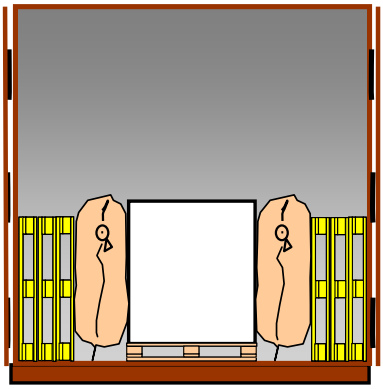
Blocking with dunnage bags (and boards, if required)



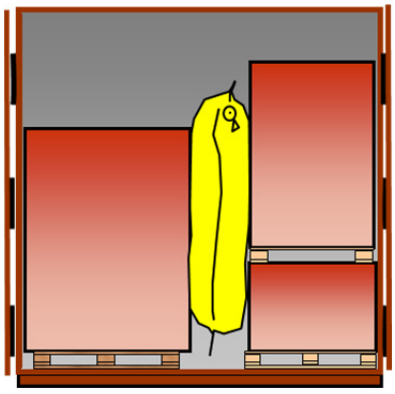
Blocking with empty pallets



Blocking with timber (H-frames)



Blocking with dunnage bags and empty pallets



Blocking with dunnage bags

Blocking with dunnage bags

Blocking with timber


Blocking of machinery parts with timber

When using dunnage bags it is important to protect the bags from sharp edges and corners with for example boards or empty pallets. Note that the maximum void space to fill with a dunnage bag is about 40 cm.

Blocking in longitudinal direction: If possible due to weight distribution, the cargo is to be stowed tightly to the inner wall of the container. The cargo items are then to be stowed tightly without any void space in longitudinal direction. Any void space in longitudinal direction is to be filled with dunnage bags, empty pallets or timber, or by a combination of these measures.

Blocking with timber

Blocking with empty pallets

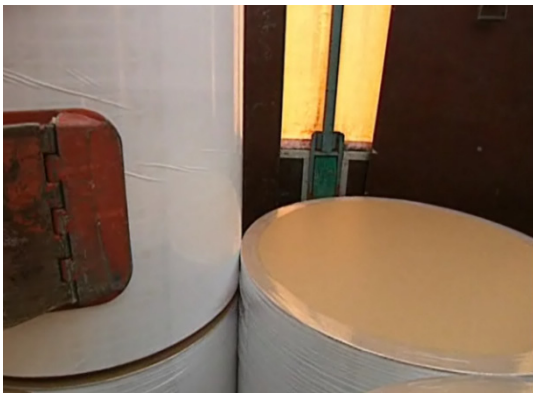
Blocking with a dunnage bag in the second last section

Blocking with dunnage bags and timber

Dunnage bags must never be placed directly against the doors of the cargo transport unit because the doors then risk to be pushed up with a violent force. Dunnage bags that are to fill void space longitudinally are therefore preferably placed inside the last section of the cargo transport unit. See further instructions for dunnage bags in section 6.4.

Broken layers of cargo can be blocked against sliding forward and backward in the cargo transport unit by so-called threshold blocking. A threshold blocking can be achieved either by an elevation of other cargo or by means of empty pallets, battens, boards, etc.

Threshold created by using empty pallets under cargo units with the same height



Threshold created by using cargo units with different heights

Upper layer blocked with boards and battens

5. Cargo securing methods

Cargo is to be secured by blocking, lashing or mechanical locking or by a combination of these methods, in such a way that it is sufficiently prevented from sliding and tipping in all directions.

5.1 Blocking

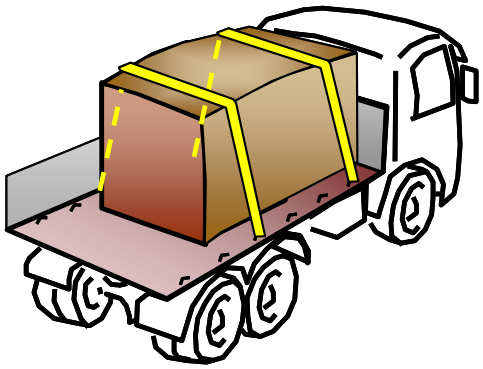
Blocking is the primary method for securing cargoes and it is achieved by placing cargo in tight stows between strong walls of the cargo transport unit, stanchions or other blocking devices. If the cargo is blocked at the bottom only, it is prevented from sliding but not tipping. As a rule of thumb, bottom blocking devices should cover a height of at least 5 cm of the cargo. If the blocking device reaches up to the cargo's centre of gravity, the cargo is also secured against tipping.

Void spaces should be filled and may be favourably stuffed by dunnage bags, empty pallets inserted vertically or battens as necessary. Small gaps between unit loads and similar cargo items, which cannot be avoided and which are necessary for the smooth loading and unloading of the cargo, are acceptable and need not to be filled. The sum of void spaces in any horizontal direction shall not exceed 15 cm. However, between fragile cargoes or dense and rigid cargo items, such as steel, concrete or stone, void spaces should, as far as possible, be further minimized.

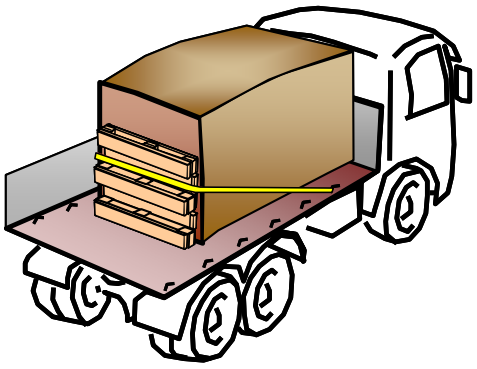
In case cargo is intended to be blocked against walls of road vehicles, these shall have a documented strength. This is extra important to observe for curtainsided vehicles.

5.2 Lashing

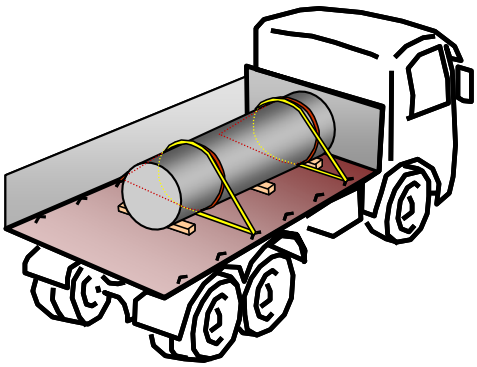
Cargo may be secured by several different lashing methods, as shown in the examples in the figures below.



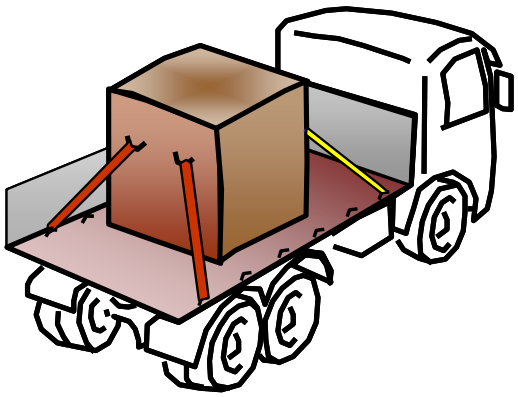
Top-over lashing



Spring lashing



Half-loop lashing



Straight lashing

It must be noted that top-over lashing is a frictional lashing method which is designed to increase the pressure between the cargo and the platform, whereas the other methods are direct lashings. Top-over lashings utilize the pre-tension in the equipment achieved by the tensioning device. The other methods on the other hand, make full use of the safe working load in the lashings, since they are further tightened if the cargo begins to move.

5.3 Locking

Cargo securing by mechanical locking requires that both the cargo and the CTU have locking devices that are strong enough and suitable for each other. The locking devices must be able to withstand the forces on the cargo that results from the accelerations given in chapter 3.1. Consideration shall be given to the fact that due to the tolerances between the fittings and the locking device, not all devices are engaged simultaneously. For example, if four locking devices are used only two may be considered to take up any forces simultaneously in any direction.

6. Cargo securing equipment

When securing Volvo cargo, only cargo securing equipment of known strength, quality and correct marking shall be used. All equipment shall be in good, fully working condition and inspected prior to use.

Care shall be taken not to combine, in an inappropriate way, lashing equipment with different strength and elongation characteristics on the same cargo unit. Furthermore, the equipment may not be applied in such a way that it damages the cargo.

The strength of cargo securing equipment may be expressed in various ways, depending on the manufacturer and the country of origin, as shown in the table below.

Strength	Explanation	Common denominations
Breaking strength	The load at which new, unused equipment of that kind may break at testing	**BL** - Breaking Load **MBL** - Minimum Break Load **BS** - Breaking Strength
Safe working load	The load to which the equipment may safely be subjected to when applied	**LC** - Lashing Capacity **MSL** - Maximum Securing Load **SWL** - Safe Working Load **WLL** - Working Load Limit
Pre-tension	The tension achieved in a lashing when applying normal hand force to the tensioning device or by applying a powered tensioning device according to suppliers instruction	**STF** - Standard Tension Force

6.1 Web lashings

Web lashings are produced in a great variety of material, dimensions and strengths. Both single use and re-usable equipment is available. Lashings intended for single use are delive-red with a detachable tensioning device and loose hooks and locking devices. They are most commonly used in containers and on flat racks.

Lashings intended for re-use are delivered as a complete set and this equipment is the most common on trucks and trailers. When securing Volvo cargo with re-usable equipment, all lashings shall be in good condition and show limited wear only, without any significant tears, clear cut marks or severe discoloration. Knots may not be used to fasten or repair re-usable lashings.

Lashing shall be applied and, where possible, checked during the voyage in such a way that it is ensured that they remain well tightened throughout the transport. Web lashings must be protected from sharp corners.

An example of a marking of a web lashing is shown and described in Appendix 5.

6.2 Chain lashings

Chain lashings are typically used for securing vehicles and heavy machinery. The lashing fittings to which the chain is fastened must have at least the same strength as the chain itself.

Just as web lashings, chain lashings come in a variety of dimensions and sizes. Their strength is decided by the link diameter and the steel grade. Chain lashings may be tightened either with a turn buckle or a lever arm.

An example of a marking of a chain lashing is shown and described in Appendix 5.

Chain with turn buckle

Chain with lever arm tensioner

Short linked chains are heavier per meter but are useful if the lashing have to pass over a sharp corner since the short links bend less easily than those on a long linked chain.

Broken links due to bending over at sharp corners

Before use, chain lashings used to secure Volvo cargo shall be inspected for any visible damages that may weaken the lashing, such as bent links, deformed hooks or significant link wear. Any deficiencies found should result in the lashing being rejected.

Lashing shall be applied and, where possible, checked during the voyage in such a way that it is ensured that they remain well tightened throughout the transport.

6.3 Corner protectors

Corner protections are typically made of rigid plastic, plastic-coated cardboard, wood or light metal and they shall be used to perform any of the following functions:

- To protect the lashings from sharp corners
- To protect fragile cargo from being damaged by the lashings
- To spread out the effect of the lashings over several cargo sections

In case corner protectors are used to protect the cargo they should rest against a sufficiently large area on the cargo. The weaker the cargo, the bigger area is needed. An empty pallet turned upside down may be used to the same effect.

When corner protectors are used to spread the effect of the lashing over several cargoes, they must be made of strong plastic profiles or wooden boards (25 × 100 mm) nailed together.

Different types of corner protections

Corner profiles used to spread the effect of the lashings

6.4 Dunnage bags

Dunnage bags may be used to fill void spaces between cargo units and ensure a tight stow to block the cargo in cargo transport units with strong walls. The size and strength of the dunnage bag should be chosen in consultation with the supplier.

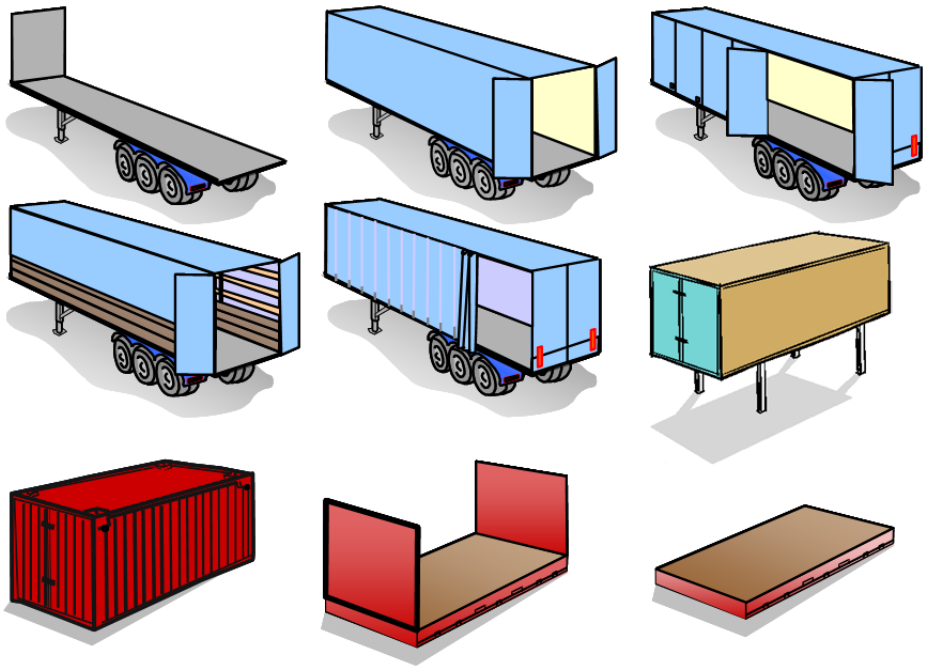
The supplier's instructions shall also be observed to ensure correct filling pressure. If the pressure is too low the bag might fall down and if it is too high the bag may burst or it may damage the cargo or cargo transport unit. See further instructions for filling pressure in Appendix 8.

When dunnage bags are used to block cargo in several layers they should primarily be placed in the upper part of the section. Dunnage bags should not be on the floor and preferably not against the roof in the cargo transport unit.

Dunnage bags are sensitive to sharp edges and must be protected from these by means of thick cardboard or wooden boards.

7. Cargo transport units

Below some different types of vehicles and CTUs are shown that could be used when transporting Volvo cargo.



Different types of vehicles and CTUs

The transport operator shall provide a CTU that:

- Is in good condition
- Is suitable for the intended voyage
- Is suitable for the cargo and weather proof when so required
- Provides suitable access to the cargo for loading and unloading
- Has a floor which is strong enough to support the cargo and any equipment needed to load or unload the cargo
- Provides suitable means of securing the cargo
- Have sufficiently strong walls with a documented strength if it is intended to use these to block the cargo any direction.

7.1 Inspection of CTUs

The CTU shall be checked before the loading of the cargo is started. The check is performed according to the checklists in Appendix 10 and 11 and errors or deficiencies are noted. When anything is unclear the person responsible at the shipping department shall be consulted for decision on whether the CTU can be accepted, has to be rectified or refused. If the CTU is refused the transport company has to be informed accordingly.

In general, the CTU shall be in good condition and the cargo space shall be clean and free from fixed or loose protruding details that can damage the cargo.

Closed CTUs must be sufficiently weatherproof to minimize the risk of damaging the cargo. If the contents in a CTU have been fumigated by pesticides to kill any vermin, the container must be labelled so that the person who opens the unit and shall unload the cargo not is harmed by remaining gases, even if the cargo in the container is not in itself dangerous goods.

7.2 Requirements on swap bodies, trailers and other vehicles

- The CTU shall have an undamaged platform, landing legs and headboard
- The CTU shall be weatherproof and it shall be possible to close and seal it, which means that doors, drop sides, tarpaulins, laths and tarpaulin sealings shall be undamaged
- Any structure used for blocking of the cargo shall have sufficient strength[3]
- The cargo area including the platform shall be undamaged
- The cargo area shall be clean, dry and free from odour
- The load carrier shall be equipped with sufficient amount of cargo securing equipment
- Securing points intended for securing of the cargo shall be sufficiently strong for the intended lashing equipment
- In case of sea transport, trailers shall be equipped with required amount of 12 tons external securing fittings for the securing of the unit in ferry traffic

  Minimum amount of ferry eyes per trailer side:
  total weight up to 20 ton - 2 pcs
  total weight between 20 and 30 ton - 3 pcs
  total weight between 30 and 40 ton - 4 pcs

- Corner castings and other bottom fittings on swap bodies shall be undamaged
- Invalid labels shall be removed or masked
- CTU, which shall be transported by rail, shall be marked with the required code sign
- CTU, which shall be transported by rail, shall fulfil the requirements from the rail administrations and/or rail operator regarding the strength of the stake body structure

7.3 Requirements on containers

- The container shall fulfil standard ISO 1496-1 for containers
- The frame work of the container shall be undamaged
- The container shall be weather tight and it shall be possible to seal it when closed, which means that walls, floor, roof, doors, door sealing as well as possible tarpaulin cover with sealing shall be undamaged
- The cargo area including the floor shall be undamaged
- The cargo area shall be clean, dry and free from odour

[3] For European transport, the strength of headboard, drop sides and rear wall should fulfil the European standards EN 283, EN 12642 L or EN 12642 XL.

- Ventilation openings shall be undamaged
- Corner castings shall be undamaged
- The container shall be marked with safety plate in accordance with the Container Safe Convention (CSC)
- Invalid labels shall be removed or masked

7.4 Requirements on L and XL units

The European standard EN 12642 provides test criteria for verifying that the strength of the body structure on road vehicles meets minimum requirements to enable them to be used for securing cargo by blocking during road transport. However, the standard differentiates between Code L, standard vehicle bodies, and Code XL, reinforced vehicle bodies.

The test criteria for XL-vehicles allows for most types of palletized cargo to be blocked against the body structure in all directions. However, the following should be noted for vehicles tested according to Code L:

- The headboard and rear doors have a limited strength that may not correspond to the force required to block the full payload of the vehicle. It may thus be necessary to secure the cargo also by lashings in the forward and rearward direction.
- For box type structures, the test load shall be applied evenly over the full height of the wall. However, on cover/stake structures, the largest portion of the test force is applied over the side board at the bottom while the lathes are subjected to a very limited test force only. Heavy cargo items should thus be placed in the bottom and the sides may only block an upper layer of limited weight.
- There are no test criteria for the sides of curtainsiders in the Code L section of the standard and they are thus to be considered as weather protection only.

More details of the test criteria for different body structures are found in Appendix 5.

A vehicle tested in accordance with the Code XL requirements in the standard shall be fitted with a yellow marking plate with black text, providing details according to the example to the left below. The marking plate to the right below is according to the 2006 version of the standard. It provides less information but it is the most prevalent on the roads today.

Name of manufacturer	EN 12642-XL		
Vehicle body in compliance with	P (27 000 kg) (P is the test value)		
Loading height up to	200 mm	800 mm	Max height
Front wall	18 100 daN	15 700 daN	13 500 daN
Rear wall	–	–	8 100 daN
Side walls	–	12 600 daN	10 800 daN
Number of laths per section	3 aluminum / wood		

Fahrzeugaufbau entspricht	EN 12642-XL
Véhicule conform à la norm	
Vehicle body in compliance with	
Mustermann AG	**2006**

Marking plates for vehicles built according to the EN 12642 XL from 2016 (left) and 2006 (right)

Please note: The cargo weight considered during testing of XL vehicles may not be equal to the payload and only cargo weighing up to the test value P may be blocked against the superstructure without additional securing.

8. Other general requirements

The cargo should always be loaded in a way that makes the unloading easy. Cargo handling symbols shall always be taken into consideration at the loading. Pallets and boxes must be loaded with the right side up, as indicated for example by arrow symbols.

8.1 Damaged wrapping

It is not allowed to use damaged wrapping. The wrapping shall be in good condition without damaged corners, cracks or holes. Damaged or worn out wrapping must be changed. (See "Emballagehandbok Kvalitet, Februari 1995", Volvo Logistics AB Wrapping administration).

8.2 Weather protection

When loading cargo it is important to make sure that the cargo is weather protected. It is also important to notice that the cargo can be affected by local weather conditions with various temperature, precipitation and humidity of the air.

The CTU should be closed in such a way that no water can penetrate during the transport. When it is an open CTU the cargo should be covered with plastic wrapping or a tarpaulin. Covering with plastic wrapping or walking boards can eliminate leakage from below.

It is important that the cargo in closed CTUs is protected not only from exposure to water but also from condense that may occur during transports through different climate regions. Condense may cause rust and mould damages, it may weaken cardboard boxes and can cause important labels to fall off. Damages by condense can be eliminated by good ventilation or by the use of moist absorbers.

8.3 Checking of transport documents

The transport company is responsible for checking that the transport documents (consignment note) are corresponding with the loaded cargo. Changes in the transport documents are never to be done by the transport company.

8.4 Inspection of damages and loading of damaged cargo

The transport company shall inspect the cargo for damages prior to loading. Attention should be drawn to external damages, deformations, moisture etc. If damaged cargo is to be loaded, the damage should be noted in the transport documents or in a special damage

report, issued by the shipper. The transport company shall never load damaged cargo if the damage hasn't been documented.

The cargo securing shall fulfil all national and/or international regulations for sending and receiving countries including countries of transit. The responsibility for cargo securing differs between different countries and mode of transport.

8.5 Routines for damaged cargo

All damaged pallets shall be clearly marked with a damage label and reported on the manifest list and on CMR or freight document. Pallets that are damaged upon arrival at the x-dock shall also be noted on the CMR document for the arriving transport. If a repair is not possible, contact Volvo for further instructions. Photos of severely damaged goods or pallets shall be taken before securing, the photos shall then be sent to Volvo. Securing of pallets for safety reasons shall be reported on the CMR or freight document. Secured pallets shall be clearly marked with damage label and be loaded in a way that makes it visible from the left-hand side of the trailer. A damaged pallet that is not repaired shall always be loaded in a way that makes it visible from the left side of the trailer and that makes it possible to transport and unload the pallet in a safe way. This also applies to pallets with damaged runners.

8.6 Stacking

In general, heavy cargo should never be loaded on top of light cargo or cargo packaged in corrugated cardboard or plastic boxes. Heavy cargo and light cargo should be secured separately, not together.

8.7 Load distribution and verified weight

Cargo shall be loaded and transported in such a way that the cargo transport unit, the carrying vehicle or the infrastructure never is overloaded. Thus, the following limitations shall be observed:

- Concentrated load restriction on platform floor
- Axle loads
- Vehicle gross weight

As mentioned above, the centre of gravity in ISO containers shall not exceed 5 % of the containers length or width. As a rule of thumb, this may be achieved by not loading more than 60 % of the cargo weight in one half and not less than 40 % in the other.

Furthermore, transport operators may according to SOLAS[4] request a verified gross mass (VGM) of containers. This may be provided either by weighing the container after loading or

[4] Safety of Life at Sea – IMO Resolution MSC.404(96)

by summarizing the tare weight of the container, the weight of all cargo items as well as any additional securing or packing material used.

8.8 Collective consignment

Other consignor that has collective consignment with Volvo shall also have its cargo secured according to valid regulations as well as the instructions found herein.

9. Dangerous goods

Each mode of transport has its own regulation for transport of dangerous goods (DG). While some of the DG regulations are for a certain region, e.g. ADR for road transport in Europe, others are global like the IMDG Code for sea transport. The transport operator shall follow the DG regulations valid for the actual transport.

However, the basic requirements for cargo securing of dangerous goods are more or less the same in the different DG regulations, see example below from the IMDG Code[5]:

"Packages containing dangerous goods and unpackaged dangerous articles shall be secured by suitable means capable of restraining the goods (such as fastening straps, sliding slat-boards, adjustable brackets) in the cargo transport unit in a manner that will prevent any movement during transport which would change the orientation of the packages or cause them to be damaged…"

In the different DG regulations there are references to different standards or guidelines to further explain *"Suitable means"* in the text above.

When dangerous goods are packed or loaded into any container or vehicle for a sea transport, those responsible for packing the container or vehicle shall provide a CPC (Container/ Vehicle Packing Certificate) specifying the container/vehicle identification number(s) and certifying that the operation has been carried out in accordance with the conditions in section 5.4.2 in the IMDG Code. One of the points in section 5.4.2.1 is regarding cargo securing:

".4 Drums have been stowed in an upright position, unless otherwise authorized by the competent authority, and all goods have been properly loaded and, where necessary, adequately braced with securing material to suit the mode(s)† of transport for the intended journey.

† See CTU Code."

All personnel involved in handling or transporting dangerous goods shall have proper training according to applicable DG regulations.

[5] IMDG Code Amdt 40-20; Section 7.3.3.6

Appendix 1 – Regional and national standards

Below regional and national standards are given for road, rail and sea transport respectively.

Road

EU: ***Crossborder traffic***

- The EU Directive (2014/47/EU) about the technical roadside inspection of the roadworthiness of commercial vehicles came into force in May 2014. Member States had to implement it into their national legislation by May 2017 and start applying it by May 2018.

  https://ec.europa.eu/transport/road_safety/topics/vehicles/cargo_securing_loads

Standards in directive 2014/47/EU:	
EN 12195-1	Calculation of lashing forces
EN 12195-2	Web lashings made from man-made fibres
EN 12195-3	Lashing chains
EN 12195-4	Lashing steel wire ropes
EN 12640	Lashing points
EN 12641	Tarpaulins
EN 12642	Strength of vehicle body structure
ISO 1161, ISO 1496	ISO container
EN 283	Swap bodies
EUMOS 40509	Transport packaging
EUMOS 40511	Poles – stanchions

- EU Best Practice Guidelines on Cargo Securing for Road Transport, May 2014

EU: ***Domestic traffic***

- **Sweden:** TSFS 2017:25
- **Norway:** Föreskrift om bruk av køretøy: FOR-1990-01-25-92
- **Denmark:** BEK nr. 1306 af 07/09/2020
- **Finland:** TRAFICOM/149639/03.04.03.00/2019
- **Germany:** VDI 2700
- **Belgium:** Verkeersreglement KB 01/12/1975
- **Austria:** Kraftfahrgesetz 1967
- **Poland:** Dziennik Ustaw 2018; poz. 361
- **Slovakia:** 134/2018 Z.z.

North America:

- North American Cargo Securement Standard, September 2010

Australia:

- National Road Commission – Load restrain Guide, 3rd edition 2018

New Zeeland:

- Truck Loading Code, 2017

Railway

Europe:

- UIC Loading Guidelines (UIC - the International Union of Railways)

North America:

- AAR Regulations

Australia:

- ARA Regulations

Sea

International – IMO:

- IMO/ILO/UN ECE Code of Safe Practice for Packing of Cargo Transport Units (CTU Code)
- IMO Model course 3.18

Sweden:

- TSFS 2010:174, Transportstyrelsens föreskrifter och allmänna råd om transport av last, amended through TSFS 2018:89

Below a small compilation of the details regarding cargo securing of some of the regulations for road mentioned above is shown.

	Friction	**Securing requirements**	**Acceleration factors for road transport** (in parts of gravity acceleration 1g = 9.81 m/s^2)	**Safety factor**	**Deviation from securing regulations/ recommendations allowed**
International CTU Code	0.3/0.2/0.1 or actual	General	Forward: 0.8 g Rearward: 0.5 g Sideways: 0.5 g Vertical: -	Specified for top-over lashing only	Arrangements to be individually designed; by detailed calculations or according to the Quick Lashing Guide
Europe ***Crossborder traffic***	Actual may be used	General	Forward: 0.8 g Rearward: 0.5 g Sideways: 0.5 g Vertical: -	Specified in standard EN 12195-1:2010	Yes, the system should be designed according to basic parameters
North America	No values are specified	Min four lashings required	Forward: 0.8 g Rearward: 0.5 g Sideways: 0.5 g Vertical: 0.2 g	Not specified	Yes, as no detailed regulations exist
Australia	Actual or a conservative value	Detailed	Forward: 0.8 g Rearward: 0.5 g Sideways: 0.5 g Vertical: 0.2 g	Not specified	Yes, if following the basic accelerations and meeting the performance standards
New Zealand	Actual may be used	Detailed	Forward: 1.0 g Rearward: 0.5 g Sideways: 0.5 g Vertical: 0.2 g	Not specified	Yes, if loaded on a special purpose vehicle

Appendix 2 – Forces acting on cargo during transport

Cargo securing arrangements shall be designed to at least withstand the accelerations given for different modes of transport in the table below[6]. The accelerations in the table are expressed in parts of g (gravity acceleration: 1 g = 9.81 m/s^2).

Road transport				
Securing in	Acceleration coefficients			
	Longitudinally (c_x)		Transversely (c_y)	Minimum vertically down (c_z)
	forward	rearward		
Longitudinal direction	0.8	0.5	-	1.0
Transverse direction	-	-	0.5	1.0

Rail transport (combined transport)				
Securing in	Acceleration coefficients			
	Longitudinally (c_x)		Transversely (c_y)	Minimum vertically down (c_z)
	forward	rearward		
Longitudinal direction	0.5 (1.0)†	0.5 (1.0)†	-	1.0 (0.7)†
Transverse direction	-	-	0.5	1.0 (0.7)†
† The values in brackets apply to shock loads only with short impacts of 150 milliseconds or shorter, and may be used, for example, for the design of packaging.				

Sea transport					
Significant wave height in sea area		Securing in	Acceleration coefficients		
			Longitudinally (c_x)	Transversely (c_y)	Minimum vertically down (c_z)
A	$H_s \leq 8$ m	Longitudinal direction	0.3	-	0.5
		Transverse direction	-	0.5	1.0
B	8 m < $H_s \leq$ 12 m	Longitudinal direction	0.3	-	0.3
		Transverse direction	-	0.7	1.0
C	H_s > 12 m	Longitudinal direction	0.4	-	0.2
		Transverse direction	-	0.8	1.0

The different sea areas are defined according to the table below:

A	B	C
$H_s \leq 8$ m	8 m < $H_s \leq$ 12 m	H_s > 12 m
Baltic Sea (incl. Kattegat) Mediterranean Sea Black Sea Red Sea Persian Gulf Coastal or inter-island voyages in following areas: Central Atlantic Ocean (between 30°N and 35°S) Central Indian Ocean (down to 35°S) Central Pacific Ocean (between 30°N and 35°S)	North Sea Skagerak English Channel Sea of Japan Sea of Okhotsk Coastal or inter-island voyages in following areas: South-Central Atlantic Ocean (between 35°S and 40°S) South-Central Indian Ocean (between 35°S and 40°S) South-Central Pacific Ocean (between 35°S and 45°S)	unrestricted

[6] IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code), chapter 5.3

Appendix 3 – Friction factors

Friction factors for different material combinations may be taken from the table below[7].

Material combination in contact surface	Dry	Wet
SAWN TIMBER/WOODEN PALLET		
Sawn timber/wooden pallet against fabric base laminate/plywood	0.45	0.45
Sawn timber/wooden pallet against grooved aluminium	0.4	0.4
Sawn timber/wooden pallet against stainless steel sheet	0.3	0.3
Sawn timber/wooden pallet against shrink film	0.3	0.3
PLANED WOOD		
Planed wood against fabric base laminate/plywood	0.3	0.3
Planed wood against grooved aluminium	0.25	0.25
Planed wood against stainless steel sheet	0.2	0.2
PLASTIC PALLETS		
Plastic pallet against fabric base laminates/plywood	0.2	0.2
Plastic pallet against grooved aluminium	0.15	0.15
Plastic pallet against stainless steel sheet	0.15	0.15
CARDBOARD (UNTREATED)		
Cardboard against cardboard	0.5	-
Cardboard against wooden pallet	0.5	-
STEEL AND SHEET METAL		
Unpainted metal with rough surface against unpainted rough metal	0.4	-
Painted metal with rough surface against painted rough metal	0.3	-
Painted metal with smooth surface against painted smooth metal	0.2	-
Metal with smooth surface against metal with smooth surface	0.2	
STEEL CRATES		
Steel crate against fabric based laminate/plywood	0.45	0.45
Steel crate against grooved aluminium	0.3	0.3
Steel crate against stainless steel sheet	0.2	0.2
ANTI-SLIP MATERIAL		
Rubber against other materials when contact surfaces are clean	0.6	0.6
Materials other than rubber against other materials	as certified or tested according to appendix 3	

Friction factors (μ) should be applicable to the actual conditions of transport. When a combination of contact surfaces is missing in the table above or if its friction factor cannot be verified in another way, the maximum allowable friction factor of 0.3 should be used. If the surface contacts are not swept clean, the maximum allowable friction factor of 0.3 or, when lower, the value in the table should be used. If the surface contacts are not free from frost, ice and snow a static friction factor of 0.2 should be used, unless the table shows a lower value. For oily and greasy surfaces or when slip sheets have been used a friction factor of 0.1 applies.

[7] IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code), Annex 7 – Appendix 2

Appendix 4 – Relation between MSL and MBL

When unknown, the MSL, i.e. the safe working load, may be determined from the equipment's breaking strength load according to the following table:[8]

Material	MSL
Shackles, rings, deck eyes, turnbuckles of mild steel	50% of breaking strength
Fibre ropes	33% of breaking strength
Web lashings (single use)	75% of breaking strength[a]
Web lashings (reusable)	50% of breaking strength
Wire ropes (single use)	80% of breaking strength
Wire ropes (reusable)	30% of breaking strength
Steel band (single use)	70% of breaking strength[b]
Chains	50% of breaking strength

[a] *Maximum allowed elongation 9 % at MSL*
[b] *It is recommended to use 50 %*

The transport company should provide all cargo securing equipment necessary, unless otherwise agreed.

[8] IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code), Annex 7, section 2.4.2

Appendix 5 – Marking of web and chain lashings according to EN 12195-2--3

Marking of web lashings according to European standard EN 12195-2

1 daN ≈ 1 kg

LC = *Lashing capacity* = 1 600 kg

S_{HF} = *Standard hand force* = 50 kg
Force for which the tensioner is dimensioned

S_{TF} = *Standard tension force* = 400 kg
Force obtained in the lashing

Marking of chain lashings according to standard EN 12195-3

1 daN = 1 kg

10 kN ≈ 1 ton

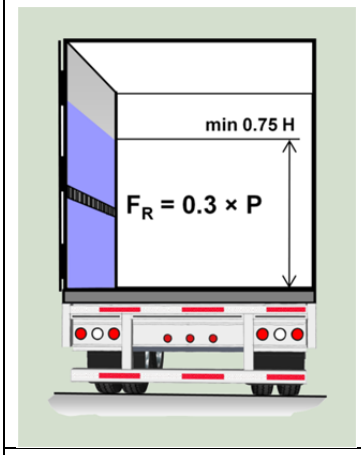
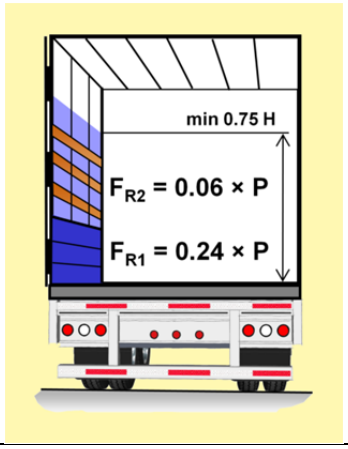
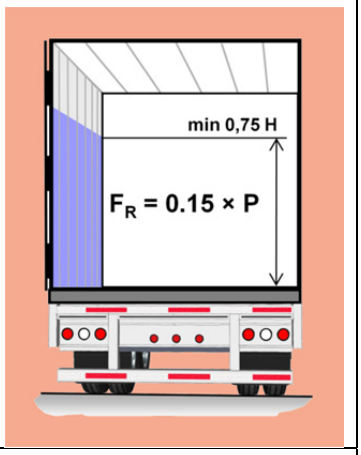
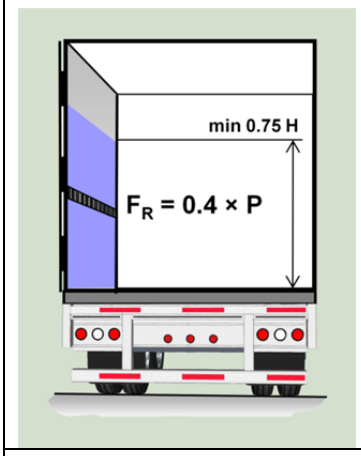
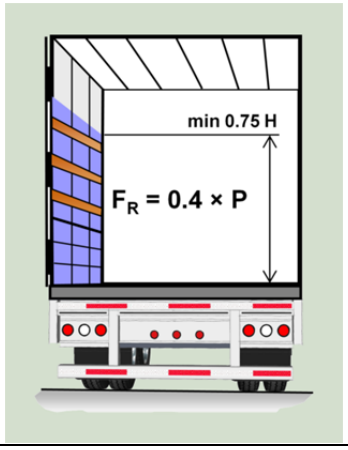
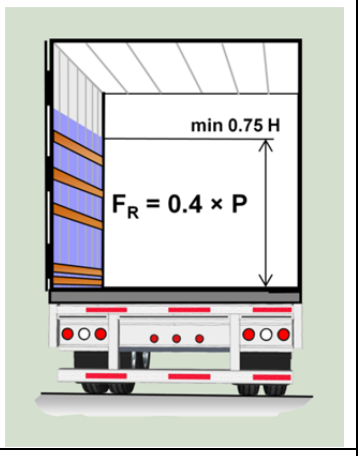
LC = *Lashing capacity* **= 63 kN ≈ 6,3 ton**

S_{TF} = *Standard tension force* **= 1 600 daN = 1 600 kg**

The allowed lashing force is 50 % of the breaking load, MBL. Breaking load for this chain is thus 12.6 ton.

Please note that different denominations are used in different standards for the allowable force in a lashing, considering a safety factor against ultimate failure. The EN 12195 series refers to the allowable lashing force as Lashing Capacity, LC, while the CTU Code uses the term Maximum Securing Load, MSL. American standards use Working Load Limit, WLL. The term Safe Working Load, SWL, is used for lifting equipment.

Appendix 6 – Comparison of strength requirements of CTUs according to EN 12642 L and XL

	Box-type trailer	Cover/stake trailer	Curtainsider
			
EN 12642 L			
	Headboard: F_R = 40 % of test value *P*, maximum 5 ton **Rear wall:** F_R = 25 % of test value *P*, maximum 3.1 ton		
EN 12642 XL			
	Headboard: F_R = 50 % of test value P **Rear wall:** F_R = 30 % of test value P		

According to the XL requirements of the standard, a trailer shall be tested with a force equal to 40 % of the test load *P* sideways. If the test load *P* = 27 000 kg, as in the example of label below, the side wall has been subjected to a force of 10 800 daN (10.8 tonnes; 0.4 · 27 tonnes = 10.8 tonnes) during testing. The test is designed to simulate the forces from the cargo on the side wall during cornering or evasive manoeuvres during road transport.

This may thus be taken as the permissible load on the side walls of max height for transport on road and in the Baltic Sea (sea area A).

Name of manufacturer	EN 12642-XL		
Vehicle body in compliance with	P (27 000 kg) (P is the test value)		
Loading height up to	200 mm	800 mm	Max height
Front wall	18 100 daN	15 700 daN	13 500 daN
Rear wall	–	–	8 100 daN
Side walls	–	12 600 daN	10 800 daN
Number of laths per section	3 aluminum / wood		

According to the standard, the forces applied during testing may be invoked for load securing purposes. This means that the maximum permissible cargo weight that can be secured against the side during over means of transport may be calculated by the following formula in our case:

$$m = \text{Permissible load} / (a - \mu) = 10.8 / (a - \mu)$$

Where: a = acceleration and μ = friction

If, for example, the friction is $\mu = 0.2$ and the vehicle is transported on the North Sea (Sea Area B) where the transverse acceleration may be up to 0.7 g, the maximum cargo weight that can be blocked against the side can be calculated as:

$$m = 10.8 / (0.7 – 0.2) = 21.6 \text{ ton}$$

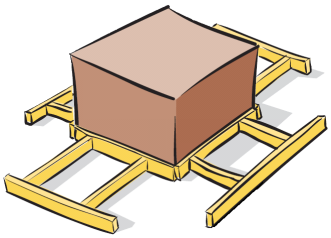
Appendix 7 – Blocking by timber

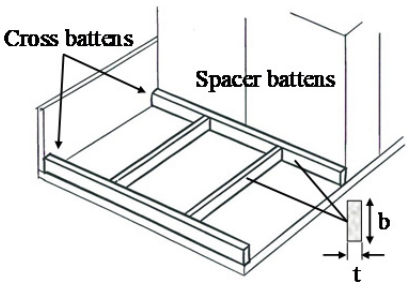
Due to the limited strength in container lashing fittings, see Appendix 9, they cannot be used for securing of heavy cargo.

Thus, heavy cargo has to be blocked to the framework of the container. And, when it comes to heavy cargo any void space should be avoided.

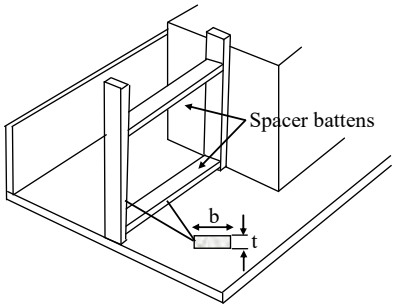
To prevent sliding the cargo may be bottom blocked by H-frames according to the principle in the figure to the left below.

The total compressive force, P, in ton of the blocking timber is derived from the following table. If the spacer battens are nailed to the platform and buckling is avoided, the blocking strength can be found in the column for L = 0.5.





Laying double H-frame



Standing double H-frame

Timber cross section	Compressive force ***P*** (ton) of blocking for 2 **spacer battens** with varying lengths *L*					
t × *b* mm	0.5 m	1.0 m	1.5 m	2.0 m	2.5 m	3.0 m
25 × 50	2.6					
25 × 75	4.0					
50 × 50	7.5	5.3	3.0	1.7		
50 × 75	11.3	7.9	4.6	2.6	1.7	
50 × 100	15.1	10.6	6.1	3.4	2.2	
50 × 150	22.6	15.9	9.1	5.1	3.3	2.3
75 × 75	18.6	15.3	11.9	8.5	5.6	3.9
75 × 100	24.8	20.3	15.9	11.4	7.4	5.1
75 × 150		30.5	23.8	17.1	11.1	7.7
75 × 200			31.7	22.7	14.8	10.3
100 × 100		30.1	25.6	21.2	16.7	12.2
125 × 125					33.4	27.4

The compressive force *P* in above table is valid for two spacer battens. If three spacer battens are used instead of two the compressive force will increase the compressive force with 40 %, i.e. the values in above table will increase with a factor 1.4.

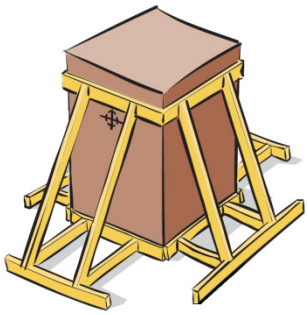
Required compressive force *P* is calculated according to the following formula:

$$P = m \cdot c_x \cdot g - m \cdot c_z \cdot g \cdot \mu$$

where m is the weight of the cargo, c_x the horizontal acceleration in longitudinal direction, g the gravity acceleration, c_z the vertical acceleration and μ the friction factor.

To prevent sliding the H-frames between the cargo and the container sides can be replaced by dunnage bags or timber filling the entire space.

To prevent tipping in longitudinal and transverse direction, diagonal timber supports could be applied according to the principle in the figure below. To save space, these supports could alternatively be horizontal and be placed between cargo and the corner posts of the container.



As an alternative to diagonal timber supports to prevent tipping sideways the gap between the container sides and the cargo can be filled. Note that vertical timbers must be placed from floor to roof against the container sides to avoid spot loads on the sides.

Accordingly, the best way of securing cargo in containers is to block it against the long sides and gables. Also the doors may be used for blocking but note that the cargo must be prevented from falling out when the doors are opened.

Appendix 8 – Cargo securing with dunnage bags

Accelerations in different directions during transport may cause movements of cargo, either sliding or tipping. Dunnage bags, or air bags, used as blocking device may be able to prevent these movements.

The size and strength of the dunnage bag are to be adjusted to the cargo weight so that the permissible lashing capacity of the dunnage bag, without risk of breaking it, is larger than the force the cargo needs to be supported with:

$$F_{dunnage\ bag} \geq F_{cargo}$$

The following describes how these forces are calculated and what characteristics and conditions that determine the magnitude of these forces.

Note that this instruction is general and that dunnage bags should be chosen in consultation with the supplier.

Force on dunnage bag from cargo (F_{cargo})

The maximum force, with which rigid cargo may impact a dunnage bag, depends on the cargos weight, size and friction against the surface and the dimensioning accelerations according to the formulas below:

Sliding:

$$F_{cargo} = M \cdot [a_h - \mu \cdot 0.7 \cdot a_v]$$

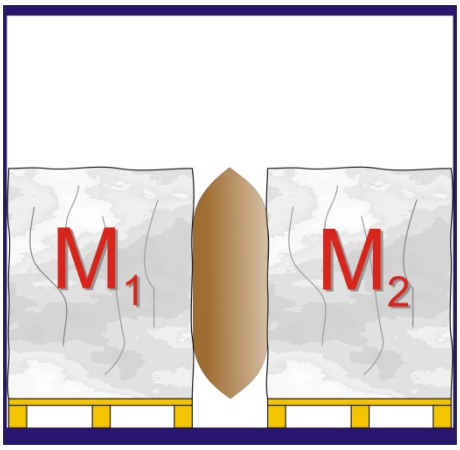
Tipping:

$$F_{cargo} = M \cdot [a_h - B/H \cdot a_v]$$

where F_{cargo} = *The force in ton on the dunnage bag caused by the cargo*
M = *Cargo weight in ton*
a_h = *Horizontal acceleration, expressed in g, that acts on the cargo sideways or in forward or backward directions*
a_v = *Vertical acceleration that acts on the cargo, expressed in g*
μ = *Static friction for the contact area between the cargo and the surface or between different cargo units*
B = *Width of the cargo stack for tipping sideways, or alternatively the length of the cargo for tipping forward or backward*
H = *Height of the cargo stack*

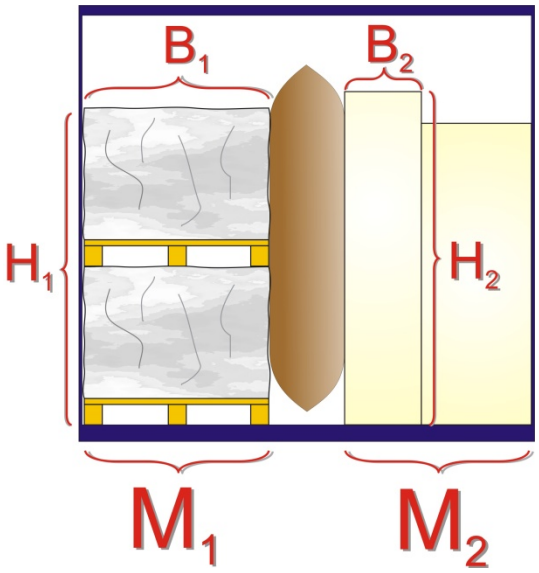
The load on the dunnage bag is determined of the movement (sliding or tipping) and the mode of transport that gives the largest force on the dunnage bag from the cargo.

It is the cargo weight only that actually impacts the dunnage bag that shall to be used in the above formulas. The movement forward, when breaking for example, the weight of the cargo behind the dunnage bag is to be used in the formulas.



If the dunnage bag instead is used to prevent movement sideways, the largest total weight of the cargo that either is on the right or left side of the dunnage bag is to be used, that is, either the weight M1 **or** M2, see the illustration to the right.

In order to have some safety margin in the calculations, the **lowest** friction should be used, either the one between the cargo in the bottom layer and the platform or between the layers of cargo.



If the cargo unit on each side of the dunnage bag has different forms, when tipping the relationship between the cargo width and height of the cargo stack that have the smallest value of B/H is chosen.

However, in both cases the total weight of the cargo that is on the same side of the dunnage bag is to be used, that is, either the weight M1 **or** M2 in the sketch to the right.

Permissible load on the dunnage bag ($F_{dunnage\ bag}$)

The force that the dunnage bag is able to take up depends on the area of the dunnage bag which the cargo is resting against and the maximum allowable working pressure. The force of the dunnage bag is calculated from:

$$F_{dunnage\ bag} = A \cdot 10 \cdot P_B / SF$$

where $F_{dunnage\ bag}$ = *The force in ton that the dunnage bag is able to take up without exceeding the maximum allowable pressure*

P_B = *Bursting pressure of the dunnage bag in bar*

A = *Contact area between the dunnage bag and the cargo in* m^2

SF = *2, safety factor*

Contact area (A)

The contact area between the dunnage bag and the cargo depends on the size of the bag and the gap that the bag is filling. This area may be approximated by the following formula:

$$A = (b - \pi \cdot d/2) \cdot (h - \pi \cdot d/2)$$

where b = *Width of the dunnage bag in m*
h = *Height of the dunnage bag in m*
d = *The gap that the bag is filling*
π = *3.14*

Pressure in the dunnage bag

Upon application of the dunnage bag it is filled to a slight overpressure. If this pressure is too low there is a risk that the dunnage bag come loose if the ambient pressure is rising or if the air temperature drops. Inversely, if the filling pressure is too high there is a risk of the dunnage bag to burst or to damage the cargo if the ambient pressure decreases, or if the air temperature rises.

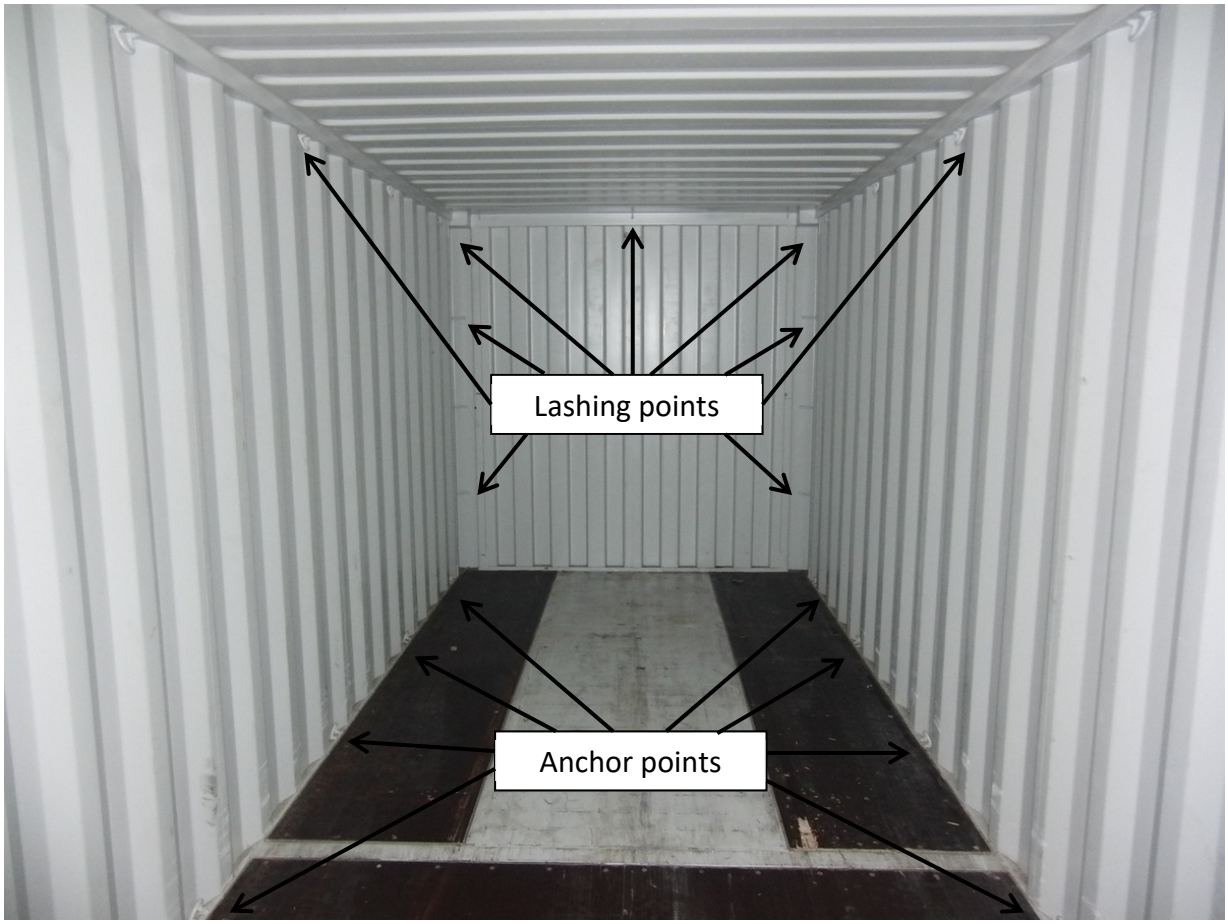
The **bursting pressure (P_B)** of a dunnage bag depends on the quality, size and the gap that the bag is filling. The pressure that the dunnage bag is experiencing as a result of forces acting from the cargo may never come close to bursting pressure as the bag is in danger of bursting and thus a safety factor of 2 against bursting shall be used.

Appendix 9 – Strength in container lashing fittings

For general purpose containers, cargo securing fittings are optional. However, when fitted, they shall comply with the requirements of Annex F of the container standard ISO 1496-1. This standard makes a separation between two types of fittings:

- **Anchor points** – Securing devices located in the base structure
- **Lashing points** – Securing devices located in any other part of the container

Each anchor point shall provide a minimum rated load of 1 000 kg in any direction.
Each lashing point shall provide a minimum rated load of 500 kg in any direction

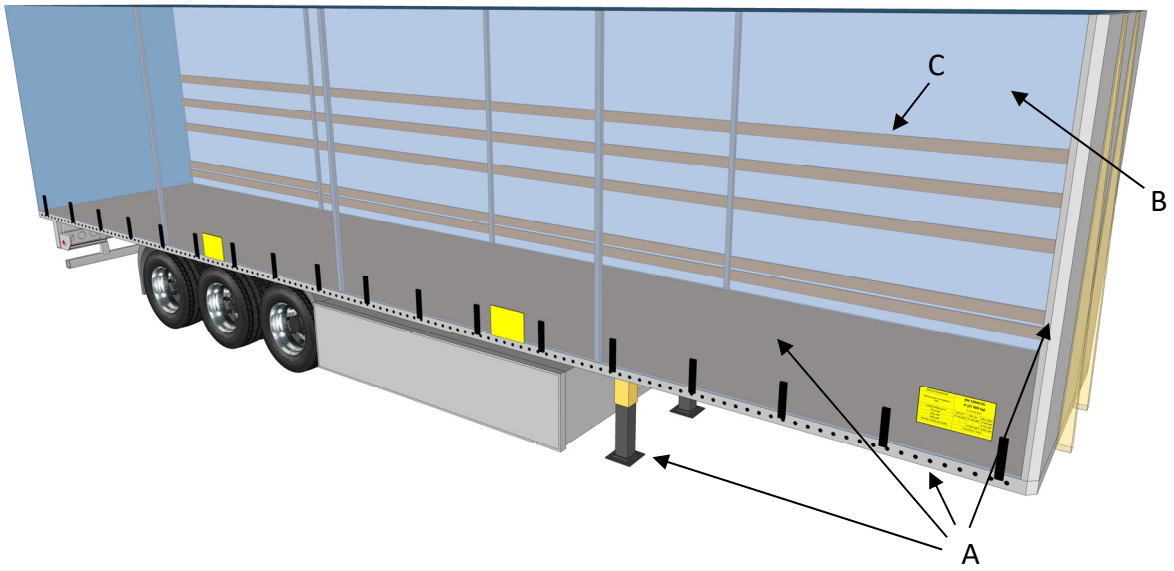


The typical number of anchor points according to ISO 1496-1 is:

- In 40 ft containers – 16
- In 20 ft containers – 10

The typical number of lashing points according to ISO 1496-1 is unspecified.

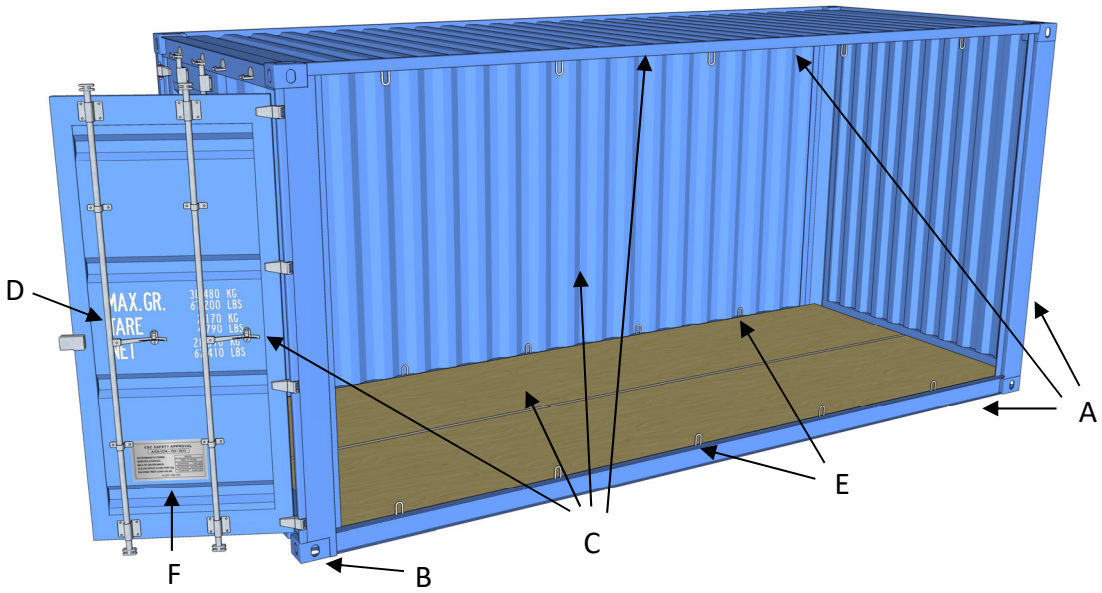
Appendix 10 – Checklist for inspection of trailers and swap bodies



Checklist trailers and swap bodies		Yes	No	Comments
1	Are the platform, landing legs, the head board, alongside and crossways beams undamaged? (A)			
2	Are sideboards, cover laths, canopy, canopy seal and possible centre and side stanchions undamaged and complete? (B and C)			
3	Is the CTU weatherproof?			
4	Is the cargo area undamaged?			
5	Is the cargo area clean, dry and free from residue and odour?			
6	Does the CTU have functioning and undamaged cargo securing equipment?			
7	Is the CTU equipped with unbroken internal lashing points for securing of cargo?			
8	Does the CTU have enough numbers of unbroken external lashing points?			
9	Are the corner castings on the swap body undamaged?			
10	Are there pockets for dangerous goods labels? Are non-actual labels removed or masked?			
Extra checkpoints for transport by railway				
11	Is there a UIC code number plate?			
12	Are the TIR-line and the sealing line correctly applied?			
13	Does the lock for the landing legs function and is the canopy unsplit?			

Date _____ **Number of CTU** _____ **Sign** _____

Appendix 11 – Checklist for inspection of containers



Checklist containers		Yes	No	Comments
1	Is the framework undamaged? (A)			
2	Are the corner castings undamaged? (B)			
3	Are the walls, floor, roof, doors, door sealing's and possible canopy and canopy seal undamaged? (C)			
4	Is the CTU weatherproof?			
5	Are the doors possible to close and are the packing's unbroken and soft? (D)			
6	Is the cargo area undamaged?			
7	Is the cargo area clean, dry and free from residue and odour from previous cargoes?			
8	Are the ventilation devices open and undamaged?			
9	Is the CTU equipped with undamaged and functioning lashing points? (E)			
10	Is the container marked with a safety approved plate, CSC? (F)			
11	Are non-actual labels removed and marked?			

Date _____ **Number of CTU** _____ **Sign** _____

Appendix 12 – Quick Lashing Guide

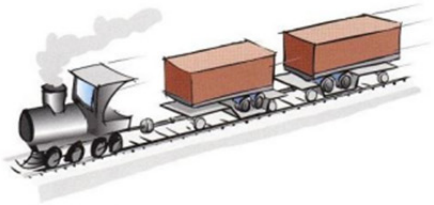
The three UN agencies IMO (International Maritime Organization), ILO (International Labor Organization) and UN ECE (Economic Commission for Europe) have developed the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code) for cargo securing inside CTUs. As part of the informative material of the Code, there are Quick Lashing Guides, applicable to different sea areas as well as road and combined rail transports, available through the link below.

https://en.mariterm.se/wp-content/uploads/2016/09/CTU-Code-Quick-Lashing-Guide-dec-2014.pdf

INFORMATIVE MATERIAL 5

QUICK LASHING GUIDE

Cargo securing on CTUs for transports on Road, Combined Rail and in Sea Area A, B & C



SEA AREAS

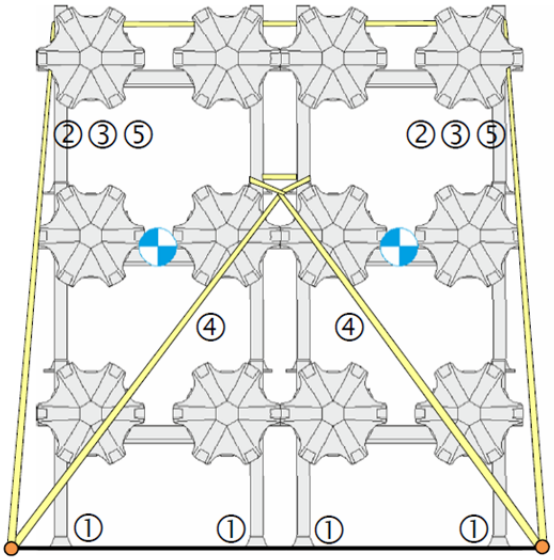
A	B	C
$H_s \leq 8$ m	8 m < $H_s \leq$ 12 m	H_s > 12 m
Baltic Sea (incl. Kattegat) Mediterranean Sea Black Sea Red Sea Persian Gulf Coastal or inter–island voyages in following areas: Central Atlantic Ocean (between 30°N and 35°S) Central Indian Ocean (down to 35°S) Central Pacific Ocean (between 30°N and 35°S)	North Sea Skagerak English Channel Sea of Japan Sea of Okhotsk Coastal or inter-island voyages in following areas: South-Central Atlantic Ocean (between 35°S and 40°S) South-Central Indian Ocean (between 35°S and 40°S) South-Central Pacific Ocean (between 35°S and 45°S)	unrestricted

Appendix 13 – Instructions for cargo securing of Volvo cargo

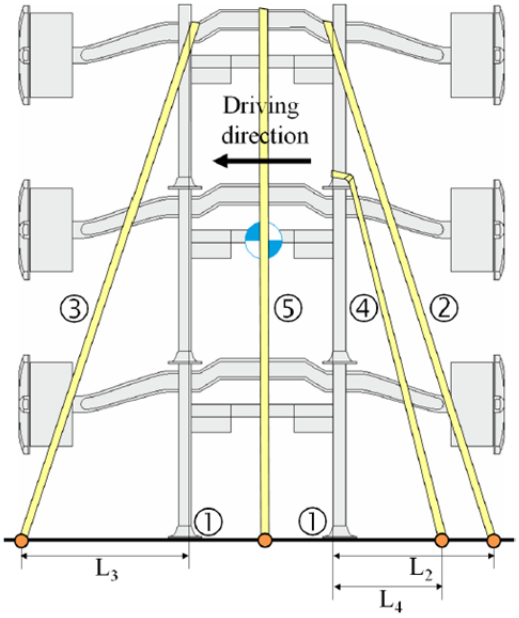
VOLVO MERITOR | Road / Sea area B | Date: 20.2.2018 | Page: 1 (3)

CARGO SECURING CERTIFICATE

Securing of front axle and IFS axle racks from Meritor HVS AB loaded on vehicles for road and North Sea (sea area B) transport.



Rear view of the section of front axles



Side view of the section of front axles

Each section of front axle racks, stacked three high and with max weight 7.0 ton, is to be secured as follows:

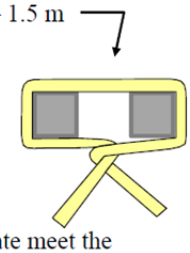
① Friction-enhancing material between the racks and the platform of type Lanocatch

② One spring lashing to prevent movements in forward direction, permissible interval L_2 = 1.0 – 2.0 m

③ One spring lashing to prevent movements in rearward direction, permissible interval L_3 = 1.0 – 2.0 m

④ One spring snare to prevent movements in forward direction, permissible interval L_4 = 0.5 – 1.5 m

⑤ One top-over lashing



L_2 – L_4 are the longitudinal distances between the lashing points on the axle racks and the lashing points on the platform.

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Lindesberg, Sweden, 20.2.2018

Meritor HVS AB

Christer Edvardsson
P.O. Box 90, SE-711 22 Lindesberg
Phone: +46 581 84 355
E-mail: christer.edvardsson@meritor.com

This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for sea TSFS 2010:174, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 20.2.2018

MariTerm AB

Nils Andersson
P.O. Box 74, SE-263 21 Höganäs
Phone: +46 42 33 31 00
E-mail: nils.andersson@mariterm.se

This certificate for front axle and IFS axle racks is valid when the following conditions are met:

Design acceleration data

- Racks and axles are subjected to max accelerations of; 0.8 g forward, 0.7 g sideways and 0.5 g rearward.
- The above accelerations are acting individually and are combined with 1 g downward.

Front axle racks

- The front axle racks from Meritor have the following dimensions: L × B × H = 900 × 1140 × 885 mm.
- Each rack is loaded with maximum two front axles.
- The total weight per section (two stacks with maximum three racks per stack) is maximum 7000 kg.
- The center of gravity for the stack is located maximum 1.425 meter above the platform and in the center of the stack sideways and in longitudinal direction.
- The axles are secured to the racks to withstand the above accelerations.

IFS axle racks

- The IFS axle racks from Meritor have the following dimensions: L × B × H = 1780 × 1140 × 885 mm.
- Each rack is loaded with one IFS axle.
- The total weight of an IFS axle and rack is maximum 1200 kg.
- The axles are secured to the racks to withstand the above accelerations.

IFS axle racks

- The IFS axle racks from Meritor have the following dimensions: L × B × H = 1780 × 1140 × 885 mm.
- Each rack is loaded with one IFS axle.
- The total weight of an IFS axle and rack is maximum 1200 kg.
- The axles are secured to the racks to withstand the above accelerations.

Vehicle and stowage

- The vehicle platform floor is made of wood or plyfa and is clean, dry and free from frost, ice and snow.
- Friction-enhancing material ① of type Lanocatch is placed between the rack and the platform.
- The static coefficient of friction between the rack and the friction-enhancing material is at least 0.59 in accordance with performed practical tests documented in the report "Documentation of practical tests with front and rear axles in racks from Meritor HVS AB, 13.12.2011". During these tests the lashing arrangement according to this certificate was also tested.
- The friction factor between the rack and the friction-enhancing material is at least 0.55 in accordance with performed practical tests documented in the report "Documentation of practical tests with a section of front axles including one rack with an IFS-axle, 31th of August 2018". During these tests the lashing arrangement according to this certificate was also tested.

Lashing arrangement

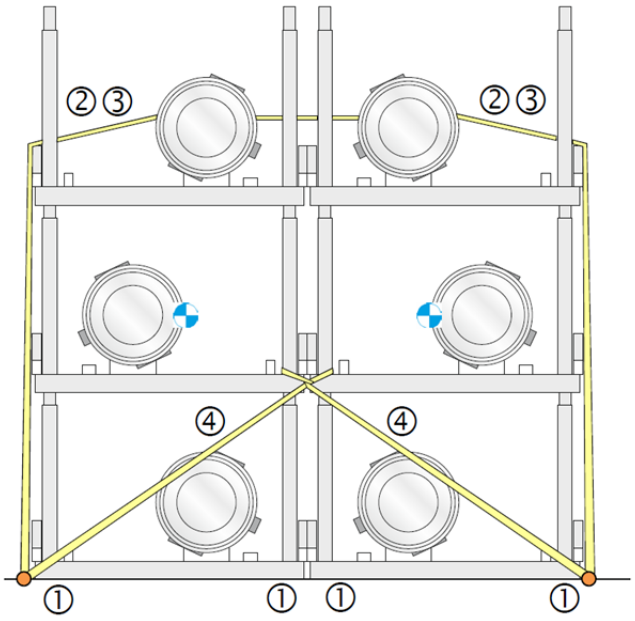
- The lashings are pre-tensioned to at least 400 daN (400 kg) during the entire voyage.
- The lashings have a lashing capacity, LC, of at least 1600 daN (1.6 ton) and MSL is 50 % of the breaking strength, at least 2000 daN (2 ton).
- The lashing points on the vehicle have a lashing capacity of at least 2000 daN (2 ton).
- Lashings in the same direction are placed in different lashing points on the vehicle. Lashings drawn in opposite directions may be placed in the same lashing point on the vehicle.
- The lashings are protected from sharp edges and corners.

VOLVO MERITOR

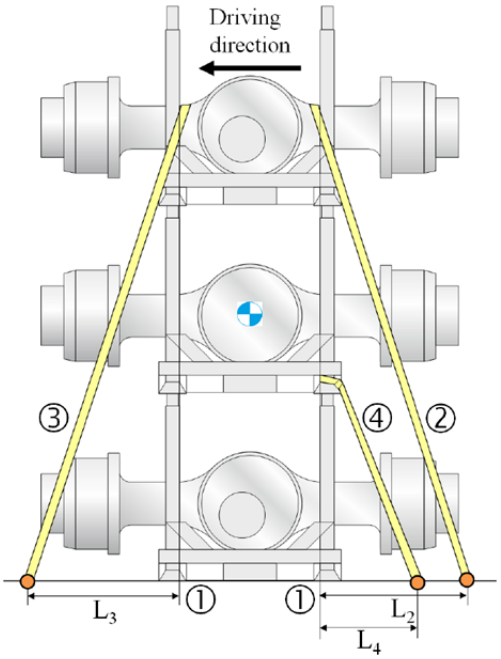
Road Date: 20.2.2018
Sea area B Page: 1 (2)

CARGO SECURING CERTIFICATE

Securing of rear axle racks from Meritor HVS AB loaded on vehicles for road and North Sea (sea area B) transport.



Rear view of the section



Side view of the section

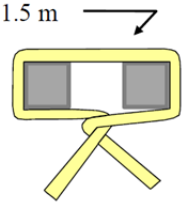
Each section of rear axle racks, stacked three high and with max weight 7.0 ton, is to be secured as follows:

① Friction-enhancing material between the racks and the platform of type Lanocatch

② One spring lashing to prevent movements in forward direction, permissible interval L_2 = 1.0 – 2.0 m

③ One spring lashing to prevent movements in rearward direction, permissible interval L_3 = 1.0 – 2.0 m

④ One spring snare to prevent movements in forward direction, permissible interval L_4 = 0.5 – 1.5 m



L_2 – L_4 are the longitudinal distances between the lashing points on the axle racks and the lashing points on the platform.

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Lindesberg, Sweden, 20.2.2018

Meritor HVS AB

Christer Edvardsson
P.O. Box 90, SE-711 22 Lindesberg
Phone: +46 581 84 355
E-mail: christer.edvardsson@meritor.com

This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 20.2.2018

MariTerm AB

Peter Andersson
P.O. Box 74, SE-263 21 Höganäs
Phone: +46 42 33 31 00
E-mail: peter.andersson@mariterm.se

VOLVO MERITOR Road Date: 20.2.2018
Sea area B Page: 2 (2)

This certificate for rear axle racks is valid when the following conditions are met:

Design acceleration data

- Racks and axles are subjected to max accelerations of; 1.0 g forward, 0.7 g sideways and 0.5 g rearward.
- The above accelerations are acting individually and are combined with 1 g downward.

Rear axle racks

- The racks with axles from Meritor have the following dimensions: L × B × H = 800 × 1172 × 868 mm.
- Each rack is loaded with maximum one rear axle.
- The total weight per section (two stacks with maximum three racks per stack) is maximum 7000 kg.
- The center of gravity for the stack is located maximum 1.0 meter above the platform, on half of the length of the rack and not dislocated sideways more than 0.16 m from the center of the stack.
- The axles are secured to the racks to withstand the above accelerations.

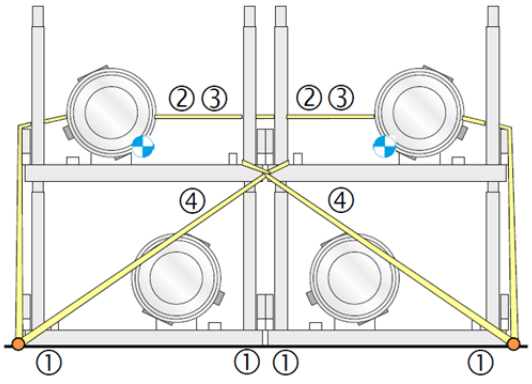
Vehicle and stowage

- The vehicle platform floor is made of wood or plyfa and is clean, dry and free from frost, ice and snow.
- Friction-enhancing material ① of type Lanocatch is placed between the rack and the platform.
- The static coefficient of friction between the rack and the friction-enhancing material is at least 0.59 in accordance with performed practical tests documented in the report "Documentation of practical tests with front and rear axles in racks from Meritor HVS AB, 13.12.2011". During these tests the lashing arrangement according to this certificate was also tested.

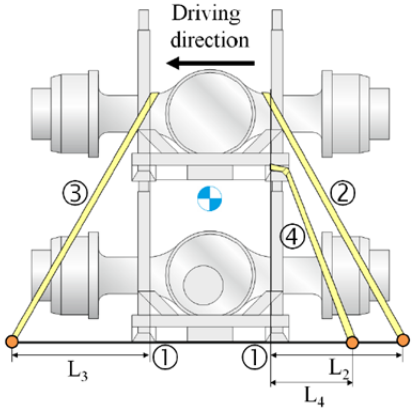
Lashing arrangement

- The lashings are pre-tensioned to at least 400 daN (400 kg) during the entire voyage.
- The lashings have a lashing capacity, LC, of at least 1600 daN (1.6 ton) and MSL is 50 % of the breaking strength, at least 2000 daN (2 ton).
- The lashing points on the vehicle have a lashing capacity of at least 2000 daN (2 ton).
- Lashings in the same direction are placed in different lashing points on the vehicle. Lashings drawn in opposite directions may be placed in the same lashing point on the vehicle.
- The lashings are protected from sharp edges and corners.

Rear axle racks stacked two high only is secured in the same way as racks stacked three high:



Rear view of the section



Side view of the section

① Friction-enhancing material between the racks and the platform of type Lanocatch

② One spring lashing to prevent movements in forward direction, permissible interval L_2 = 1.0 – 2.0 m

③ One spring lashing to prevent movements in rearward direction, permissible interval L_3 = 1.0 – 2.0 m

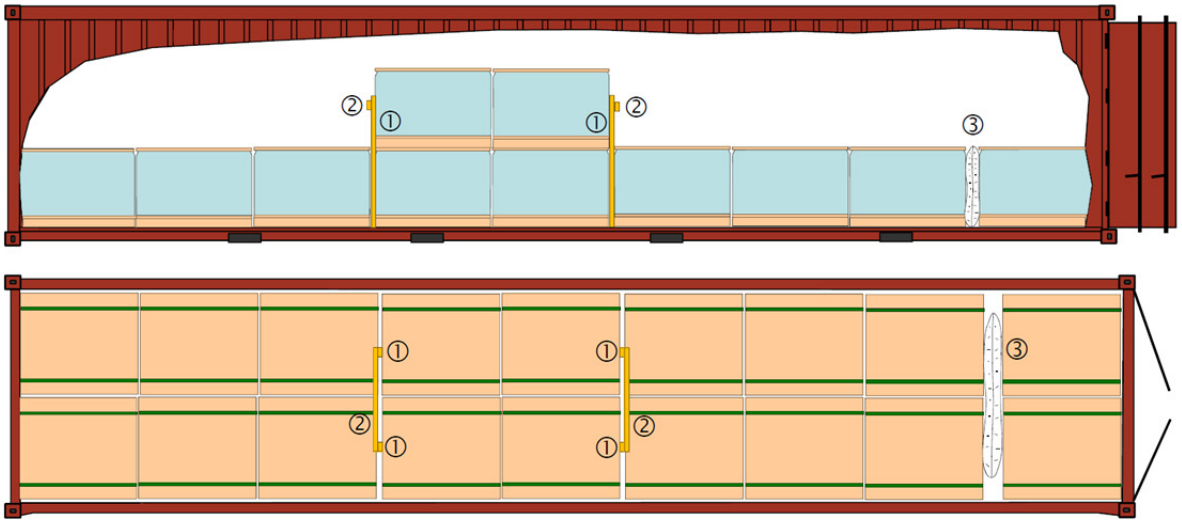
④ One spring snare to prevent movements in forward direction, permissible interval L_4 = 0.5 – 1.5 m

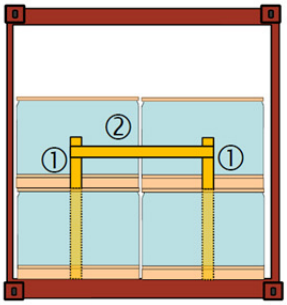
VOLVO	Engine blocks on wooden pallets Cylinder heads in steel racks	Road Sea area C	5.9.2012 Page 1 (2)

CARGO SECURING INSTRUCTION

Securing of engine blocks on wooden pallets and cylinder heads in steel racks in containers for transport on road and in sea area C.

Alternative 1:





Alternative 1:

The double stacked pallets/racks are secured with vertical battens 2"× 4"; one batten for each cargo row ①. The battens are held in place with a transverse batten ②.

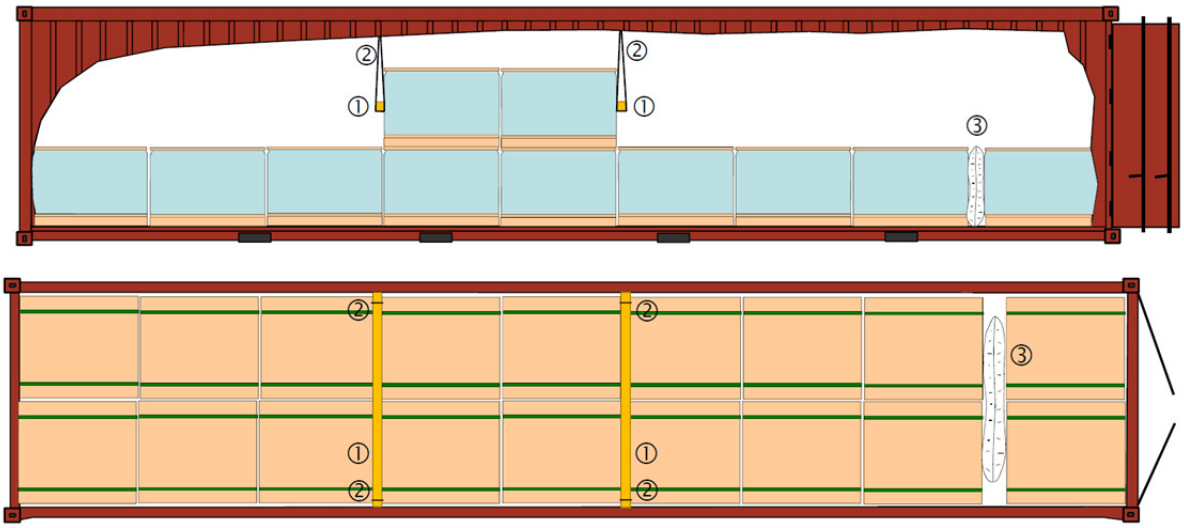
Any free space in longitudinal direction is filled with air bags or empty pallets ③.

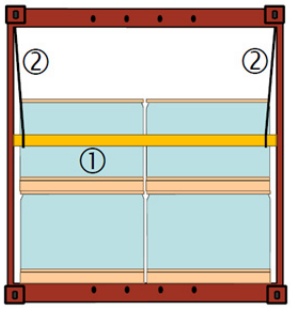
See alternative cargo securing on page 2.

The instruction is valid when the following conditions are met:

- Maximum dimension on engine blocks on wooden pallets and cylinder heads in steel racks is L × B × H = 1300 × 1100 × 720 mm and maximum weight is 966 kg.
- The pallets and/or racks are loaded in nine sections of which two are double stacked. The two double stacked sections are loaded in the center of the container.

Alternative 2:





Alternative 2:

The double stacked pallets/racks are secured with battens 4"× 4" in the corrugation ①. The battens are kept in place by ropes ② attached to the roof. Any free space in longitudinal direction is filled out with air bags or empty pallets ③.

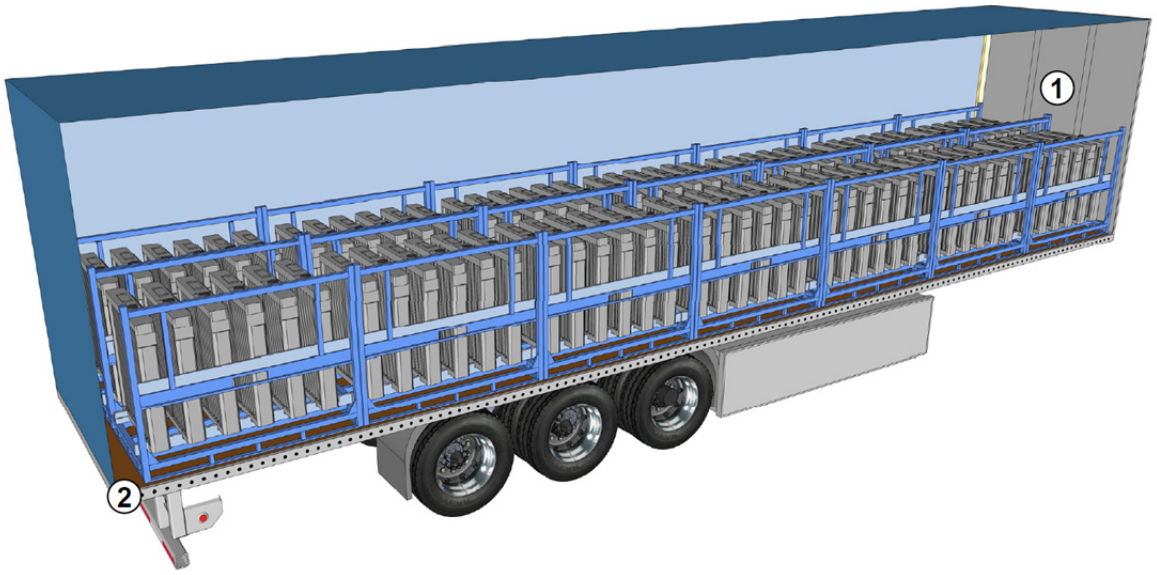
The instruction is developed 5.9.2012 by:

MariTerm AB
P.O. Box 74
SE-263 21 Höganäs
+46 42 33 31 00
info@mariterm.se
www.mariterm.se

VOLVO	Radiator racks	Road Sea area A	2017-12-21 Page 1 (2)

Cargo securing certificate

Securing of radiator racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road and in the Baltic Sea (sea area A).



① Block stowage against the headboard. All racks to be tightly stowed against each other.

② If the free space between the last section of racks and the rear wall is more than 15 cm, the free space is filled out with empty pallets or similar or one spring lashing on the last section is used.

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Gothenburg, Sweden, 2017-12-21

Volvo Logistics AB

Arne Lingårdsson
SE-405 08 Gothenburg
Phone: +46 31 660 000
E-mail: arne.lingardsson@volvo.com

This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 2017-12-21

MariTerm AB

Petra Hugoson
P.O. Box 74, SE-263 21 Höganäs
Phone: +46 42 33 31 00
E-mail: petra.hugoson@mariterm.se

This certificate is valid for transport of radiator racks from Volvo in trailers built and marked in accordance with EN 12642 XL for transport on road and in sea area A when the following conditions are met:

Dimensions

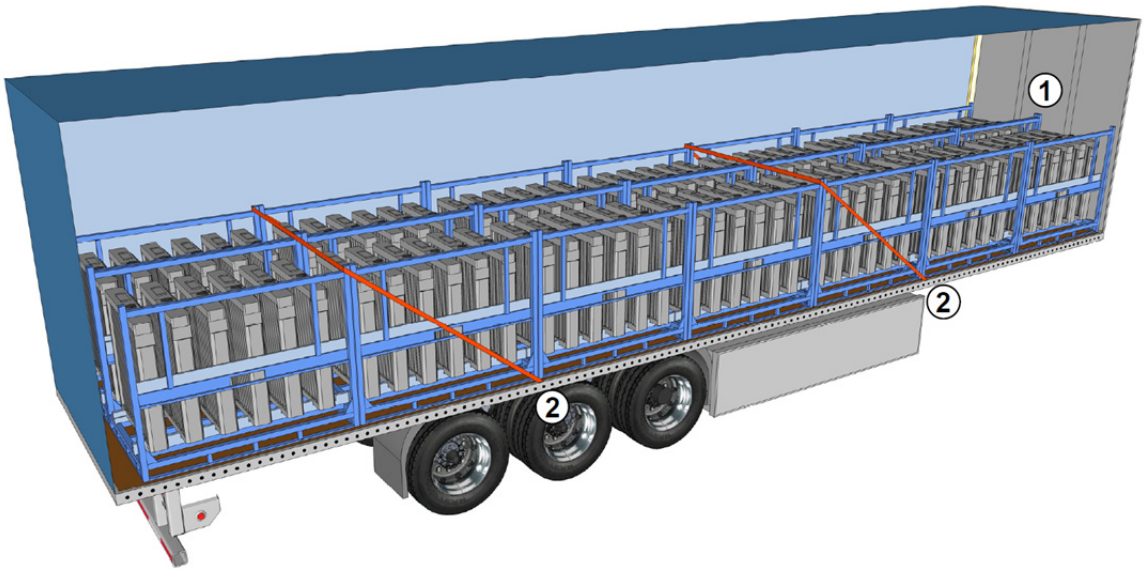
- The radiator racks have the following dimensions: L × B × H = 1 910 × 1 200 × 1 520 mm.
- Each steel rack is loaded with maximum six radiators.
- The total weight of each rack loaded with six radiators does not exceed 615 kg.
- The centre of gravity is approximately centered in longitudinal and transverse directions and located maximum 1 000 mm above the floor.
- The radiators are fixed to the steel rack to withstand the transport forces and the rack is strong enough so that it will tip around its outer edges without collapsing.

Platform/stowing

- The platform bed is made of wood or plyfa and is clean as well as free from frost, ice and snow.
- The friction factor is at least μ = 0.45 (steel crate against fabric base laminat/plywood as taken from standard EN 12195-1:2010).
- The racks are blocked against the headboard and all sections are stowed tightly against each other.
- Maximum 14 racks are loaded into the trailer.
- One spring lashing with lashing capacity (LC/MSL/SWL) at least 1.6 ton (1 600 daN) is used if the free space between the last section of racks and the rear wall is more than 30 cm.

Cargo securing certificate

Securing of radiator racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in the Baltic Sea (sea area A).



① Block stowage against the headboard. All racks to be tightly stowed against each other.

② Two spring lashings*; one on the section loaded closest to the doors and one on the section loaded in the middle of the platform

*) *The angle between the spring lashings and the platform floor do not exceed 45°.*

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Gothenburg, Sweden, 2017-12-21

Volvo Logistics AB

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This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 2017-12-21

MariTerm AB

Petra Hugoson
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This certificate is valid for transport of radiator racks from Volvo in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in sea area A when the following conditions are met:

Dimensions

- The radiator racks have the following dimensions: L × B × H = 1 910 × 1 200 × 1 520 mm.
- Each steel rack is loaded with maximum six radiators.
- The total weight of each rack loaded with six radiators does not exceed 615 kg.
- The centre of gravity is approximately centered in longitudinal and transverse directions and located maximum 1 000 mm above the floor.
- The radiators are fixed to the steel rack to withstand the transport forces and the rack is strong enough so that it will tip around its outer edges without collapsing.

Platform/stowing

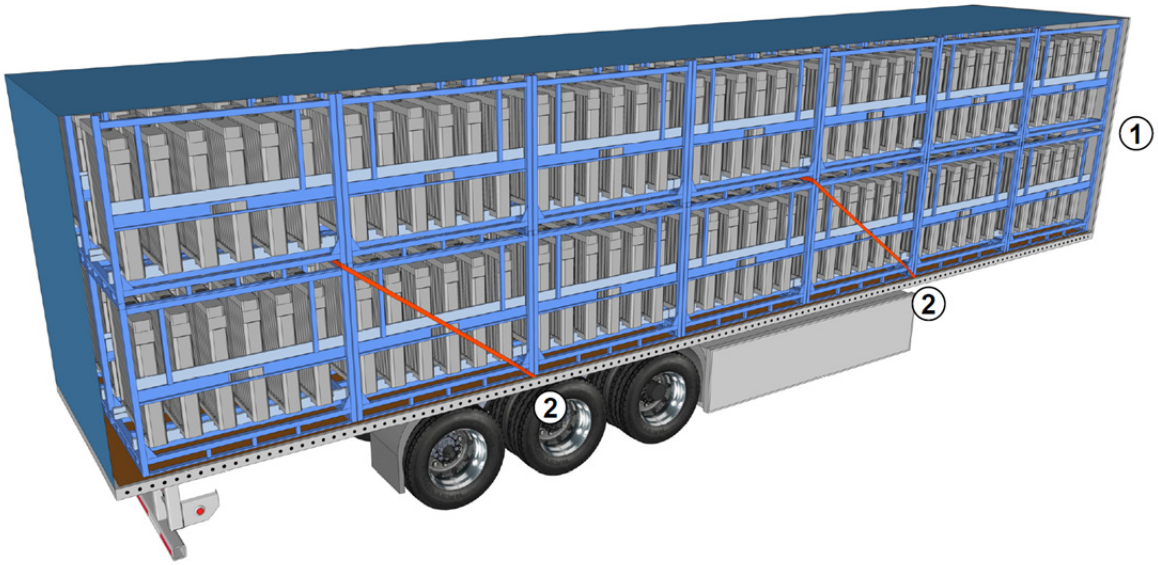
- The platform bed is made of wood or plyfa and is clean as well as free from frost, ice and snow.
- The friction factor is at least $\mu = 0.45$ (steel crate against fabric base laminat/plywood as taken from standard EN 12195-1:2010).
- The racks are blocked against the headboard and all sections are stowed tightly against each other.
- Maximum 14 racks are loaded into the trailer.

Lashing arrangement

- The lashing capacity (LC/MSL/SWL) of the lashings is at least 1.6 ton (1 600 daN).
- The lashings are pre-tensioned to at least S_{TF} 400 daN (kg) during the entire transport. The lashings may need to be re-tensioned during the transport.
- The lashing fittings on the trailer have a safe working load (or lashing capacity) of at least 2 ton (2 000 daN).
- The lashings are protected from sharp edges.

Cargo securing certificate

Securing of radiator racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in the North Sea (sea area B).



① Block stowage against the headboard. All racks are to be tightly stowed against each other.

② The total free space between all sections of racks and the doors is maximum 15 cm. If not, two spring lashings* are fastened on the upper layer of racks; one on the section loaded closest to the doors and one on the section loaded in the middle of the platform.

*) *The angle between the spring lashings and the platform floor do not exceed 45°.*

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Gothenburg, Sweden, 2019-02-27

Volvo Logistics AB

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This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174 incl amendments, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 2019-02-27

MariTerm AB

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This certificate is valid for transport of radiator racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in sea area B when the following conditions are met:

Dimensions

- The radiator racks have the following dimensions: L × B × H = 1 910 × 1 200 × 1 430 mm.
- Each steel rack is loaded with maximum six radiators.
- The total weight of each rack loaded with six radiators does not exceed 615 kg.
- The centre of gravity is approximately centered in longitudinal and transverse directions and located maximum 1 000 mm above the floor.
- The radiators are fixed to the steel rack to withstand the transport forces and the rack is strong enough so that it will tip around its outer edges without collapsing.

Platform/stowing

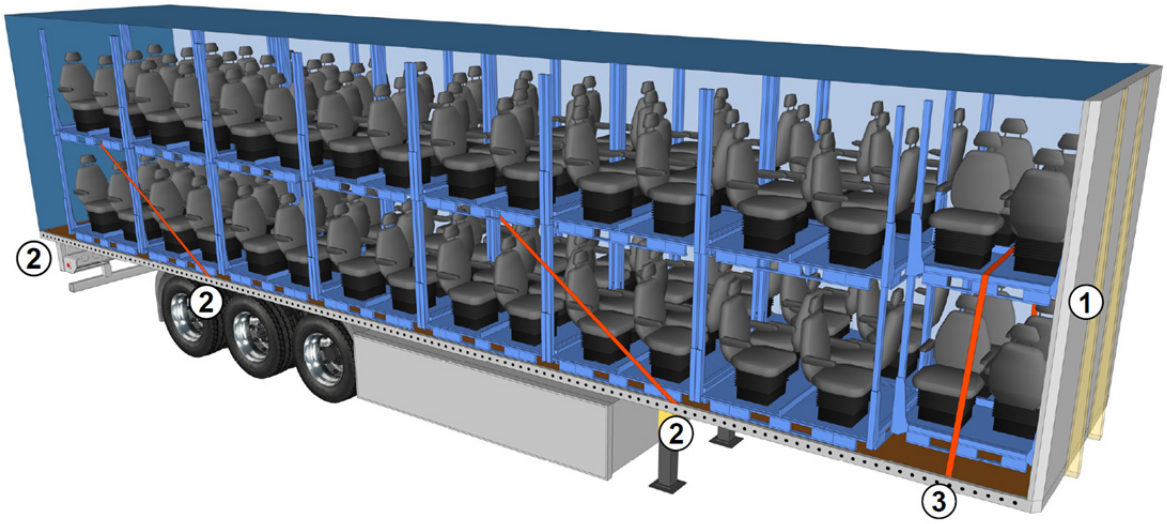
- The platform bed is made of wood or plyfa and is clean as well as free from frost, ice and snow.
- The friction factor is at least $\mu = 0.45$ (steel crate against fabric base laminate/plywood as taken from standard EN 12195-1:2010).
- The racks are blocked against the headboard and all sections are stowed tightly against each other.
- Maximum 28 racks, stowed in two layers, are loaded into the trailer.
- The racks in the upper layer are threaded on the racks in the bottom layer and are therefore prevented from sliding in all directions.
- If sections with different heights are loaded onto the semitrailer, the sections are to be secured with one top-over lashing per section.

Lashing arrangement

- The lashing capacity (LC/MSL/SWL) of the lashings is at least 1.6 ton (1 600 daN).
- The lashings are pre-tensioned to at least S_{TF} 400 daN (kg) during the entire transport. The lashings may need to be re-tensioned during the transport.
- The lashing fittings on the trailer have a safe working load (or lashing capacity) of at least 2 ton (2 000 daN).
- The lashings are protected from sharp edges.

Cargo securing certificate

Securing of seat racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in the North Sea (sea area B).



① Block stowage against the headboard. All racks are to be tightly stowed against each other.

② The total free space between all sections of racks and the doors is maximum 15 cm. If not, two spring lashings* are fastened on the upper layer of racks; one on the section loaded closest to the doors and one on the section loaded in the middle of the platform.

③ Top-over lashings, fastened on the upper layer of racks, on sections consisting of two racks only.

*) *The angle between the spring lashings and the platform floor do not exceed 45°.*

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Gothenburg, Sweden, 2019-02-27

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This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174 incl amendments, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 2019-02-27

MariTerm AB

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This certificate is valid for transport of seat racks from Volvo loaded in trailers built and marked in accordance with EN 12642 XL for transport on road, combined rail and in sea area B when the following conditions are met:

Dimensions

- The seat racks, made of steel, have the following dimensions: L × B × H = 1 670 × 1 238 × 1 430 mm.
- Each seat rack is loaded with maximum four seats.
- The total weight of each rack loaded with four seats does not exceed 550 kg.
- The centre of gravity is approximately centered in longitudinal and transverse directions and located maximum 1 000 mm above the floor.
- The seats are fixed to the steel rack to withstand the transport forces and the rack is strong enough so that it will tip around its outer edges without collapsing.

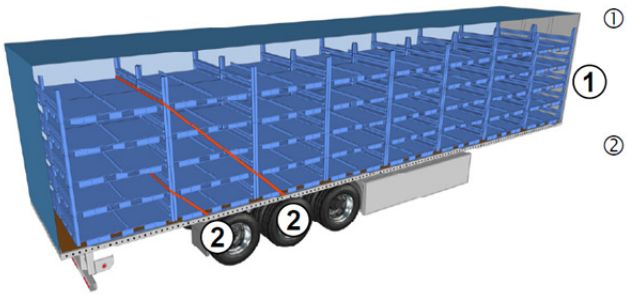
Platform/stowing

- The platform bed is made of wood or plyfa and is clean as well as free from frost, ice and snow.
- The friction factor is at least μ = 0.45 (steel crate against fabric base laminate/plywood as taken from standard EN 12195-1:2010).
- The racks are blocked against the headboard and all sections are stowed tightly against each other.
- Maximum 30 racks, stowed in two layers, are loaded into the trailer.
- The racks in the upper layer are threaded on the racks in the bottom layer and are therefore prevented from sliding in all directions.
- If sections with different heights are loaded onto the semitrailer, the sections are to be secured with one top-over lashing per section.

Lashing arrangement

- The lashing capacity (LC/MSL/SWL) of the lashings is at least 1.6 ton (1 600 daN).
- The lashings are pre-tensioned to at least S_{TF} 400 daN (kg) during the entire transport. The lashings may need to be re-tensioned during the transport.
- The lashing fittings on the trailer have a safe working load (or lashing capacity) of at least 2 ton (2 000 daN).
- The lashings are protected from sharp edges.

Transport of empty racks



① Block stowage against the headboard. All racks are to be tightly stowed against each other.

② The total free space between all sections of racks and the doors is maximum 15 cm. If not, two spring lashings*, both fastened to the section closest to the doors. One is fastened on the top layer and one on the second layer.

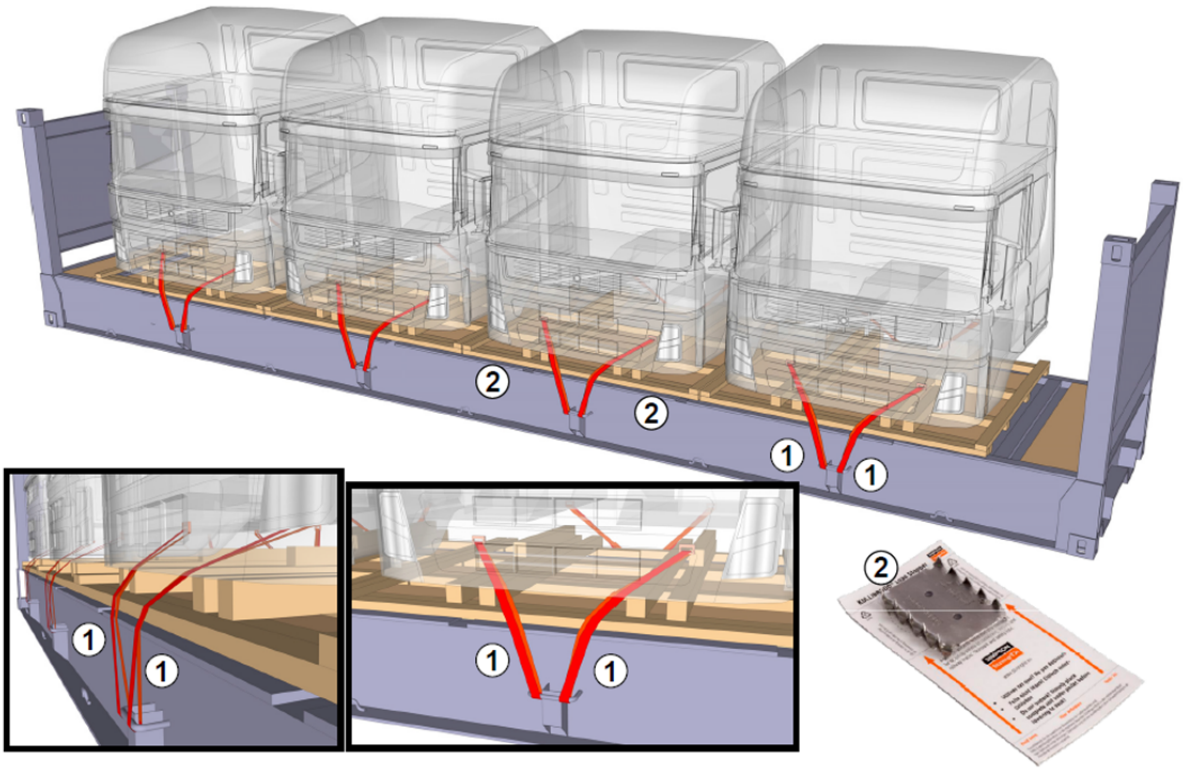
*) *The angle between the spring lashings and the platform floor do not exceed 45°.*

- Maximum 80 empty racks, stowed in five layers, are loaded into the trailer.
- If sections with different heights are loaded onto the semitrailer, the sections are to be secured with one top-over lashing per section.

VOLVO **Truck cabins on wooden skids** Road, Combined rail Sea area C 2019-03-05 Page 1 (2)

CARGO SECURING CERTIFICATE

Securing of Volvo truck cabins on wooden skids loaded on container flat racks for transport on road, combined rail and in unrestricted waters (sea area C).



① Four double web lashings with lashing capacity LC at least 2 000 daN (kg) and pre-tension S_{TF} at least 200 daN (kg). The web lashings must be protected from sharp edges.

② Four tag washers of size 48 × 65 mm are to be placed between the platform and each wooden skid.

Additional instructions are found on page 2.

The accuracy of the dimensioning data is hereby certified.

Gothenburg, Sweden, 2019-03-05

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This certifies that the securing methods in this certificate meet the Swedish Transport Agency's requirements for road TSVFS 1978:10 and for sea TSFS 2010:174 incl amendments, the European standard EN 12195-1:2010 and the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Höganäs, Sweden, 2019-03-05

MariTerm AB

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This certificate is valid for transport of Volvo truck cabins on wooden skids on container flat racks for transport on road, combined rail and in sea area C when the following conditions are met:

Dimensions

- Volvo truck cabins are of model series FH or FM and are placed on wooden skids.
- The total weight of the cabin and the wooden skid does not exceed 1 350 kg.
- The cabin is fixed to the skid in accordance with applicable instructions to withstand the transport forces. The skid is strong enough so that it will tip around its outer edges without collapsing.

Cargo transport unit/stowing

- The container flat rack floor is made of wood, plywood or plyfa and is swept clean.
- The cabin on skid is positioned laterally centered on the platform bed.
- The friction factor between skid, container flat rack floor and tag washers is $\mu = 0.30$ according to applicable regulations.
- The strength of the container flat racks fittings is at least 4.0 ton (4 000 daN).

Securing arrangement

- Each wooden skid and cabin is secured by four double straight lashings.
- The system lashing capacity (LC/MSL/SWL) of the lashings, as slings, is at least 2.0 ton (2 000 daN) and the pre-tension (S_{TF}) is at least 200 kg (daN) during the entire transport.
- The lashings are protected from sharp edges.
- Each wooden skid is secured by four tag washers (48 × 65 mm).

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