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Group of Experts for the revision of the IMO/ILO/UNECE Guidelines for Packing of Cargo Transport Units

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Item 3 of the provisional agenda
Updates on the second draft of the Code of Practice for Packing of Cargo Transport Units

Comments on the second draft of the CTU Code

Transmitted by the expert of Sweden

The comments on the second draft of the CTU Code from the expert of Sweden are presented below for consideration by the Group of Experts:

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Chapter 1. Introduction

1.1 Preamble

1.1.1 The use of freight containers, swap-bodies, vehicles or other cargo transport units substantially reduces the physical hazards to which cargoes are exposed. However, improper or careless packing of cargoes into/onto such units, or lack of proper blocking, bracing and lashing, may be the cause of personnel injury when they are handled or transported. In addition, serious and costly damage may occur to the cargo or to the equipment.

1.1.2 The person who packs and secures cargo into/onto the cargo transport unit (CTU) may be the last person to look inside the unit until it is opened by the consignee at its final destination. Consequently, a great many people in the transport chain will rely on the skill of such persons, including:

1.1.2.1 road vehicle drivers and other road users when the unit is transported;

1.1.2.2 rail workers, and others, when the unit is transported by rail;

1.1.2.3 crew members of inland waterway vessels when the unit is transported on inland waterways;

1.1.2.4 handling staff at inland terminals when the unit is transferred from one transport mode to another;

1.1.2.5 dock workers when the unit is loaded or unloaded;

1.1.2.6 crew members of a sea going ship which may be taking the unit through its most severe conditions during the transport operation as well as passengers on board RoRo passenger vessels; and

1.1.2.7 those who unpack the unit.

1.1.3 All persons, such as the above, passengers and the public, may be at risk from a poorly packed container, swap-body or vehicle, particularly one which is carrying dangerous goods.

1.2 Scope

1.2.1 The aim of this Code of Practice (CTU Code) is to give advice on safe packing of cargo transport units to those responsible for the packing and securing of the cargo and by those whose task it is to train people to pack such units. The aim is also to outline theoretical details for packing and securing as well as to give practical measures to ensure the safe packing of cargo onto or into cargo transport units.

1.2.2 The CTU Code is not intended to conflict with, or to replace or supersede, any existing national or international regulations which may refer to the packing and securing of cargo in cargo transport units, in particular existing regulations which apply to one mode of transport only, e.g. for transport of cargo in railway wagons by rail only.

1.3 Security

1.3.1 It is of important that all personnel involved in the packing, security sealing, handling, transport and processing of cargo should are made aware of the need for vigilance and the diligent application of practical procedures to enhance security, in accordance with national legislation and international agreements.

1.3.2 Guidance on the security aspects of the movement of cargo transport units intended for carriage by sea may be found in a variety of documents including the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended; the International Ship and Port Facility Security (ISPS) Code; the ILO/IMO Code of Practice on Security in Ports; and the Standards and the Publicly Available Specifications developed or being developed by the International Standards Organization (ISO) to address cargo security management and other aspects of supply chain security. Furthermore, the World Customs Organization (WCO) has developed a SAFE Framework of standards to secure and facilitate global trade.

1.4 How to use the Code of Practice (CTU Code)

1.4.1 This code of practice is split into the main text and annexes. The main text is subdivided in 15 chapters.

1.4.2 Following the introduction in Chapter 1, Chapter 2 provides an overview on key requirements, briefly described as “dos and don’ts”. Detailed information on how to comply with these “dos” and how to avoid the "don'ts" are contained in Chapters 5 to 14. Chapter 3 contains the definition of terms which are used throughout the Code. Chapter 4 outlines the consequences of improper packing procedures, thus to sensitize packers of cargo transport units on the fact that they take an important role in the safety of the transport chain. Chapter 15 provides comprehensive information on the training requirements for personnel involved in the packing of cargo transport units.

1.4.3 The annexes provide the user with additional information about specific subjects related to packing and transport of cargo transport units, such as:

1.4.3.1 acronyms

1.4.3.2 avoiding condensation

1.4.3.3 friction coefficients

1.4.3.4 specific packing calculation

1.4.3.5 inspection criteria for freight containers

1.4.3.6 description of tilting test

1.4.3.7 quick lashing guide

The list of annexes has to be updated

Chapter 2. Definitions

Allowable stacking mass	The maximum total mass of containers that may be stacked on the CTU
Ambient temperature	the temperature of a surrounding body. The ambient temperature of a container is the atmospheric temperature to which it is exposed,
Anchor points	eyes, rings or hoops fitted to the bottom side rail of containers and other CTC for anchoring lashing equipment.
Articulated vehicle	any motor vehicle with a trailer having no front axle and so attached that part of the trailer is superimposed upon the motor vehicle and a substantial part of the mass of the trailer and its load is borne by the motor vehicle. Such a trailer shall be called a semi-trailer or articulated trailer.
Barge	non sea-going conveyance used on inland or protected coastal waters to carry loose cargo or containers in small volumes
Basket wagon	a rail wagon with a demountable sub frame, fitted with devices for vertical handling, to allow the loading and unloading of semi-trailers or road vehicles, also known as spine wagon or packet wagon.
Big bag	a removable internal liner, strong enough to be lifted and to carry bulk cargoes of different types, also known as a flexible intermediate bulk container (FIBC)
Blocking	Securing method where the cargo lies against fixed structures or fixtures on the CTU, may be in the form of headboards, sideboards, walls, stanchions, wedges, supporting beams, or other devices
Bulk cargo	cargo which are intended to be transported without any intermediate form of containment in bulk packagings or portable tanks,
Bull rings	cargo–securing devices mounted in the floor of containers; allow lashing and securing of cargo, see also anchor points.
Cargo	any goods, wares, merchandise and articles of any kind which are intended to be transported
Cargo transport unit (CTU)	a freight container, swap-body, vehicle, railway wagon or any other similar unit [in particular when used in intermodal transport]
Cargo unit	one pcs of cargo as pallet, bundle, box, create etc.
Carrier	any person or entity who, in a contract of carriage, undertakes to perform or to procure the performance of carriage by rail, road, sea, air, inland waterway or by a combination of such modes.
Centre of gravity	a virtual position within a body or group of bodies of distinguished arrangement which practically represents the body or group of bodies in all statistical and dynamical respects of mass and inertia; it is therefore also referred to as centre of mass
Chassis	a trailer composed of a simple frame comprising of longitudinal main beams, transverse beams and wheels, also known as skeletal trailer
Combined transport	European term to describe intermodal transport where part of the journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road.
Compacting	application of securing devices in order to compact a group of cargo units; there is no direct or indirect transfer of forces to the CTU structure. Thus compacting must necessarily always be combined with means of direct securing or friction securing
Consignee	A person to whom a cargo is consigned under a contract of carriage or a transport document or electronic transport record.

Consignment	any package or packages, or bulk cargo presented by a consignor for transport and sent under a single contract of carriage
Consignor	the party who prepares a consignment for transport; normally, this is the producer or the distributor of the goods. If the consignor contracts the transport operation with the carrier, the consignor is also the shipper
Consolidation	the grouping together of several consignments into a full load
Consolidator	A person or firm performing a consolidation service for others. The consolidator takes advantage of lower full carload (FCL) rates, and passes on the savings to shippers.
Container	an item of transport equipment that is of a permanent character and accordingly strong enough to be suitable for repeated use; it is designed to transport a number of receptacles, packages, unit loads or overpacks together from the packing point to its final destination by road, rail, inland waterway and/or sea without intermediate separate handling of each package or unit load.
Container terminal	a docking, unloading and loading area within a port designed to suit the sizes and needs of container ships
Corner fitting	fixed points usually located at the top and bottom corners of a container into which twistlocks or other devices engage to enable the container to be lifted, stacked and secured. See also intermediate fittings
Dangerous goods	packaged dangerous, hazardous or harmful substances, materials or articles, including environmentally hazardous substances (marine pollutants) and wastes, covered by the International Dangerous Goods Regulation
Direct lashing	a lashing directly connected from a lashing point on a cargo unit to a lashing point on the CTU
Direct securing	application of lashings, shores, blocking arrangements or locks in order to directly transfer external forces acting on the cargo to the CTU structure; such securing devices should be arranged as close as possible in the direction of the desired force transfer
Discharge	unloading of liquid or solid bulk cargo from a containment under pressure or by gravity
Dolly	a set of wheels that support the front of a semi-trailer; used when the tractor unit is disconnected or to form a full trailer from a semi-trailer.
Dunnage	material used around cargo to prevent breakage or shifting, normally provided by shipper. Its weight is included in the rating.
Flexitank	A bladder that is designed to fit inside a general freight container and which converts that freight container into a non-hazardous bulk liquid transport unit. It is not an approved form of packaging for the carriage by sea of dangerous goods classified under the International Maritime Dangerous Goods (IMDG) Code.
Forwarder	the party who delivers goods for shipment either on its own behalf or for a consignor, normally based on a transport contracts with one or several carriers
Freight container	Another term used to describe a container
Freight forwarder	the party who organises shipments for individuals or other companies and may also act as a carrier. A forwarder is often not active as a carrier and acts only as an agent, in other words as a third-party (non-asset-based) logistics provider who dispatches shipments via asset-based carriers and that books or otherwise arranges space for these shipments
Friction securing	application and pre-tensioning of lashings in a way to increase the vertical force to the stowage place on the CTU and thereby create additional friction; other names for this securing technique are "over-the- top lashing", "tie-down lashing", "friction loop"

Full container load (FCL)	A single consignment packed into a container, irrespective of the volume used. May also refer to full truck load (FTL), full car load (FCL) or full wagon load (FWL).
Full trailer	a trailer supported by front and rear axles and pulled by a drawbar; the full trailer may comprise of a semi trailer and a detachable dolly
Fumigated container	a closed cargo transport unit containing goods or materials that either are or have been fumigated within the unit; the fumigant gases used are either poisonous or asphyxiant and are usually evolved from solid or liquid preparations distributed within the unit
Gantry crane	an overhead crane comprising a horizontal gantry mounted on legs which are either fixed, run in fixed tracks or on rubber tyres with relatively limited manoeuvre; the load can be moved horizontally, vertically and sideways
Gross mass	the combined mass of the CTU, all the packages, any dunnage used and the securing materials.
Groupage	See Consolidation
Half loop lashing	~~a lashing placed in a half turn around a cargo unit, most frequently vertically, but it can also be applied horizontally . Both ends of the half loop are secured to the same side; this lashing has a positive securing capacity and counts as two lashings to the side where it is secured to the CTU; the half loop is allocated to the direct securing principle~~ a lashing placed in a half turn around a cargo unit, horizontally or vertically, where both ends are secured to the same side; this lashing has a positive securing capacity and counts as two lashings to the side where it is secured to the CTU; the half loop is allocated to the direct securing principle
Handling	the operation of loading or unloading/discharging of a ship, railway wagon, vehicle or other means of transport
Intermediate bulk container (IBC)	a portable packaging that: - has a capacity of not more than 3 m^3; - is designed for mechanical handling; - is resistant to the stresses produced in handling and transport, as determined by tests
Intermediate fitting	fixed points usually located along the length of the top and bottom rails of a container into which twistlocks or other devices engage to enable the container to be lifted, stacked and secured. See also corner fittings
Intermediate lift truck	a truck equipped with devices such as arms, forks, clamps, hooks etc. to handle any kind of cargo, including cargo that is unitised, overpacked or packed in CTUs
Intermodal	refers to the movement of CTUs on all forms of surface transport modes (road, rail and sea) without the need for adjustment or alteration to the CTU or transport mode
Intermodal loading units (ILU)	See cargo transport unit
Lashing	securing method where bendable devices are used in the securing on cargo to a CTU
Less than container load (LCL)	Common term for an amount of goods to be shipped and which do not fill an entire container. Also less than truck load (LTL), less than car load (LCL) and less than wagon load (LWL).
Logistics	the process of designing and managing the supply chain in the wider sense; the chain may extend from the delivery of supplies for manufacturing, through the management of materials at the plant, delivery to warehouses and distribution centres, sorting, handling, packaging and final distribution to point of

	consumption
Manifest	Entire listing of all cargo on board a vessel as required by the relevant local authorities e.g. customs. Same as cargo manifest.
Mass	the absolute quantity of a substance measured in ~~lbs,~~ kg~~, tons~~ or tonnes
Maximum gross mass	the maximum permissible mass of cargo packed into a CTU combined with the mass of the CTU, also referred to as the rating and would normally be marked onto CTUs as appropriate
Maximum payload	the maximum permissible mass of cargo to be packed into or onto a CTU. It is the difference between the maximum gross mass or rating and the tare mass, which are normally marked on CTUs as appropriate
Misdeclared	term used to describe the action of not accurately stating the gross mass or cargo being shipped.
Multimodal	refers to CTUs that are designed for use on more than one mode of transport
Multimodal transport	carriage of goods by two or more modes of transport
Net mass	mass of the goods alone without any immediate packaging.
Out of gauge (OOG)	cargo which exceeds the internal dimensions of the CTU in width, length or height
Overloaded	a CTU where the combined mass of the cargo and the CTU is greater than the maximum permissible gross mass
Overpack	an enclosure used by a single shipper to contain one or more packages and to form one unit for convenience of handling and stowage during transport
Overweight	a CTU where the combined mass if the cargo and the CTU is greater than the maximum permissible on one or more modes of transport, but less than the maximum permissible gross mass of the CTU.
Packages	the complete product of the packing operation, consisting of the packaging and its contents as prepared for transport
Packaging	receptacles and any other components or materials necessary for the receptacle to perform its containment function
Packer	the party that places the goods within the CTU; the packer may be contracted either by the consignor, by the shipper or by the carrier; if the consignor or the shipper packs a CTU within his own premises, the consignor or the shipper is also the packer
Packing	the stowage, securing and verification of the mass of packaged and/or unitized or overpacked cargoes into CTUs
Pallet	a term used for a load-carrying platform onto which loose cargo is stacked before being placed inside a container; it is designed to be moved easily by fork-lift trucks
Platform	specific-purpose container that has no superstructure whatever, but has the same length, width, strength requirements and handling and securing features as required for interchange of its size within the ISO family of containers
Reach stacker	tractor vehicle with front equipment for lifting, stacking or moving CTUs
Receiver	the party who unloads the goods from the CTU; the receiver may by contracted either by the consignee or by the carrier; if the consignee unloads a CTU within his own premises, the consignee is also the receiver
Reefer	industry term for an insulated container, equipped with an automated system to control a pre-definable condition of temperature, humidity and gas concentration, requiring power supply

Roll on – roll off (RO-RO)	loading and unloading of a road vehicle or a wagon on or off a ship on its own wheels or wheels attached to it for that purpose
Securing arrangement	a suitable arrangement of securing devices
Securing device	a suitable combination of securing elements forming a lashing or a blocking arrangement
Securing element	a single piece of securing equipment like a lug, shackle, turn buckle, wire, wire clip, chain, fibre belt or a securing point on the cargo unit
Semi-trailer	a non-powered vehicle for the carriage of goods, intended to be coupled to a motor vehicle in such a way that a substantial part of its weight and of its load is borne by the motor vehicle; semi-trailers may have to be specially adapted for use in combined transport
Ship	a seagoing or non-seagoing watercraft, including those used on inland waters
Shipment	the specific movement of a consignment from origin to destination
Shipper	Legal entity or person named on the bill of lading or waybill as shipper and/or who (or in whose name or on whose behalf) a contract of carriage has been concluded with a carrier. Also known as consignor.
Silly loop	the silly loop is a lashing placed around a cargo unit with its ends fastened and tightened to opposite sides. This lashing gives only little protection against sliding of the cargo unit if the friction between the lashing and the unit is insufficient to retain the cargo. This loop is called "silly" because it falsely pretends to give two independent lashings. The silly loop is allocated to the friction securing principle
Spreader	Adjustable fitting on lifting equipment designed to connect with the upper corner fittings of a CTU; spreaders may have in addition grappler arms that engage the bottom side rails of a CTU
Spring lashing	a lashing which is drawn around an end section of a cargo unit from one side of the CTU to the other and thus prevents sliding and tipping forward or backward. The spring lashing supports the direct securing principle
Stacking	storage or carriage of CTUs on top of each other
Stowage	the positioning of packages, IBCs, containers, swap-bodies, tank-containers, vehicles or other CTUs on board ships, in warehouses and sheds or in other areas such as terminals.
Straddle carrier	a rubber-tyred overhead lifting vehicle for moving or stacking containers on a level reinforced surface
Stripping	unpacking cargo from a CTU
Stuffing	packing cargo into a CTU
Swap body	a freight carrying unit optimised to road vehicle dimensions and fitted with handling devices for transfer between modes, usually road/rail, most frequently used in Europe
Tare mass	mass of a CTU without cargo
TEU	twenty-foot Equivalent Unit; a standard unit based on an ISO container of 20 feet length (6 m), used as a statistical measure of traffic flows or capacities; one standard 40' ISO container equals 2 TEUs
Top over lashing	a lashing placed in a vertical plane over a cargo unit from one side to the other. Its securing effect depends solely on the pre-tension and the applicable friction coefficient between the cargo unit and the stowage ground; the top over lashing is allocated to the friction securing principle

Trailer	any road vehicle without a motive power unit, and includes semi-trailers, semi-trailers with front axle dollies, full trailers and drawbar trailers
Transport	the movement of cargo by one or more modes of transport
Twistlock	standard mechanism on handling equipment which engages and locks into the corner or intermediate fittings of CTUs; also used on ships and vehicles to fix CTUs
Unit load	a number of packages that are: • placed or stacked on and secured by strapping, shrink-wrapping or other suitable means to a load board such as a pallet; or • placed in a protective outer enclosure such as a pallet box; or • permanently secured together in a sling
Unpacking	the removal of cargo from CTUs
Vehicle	a road vehicle (including an articulated vehicle, i.e. a tractor and semi-trailer combination), railroad car or railway wagon. Each trailer shall be considered as a separate vehicle.
Vessel	any seagoing vessel or inland waterway craft used for carrying cargo

Chapter 3. Key requirements

Kommentar [B1]: Requirements or Key r..?

3.1 Introduction

3.1 This chapter outlines the key requirements for planning, packing and securing, handling and transport as well as unpacking cargo transport units. The points raised are covered in more detail in the following chapters of the Code. [11.0 and 14.0 to 16.0].

3.2 General

3.1.1 Do arrange for a safe working environment:

- Use safe and appropriate handling equipment only
- Do use proper handling techniques
- Use appropriate personal protection equipment and and ensure that all safety devices are operating correctly.
- Do not smoke, eat or drink alcohol during packing, securing or unpacking.

3.1.2 Do check that the cargo securing equipment are clean and in sound working condition. (see 10.4).

3.2 Planning

3.2.1 Do select the most suitable CTU type to accommodate the cargo for the intended voage. (see Annex XV)

3.2.2Do check that the CTU is clean, dry and apparently fit to receive the goods

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3.2.33.2.2 When required prepare a packing plan showing each package (dimensions and mass). (see XXXX.)

3.2.43.2.3 Do not exceed the maximum permitted gross mass[1] of the CTU or maximum allowed mass according to national or international regulations.

3.2.53.2.4 Do select the securing methods best adapted to the characteristics of the CTU and the cargo.

3.3 Packing

3.3.1 Do check that the CTU is clean, dry and apparently fit to receive the goods

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3.3.13.3.2 Do distribute heavy packages appropriately over the floor area[2] (see XXXX);

3.3.23.3.3 Do not pack heavy loads with a small footprint unless the load is spread appropriately (see Figure 3-1Figure 3-1 & Figure 3-2Figure 3-2). When applicable allow sufficient space in the plan for the load distribution bearers;

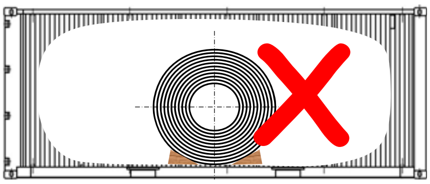

Figure 3-1 : Concentrated load The red cross shall be moved

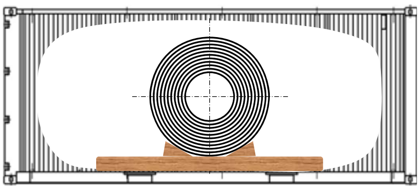

Figure 3-2 : Distributed load

3.3.33.3.4 Do keep the centre of gravity as low as possible and near the centre line of the CTU. If the CTU is to travel by road or rail, ensure that the packing plan distributes the load in line with the load distribution plan, load is distributed so that individual axles are neither over nor under loaded. For containers individual packages should be distributed so that the centre of gravity is close to half-

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[1] Gross mass = maximum payload + tare of the CTU. Payload is the mass of the cargo plus the mass of securing equipment and dunnage.

[2] As a rule of thumb, do not exceed 3,750 kg per linear m (2,500 lb per linear foot)

length of the CTU and as low as possible - If this is not possible ensure that the eccentricity is less than 5% of the container length (see orange area in Figure 3-3Figure 3-3).

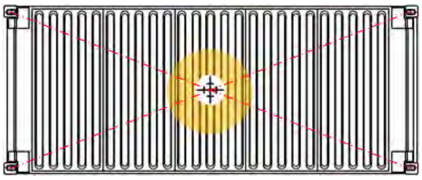
Figure 3-3 : Recommended location of CoG in a container

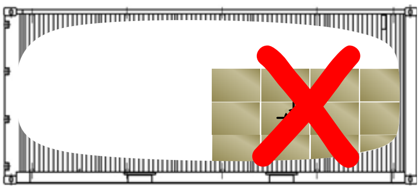
Figure 3-4 : Eccentrically packed CTU

3.3.43.3.5 Do not load a container with eccentric load distribution (see Figure 3-4Figure 3-4)

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3.3.53.3.6 Wherever possible use a block stack when planning the packing of regular packages see Figure 3-5Figure 3-5).

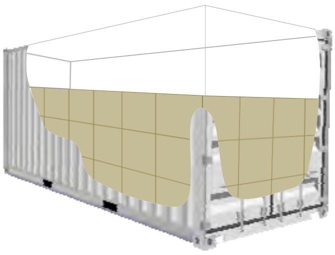
Figure 3-5 : Block stacked packages

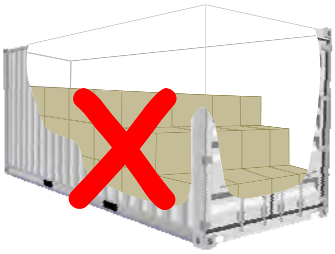
Figure 3-6 : Irregular stacked packages

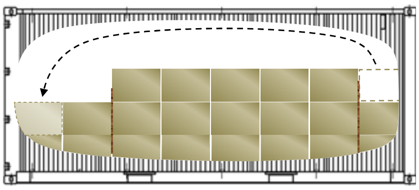
Figure 3-7 : Forming regular stacks

3.3.63.3.7 If there are insufficient packages to complete full layers do not stack in irregular layers (see Figure 3-6) but rearrange the tiers of packages so that they are more regular (see Figure 3-7).*Do not build up irregular layers of packages if it could be avoided (see Figure 3-6 and 3-7).*

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3.3.73.3.8 Don't stow heavy packages on top of light goods

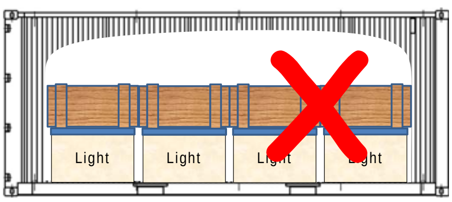

Figure 3-8 : Heavy over light

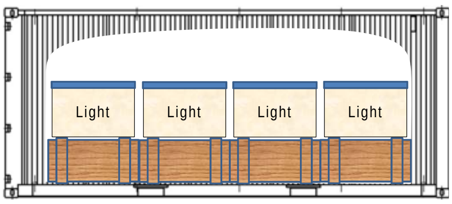

Figure 3-9 : Light over heavy

3.3.83.3.9 Do not stow goods with tainting odours with sensitive merchandise;

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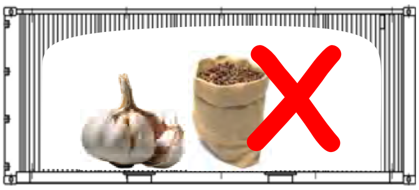

Figure 3-10 : Tainting and sensitive goods

~~3.3.9~~3.3.10 Where possible with mixed dry and liquid goods, ~~loads, prepare a plan where packages containing the~~ liquid goods should be stowed on the bottom tiers with dry goods on top;

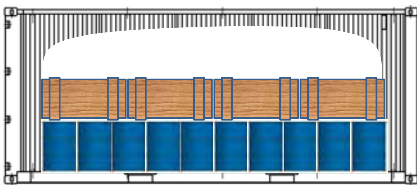

Figure 3-11 : Dry over wet goods

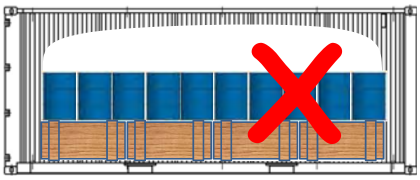

Figure 3-12 : Wet over dry goods

~~3.3.10~~3.3.11 Avoid packing wet or damp packages;

~~3.3.11~~3.3.12 Observe all the care marks and handling instructions on packages such as "Fragile" or "This side up"

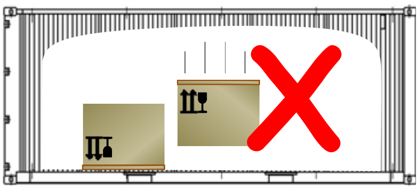

Figure 3-13 : Observe handling instructions

~~3.3.12~~3.3.13 Do not use securing or protection equipment which is incompatible with the cargo. Use corner and / or guards to protect lashings from sharp edges where applicable.

3.4 Packing of dangerous goods

3.4.1 Do not pack incompatible goods which have to be segregated;

3.4.2 Do not pack if the packaging is damaged;

3.4.3 Do check all packages and properly marked and labelled;~~overpacks are correctly marked. Use appropriate labels and placards to identify packages containing dangerous goods;~~

3.4.4 Do p~~P~~ack dangerous cargo~~hazardous cargo~~ near the doors where possible;

3.4.5 Do affix required placards on the exterior of the CTU (see **Fel! Hittar inte referenskälla.**~~**Error! Reference source not found.**~~).

3.5 Securing

3.5.1 Secure the cargo by locking, blocking, lashing or a combination of these methods to prevent all cargo units from sliding and tipping in all directions.

3.5.2 Do fill void spaces wherever necessary. ~~The transport mode will dictate the size of gap that is acceptable. Gaps between rigidly packed pallets may be acceptable when transported by road, but would not be acceptable when shipped in a container by sea~~.

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Kommentar [B2]: IS a chapter on ISO handling instructions to be included?

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Kommentar [B3]: IMO – reference to IMDG Code

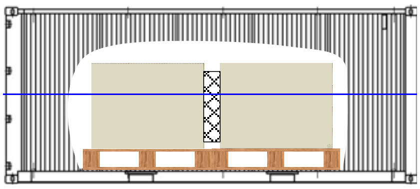


Figure 3-14 : Gap filled

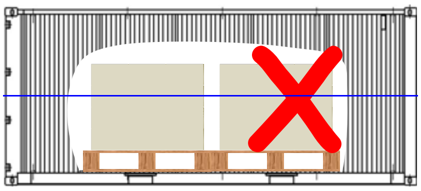


Figure 3-15 : Gap not filled

3.5.3 Do not use clamps or other loading devices unless the goods can withstand them;

3.5.4 When the cargo is secured by blocking, do block the cargo in a way that forces are distributed over a sufficiently large area of the unit;

3.5.5 Do not block the cargo with devices that over stress the CTU;

3.5.6 Wherever necessary use securing equipment such as friction mats, walking boards, straps, edge beams, etc.;

Formaterat: Färgöverstrykning

3.5.7Do secure each single loaded item so that it is prevented from sliding and tipping in all directions during the intended voyage;

Formaterade: Punkter och numrering

3.5.83.5.7 Do not overstress securing devices including anchor points on the CTU or tighten / inflate the securing devices so as to damage the packages;

3.5.93.5.8 Do fasten web lashings belts using the appropriate tensioner, do not use knots.

3.5.103.5.9 Do use hooks or shackles to attach lashings to anchor and lashing points on the CTU when applicable.

3.6 On completion of packing

3.6.1 Do dDetermine the correct gross mass of the CTU. Never load a total mass above the permitted payload limits of the CTU, i.e. the combined mass of the cargo and the CTU must not exceed the CTU's maximum gross or safe working load or load a total mass so that the combined mass of the road vehicle and / or CTU exceed any road or rail regulations applicable on the transit;

3.6.2 Do affix a seal [when required].

3.6.3 When required dDo include the CTU number, the correct gross mass and, when required, the seal number in the transport documents.

3.6.4 Do provide a packing certificate when required.

3.7 Unpacking

3.7.1 Before accepting the CTU check that the identification number on the CTU and when the CTU is seal that the seal serial number are as shown on the transport documentation. If there is any difference check with the transport operator to confirm the reason for the change (see 14.X);

3.7.2 Do check the exterior of the CTU for signs of recent damage, leakage or infestation (see XXXX);

3.7.3 Do use proper equipment to cut the seal where applicable. Properly sized cutting equipment and a safe surface from which the seal can be cut are essential (see chapter 14.X);

3.7.4 Do open the CTU with caution as cargo might fall out. Do not open both doors if the CTU is laden with bulk liquid or solids.

3.7.5 Do check the interior of the CTU prior to unloading to confirm the condition of the packages and note any damages or movement and record every package as it is removed noting any markings and damages.

3.7.6 Do remove all dunnage for re-use, recycle or dispose, unless otherwise agreed.

3.7.7 Do clean the interior of the CTU to remove all residues of the cargo, especially loose powders, grains and noxious materials, unless otherwise agreed.

3.7.8 Do remove all dangerous goods marks and placards from the exterior, or any packing information on the interior of the CTU as part of the cleaning process.

Chapter 4. CONSEQUENCES OF IMPROPER PACKING PROCEDURES

4.1 Consequences of badly packed and secured cargo

4.1.1 Cargo which has not been properly packed and sufficiently secured in a cargo transport unit may move inside the unit when it is exposed to acceleration, e.g. by hard braking of a vehicle on the road or by heavy ship motions at sea. Moving cargo may generate accidents, damage to the cargo, to other cargo or to the cargo transport unit. In particular heavy cargo items may develop inertia forces under such traffic accelerations, which may let them break through the CTU boundaries, menacing persons, environment or property of third parties.

Figure 4-1 : Lack of longitudinal securing

Figure 4-2 : Inadequate side wall strength

4.1.2 Figure 4-1 shows an example where hard braking and a lack of longitudinal securing has resulted in the cargo breaking through the container doors. Figure 4-2Figure 4-2 shows a second example where the cargo has been secured against a vehicle side with inadequate strength.

4.1.3 Cargo breaking out of CTUs is of particular danger on board RoRo vessels, where shifting cargo and CTUs may affect safe operations on the vehicle deck or the stability of the ship (See Figure 4-3 and to Figure 4-4Figure 4-54).

Figure 4-3 : Cargo having breaked out of a trailer~~Loose cargo on Ro-Ro vessel~~

Figure 4-4 : ~~Spilled~~ Shifted cargo on a Ro-Ro deck

Figure 4-5 : heavily listing vessel after a partial cargo shifting

4.1.4 Cargo having broken out of a trailer has caused other trailers to shift and the vessel to get a heavy list (see **Fel! Hittar inte referenskälla.**~~Figure 4-5~~)

4.1.5 Damage to the cargo is always an economic loss. Additionally, in case of dangerous goods, any damage to a receptacle may impair its containment capability and cause spillage of the contents ~~(see Figure 4-6),~~ thus endangering persons and affecting the safety of the transport vehicle or ship.

Figure 4-6 : Unsecured packages falling out when the doors are opened

Figure 4-7 : Loose packages on rail wagon

4.1.6 Spilled cargo may also endanger the environment. Cargo from road or rail transport may cause contamination of the soil and/or water, and marine pollution when released at sea..

Figure 4-8 : Spilled liquid dangerous goods

Figure 4-9 : Broken IBCs

4.2 Consequences of insufficient control of humidity

4.2.1 Some CTUs like containers present a closed box with a specific micro climate. During a long distance transport the humidity contained in the goods and in the packing material including timber used for blocking and protection may condensate on the inner boundaries of the container or on the cargo or even within the cargo. If sensible goods are packed carelessly into such a closed CTU, mainly box containers for sea transport, metal parts, if not properly protected, may corrode, clean surfaces may be stained and organic materials may suffer from mould or rot or other degradation.

Figure 4-10 : Mould damage

Figure 4-11 : Condensation damage

4.2.2 In particular hygroscopic cargoes have a variable water content. In ambient air of high relative humidity, they absorb water vapour, while in ambient air of low relative humidity, they release water vapour. If packed into a container in a climate of high relative humidity they would bring a considerable amount of water into the container, providing for an internal high relative humidity. This water may be released from the goods during temperature changes and may condensate with the above mentioned consequences. If this threat has not been averted by pre-drying the cargo to a so-called "container-dry" state, the high water content may result in mould, rot and biochemical changes. For some products, these phenomena are also associated with self-heating, which may go as far as spontaneous combustion, for example with oil seeds, oil seed expellers and fish meal. Extensive information may be found under www.containerhandbook.de.

4.3 Consequences of the use of unsuitable CTUs

4.3.1 A CTU should be suitable for the distinguished cargo to be packed. Climatically sensible cargoes may require ventilated containers or moreover CTUs with controlled atmosphere (reefer or heated containers) to avoid serious damages or losses. Heavy cargo units may require CTUs capable to carry concentrated loads on narrow foot prints to avoid structural failure or overloading (see Section 4.4 below).

4.3.2 CTUs showing structural deficiencies may fail under normal transport conditions, e.g. the bottom of a damaged container may collapse when the container is lifted, the front wall of a damaged road vehicle may give way upon hard braking or goods in a container with leaking roof may suffer from entering water. This makes a thorough pre-check of each CTU indispensable before packing may commence.

Figure 4-12 : Ice from leak in door gasket

Figure 4-13 : Overstressed floor

4.4 Consequences of overloading of CTUs

4.4.1 A CTU overloaded by excess mass presents a serious threat to the safety of work of the various persons along the chain of transport, who are in charge of handling, lifting or transporting the CTU. This applies to all modes of transport on road, rail and sea.

4.4.2 There are many hazards associate with an overloaded CTU:

4.4.2.1 When loading or unloading the CTU on or off a ship, vehicle or rail-car and handling the CTU by mobile lifting equipment in a terminal area may result in a failure of the lifting equipment.

4.4.2.2 While attempting to lift an overloaded CTU from a ship, vehicle or rail-car, the lifting equipment may have inadequate lifting capacity and the lift fails (see Figure 4-14) or is aborted. An unacceptable delay will occur while a replacement device with greater capacity is sourced.

Figure 4-14 : Tipped container handler (© abc.net.au)

4.4.2.3 Where cranes and lifting equipment are equipped with weight limit controls such failures may not occur, however, as these controls are designed to protect the crane from overstressing, they may not detect that the CTI is overloaded. As a consequence the overloaded CTU will enter transport chain and may cause an accident where the CTU turns over or falls from the transport equipment.

4.4.3 A CTU that is not overloaded, i.e. the gross mass of the CTU is less than the maximum permissible mass of the CTU, may be packed with cargo so that the gross mass exceeds the permissible gross mass of the vehicle. This hazard may be aggravated by the road vehicle's driver being unaware of the excess mass, and as a consequence may not adjust his driving habits accordingly. A similar hazard may arise from the specific conditions in intermodal road/rail transport, as rail-car design does not provide for a sufficient overweight safety margin.

4.4.4 In view of the above, all efforts should be taken to prevent exceeding the maximum gross mass of the CTU or the capacity of the transport medium. However, if a unit is found to be overloaded or over weight, it may be:

4.4.4.1 returned to the originator for removal from the transport unit;

4.4.4.2 removed from service until it has been repacked to its maximum gross mass. , 4.4.5 Any action that increases the number of transport movements and / or lifting operations increases the risk of an incident occurring and decreasing the efficiency of the supply chain. Deviations from standard operating procedures and boundaries may result in incidents that mat result in injuries to drivers, operators and third parties or damage to the cargo, the CTU or the infrastructure.

4.5 Consequences of improper documentation and misdeclaration

4.5.1 Missing or incomplete documentation may hamper the proper planning or executing the packing of a CTU. It may also interfere with the further transport and generate delays and thereby economic losses. This applies also to the correct and timely communication of non-technical information like the identification number or the seal number.

4.5.2 Missing information to the carrier identifying extraordinary cargo properties, such as out of gauge packages (over height, over width or over length), overweight or offset of centre of gravity, may cause damage to the cargo due to inadequate handling methods that could not be adjusted to meet the unusual properties of the packed CTU.

4.5.3 Missing or incorrect information on dangerous goods may lead to improper stowage of the CTU on the transport vehicle, in particular a ship. In case of an incident such as spillage or fire, missing dangerous goods information will impede emergency response actions.

4.5.4 Incorrect gross mass declared for a CTU could result in overloading of a road vehicle or a rail car, especially if two or more units are loaded on one vehicle or one rail car. In case of sea transport, improper mass declaration of a container may result in an improper stowage position on board the ship and thereby in a fatal overstressing of the securing equipment for a stack of containers.

Figure 4-15 : Failed stack of containers (© KIMO International)

Chapter 5. Chains of Responsibilities and information

5.1 Chain of responsibility

5.1.1 Legal responsibility for damages to people, the environment, the cargo and properties due to inadequately packed and secured cargo, is a very complicated issue. This is due partly to the large number of persons and parties that can be held responsible, and partly by transport being governed by many agreements, laws and conventions that interlock in different ways. It is important to separate cargo damage from damages to the CTU, its surroundings or persons, generally called "third party".

5.1.2 In general, transport operations, and in particular transport operations with cargo transport units, involve various responsible parties, which are included in a chain of responsibilities. It is important that the cargo in the CTU is properly packed and secured before the transport starts as the parties following in the transport chain trust that ~~At the end, the cargo is delivered to the carrier for carriage and the carrier has to trust that the properties of the CTU and its contents are properly described and that~~ the CTU is safe for transport.

5.1.3 In case of intermodal transport, normally various different carriers are involved in the transport chain. It may even happen, that one enterprise, acting as carrier in a first leg of a transport chain, contracts the next leg with another carrier and thus becomes a ~~shipper~~ consignor for the purpose of that second leg in this transport chain.

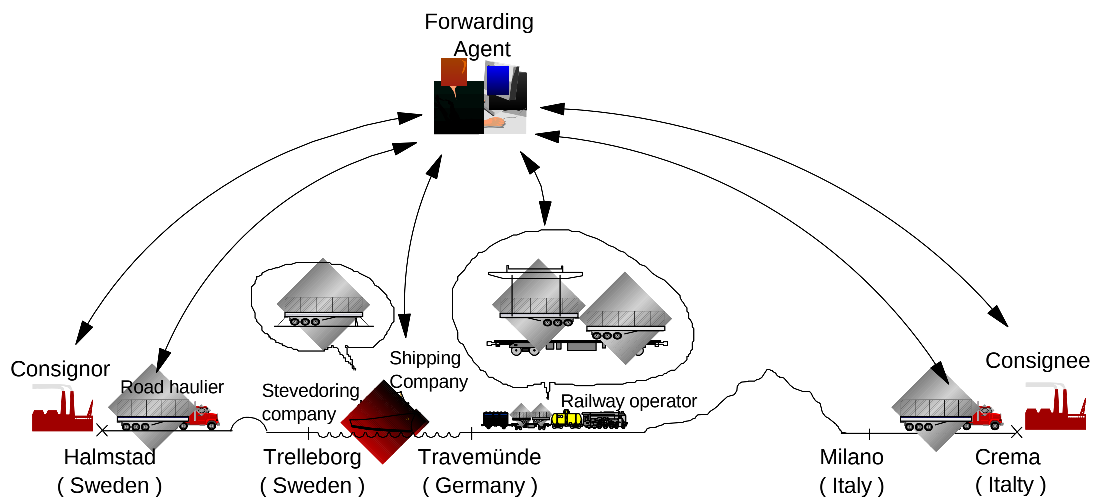
~~5.1.4 The carrier is not responsible for the condition of a CTU. He trusts that the shipper delivers a cargo which is safe and suitable for transport. Thus, the shipper will be blamed by the carrier for any deficiencies of the CTU. However, when the shipper is neither the packer nor the consignor, the shipper had to trust that the packer or the consigner did fulfil their obligations. The shipper will blame these parties for any faults which had been committed within their respective responsibilities.~~

~~5.1.5~~5.1.4 Within this chain of responsibilities, the next party in the chain always trusts that all others, who were previously engaged, did comply with their individual responsibilities. ~~In case of any faults or deficiencies causing problems to the carrier, the responsibility comes first to the shipper and then goes back to that party being originally responsible for the respective action.~~

~~5.1.6~~5.1.5 All persons involved in the movement of CTUs also have a responsibility to ensure that the CTU is not infested with insects or other animals, or that the CTU is not carrying illegal goods or immigrants, contraband or undeclared or miss-declared cargoes.

~~5.1.7~~5.1.6 The most common parties connected to an intermodal cargo transport chain are:

- **The consignor (shipper)**, normally identified as the vendor of the cargo
- **The consignee**, normally identified as the buyer of the cargo
- **The packer,** who packs the cargo into a CTU
- **The ~~shipper~~forwarder**, who supplies/organises the transport
- **The road haulier**, who executes the road transportation
- **The railway operator**, who executes the transportation by rail
- **The port facility**, which performs loading/unloading and stowing on ships
- **The shipping company**, which performs the sea transportation



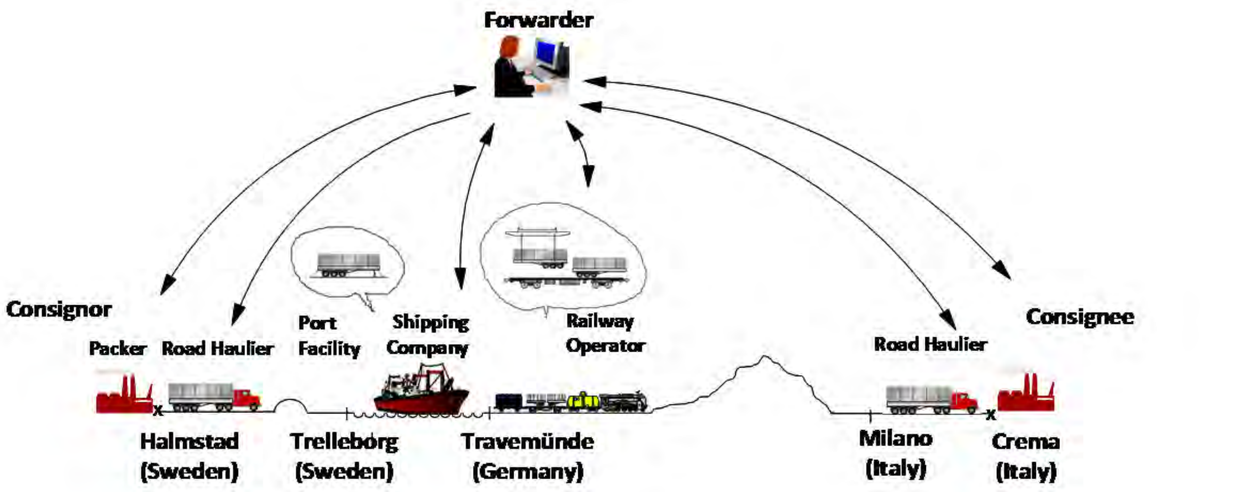


Figure 5.1: Example of a combined transport chain from Sweden to Italy

~~5.1.8~~5.1.7 The liabilities for cargo damages are normally regulated in the transport contract, other agreed documents or conventions. Various modes of transport have their own convention and they can be more or less international like CMR for international road traffic in Europe. If the parties in the business contract cannot agree on the responsibility for cargo damages caused by insufficient cargo securing they could sue each other in a business court to get compensation for lost value etc.

~~5.1.9~~5.1.8 The legal responsibility for injuries on people, environmentally and property damages are regulated by public law e.g. traffic legislation, environmentally legislation etc. If one part in the transport chain breaks a law they could in some cases get fines at the place (traffic police) or prosecuted in a public court. The consequences if they are found guilty in the court are fines or prison. Almost every country has its own public legislation regarding securing cargo.

~~5.1.10~~5.1.9 Between the different parties involved in an intermodal transport chain, the tasks are assigned as follows:

~~5.1.10.1~~5.1.9.1 The consignor is "responsible" that

- the goods are correctly described including the mass of each item of goods as well as the total payload;
- unusual transport parameters such as extraordinary cargo properties, the offset of the centre of gravity or transport temperatures which should not be exceeded or undercut, are properly communicated to the ~~shipper~~ forwarder or carrier;
- packages and unit loads are suitable to withstand the stresses which are to be expected under normal transport conditions;
- dangerous goods are correctly classified, packed and labelled;
- if applicable the dangerous goods transport document is completed and signed and transmitted to the packer, forwarder and carrier as applicable.

~~5.1.10.2~~5.1.9.2 The packer is "responsible" that

- the ~~a suitable~~ cargo transport unit (CTU) ~~is~~ used, suits~~according to~~ the properties of the cargo;
- the CTU is checked with respect to parts of importance for the transport of the cargo~~serious deficiencies~~;
- the floor of the CTU is not overstressed during packing operations;
- the cargo is correctly distributed in the CTU and properly supported according to given instructions~~where necessary~~;
- the CTU is not overloaded;
- the cargo is sufficiently secured in the CTU if so agreed;
- the CTU is properly closed and sealed if so required by the applicable mode of transport;
- any marks and placards required by Dangerous Goods Regulations are affixed to the CTU if

not agreed that this is done by the carrier;

- the pay load of the cargo, and when the tare mass of the CTU is given, also the gross mass of the CTU is properly determined;
- in case of a shippers own container ~~CTU~~ with a reduced stacking capacity (less than 192,000 kg marked on the CSC Safety Approval Plate)[1], this fact is communicated to the forwarder/carrier;
- all shipping documents including verified pay load of the cargo, information on the contents of the CTU, ~~the verified gross mass~~[2], the seal number (where applicable) and any extraordinary properties of the cargo are transmitted to the ~~shipper~~forwarder/carrier;
- in case of container transports, the verified gross mass[3], is transmitted to the forwarder/carrier;
- a CTU packing certificate, when required, is completed and signed and transmitted to the ~~shipper~~forwarder/carrier.

~~5.1.10.3~~5.1.9.3 The ~~shipper~~ forwarder is “responsible” that

- the work distribution concerning packing and securing is clearly agreed and communicated to the consignor/packer and carrier/carriers
- a suitable CTU is used for the intended cargo for the intended transport
- the CTU used for the intended transport is in good condition, checked for serious deficiencies and cleaned before supplied to the consignor or packer
- suitable modes of transport are selected to minimize the risk of accidents and damages for the actual cargo
- all required documents are received from the consignor and from the packer;
- the cargo inside the CTU is fully and accurately described, based upon the documents received;
- the pay load/gross mass of the CTU is accurately declared, based upon the documents received;
- the description of the cargo and the gross mass, based on the payload and the tare weight of the CTU, is communicated to the carrier before the transport operation commences;
- in case of sea transport, the description of the cargo and the gross mass is communicated to the carrier as early as required by the carrier;
- in case of dangerous goods, the transport document and (for sea transport) the packing certificate is transmitted to the carrier before the transport commences respectively as early as required by the carrier;
- the seal number (when applicable) is communicated to the carrier;
- any extraordinary properties such as reduced stacking capacity or out of gauge are communicated to the carrier.
- ~~the shipper’s declaration is accurate (see Annex V.1.2.1).~~
- in case of container transports, shipping instructions are despatched to the carrier on time, ~~and~~ that the CTU meets the outbound delivery window ~~(see Annex V.1.3.1.1.)~~. and that the container arrives at the terminal before the stated cargo cut off time.
- ~~the CTU arrives at the terminal before the stated cargo cut off time~~.

~~5.1.10.4~~5.1.9.4 The road haulier is “responsible” for:

- cargo securing when so agreed;
- confirming that the gross mass, length, width and height of the vehicle are within the national

[1] As of January 1st 2012, all ISO containers with reduced stacking or racking strength are required by the International Convention for Safe Containers (CSC) to be marked in accordance with the latest version of ISO 6346: Freight containers – Coding , identification and marking.

~~[2] The gross mass can be verified by exact calculation or by weighing. The gross mass needs to be verified before any transport operation commences. Incorrect gross masses are a hazard for any mode of transport. Therefore, the mass verification must be carried out before the unit leaves the premises of the packer. If a certain transport mode deems it necessary that a re-verification has to take place when the CTU is transferred from one mode to another, this is beyond the scope of this Code of Practice and should be regulated in the regulations of that mode~~

[3] The gross mass can be verified by exact calculation or by weighing. The gross mass needs to be verified before any transport operation commences. Incorrect gross masses are a hazard for any mode of transport. Therefore, the mass verification must be carried out before the unit leaves the premises of the packer. If a certain transport mode deems it necessary that a re-verification has to take place when the CTU is transferred from one mode to another, this is beyond the scope of this Code of Practice and should be regulated in the regulations of that mode

road / highway regulations limits;

- providing a trained driver who is capable of assessing the "feel" of the CTU even though the cargo may not be visible.
- ensuring that the driver is able to get sufficient rest and does not drive when fatigued.
- ensuring that the CTU is not left unattended or in a position where the cargo could be stolen or illegal entry made.
- where possible that lashings are retightened when applicable
- moving the CTU in such a manner that there are no exceptional stresses placed on the CTU or the cargo. This means that the driver of road vehicles must be aware of the idiosyncrasies of the cargo and drive accordingly, for example: bulk liquids carried in flexitanks within general purpose containers or hanging cargo such as sides of beef carried in refrigerated vehicles.

~~5.1.10.5~~5.1.9.5 The rail ~~haulier~~ operator is "responsible" for:

- handling the CTU in a manner that would not cause damage to the cargo;
- securing the CTU properly on the rail wagon;
- ensuring that the CTU is not left unattended or in a position where the cargo could be stolen or illegal entry made.

~~5.1.10.6~~5.1.9.6 The port facility is "responsible" for:

- handling the CTU in a manner that would not cause damage to the cargo;
- ensuring that safety and security checks are completed prior to entry into the terminal facilities.
- where possible that lashings are retightened when applicable
- ensuring along with the responsible ship's officer that CTUs are lashed correctly.

~~5.1.10.7~~5.1.9.7 The ~~carrier~~ shipping company is "responsible" that

- the CTU is in good condition and checked for serious deficiencies before it is supplied to the consignor or packer, unless a shipper's own or forwarder's CTU is used;
- ~~the cargo is properly secured in the CTU, if it is agreed that the carrier shall undertake this task;~~
- where possible that lashings are retightened when applicable;
- agreed temperatures in the CTUs are observed;
- the CTU is properly stowed and secured on board ~~on the means of transport~~;
- the transport of the CTU is carried out in compliance with agreements and all applicable regulations.
- providing trained personnel to deal with all cargo types (break-bulk, bulk wet and dry cargoes, dangerous goods, out of gauge, refrigerated, un-containerised).
- ensuring that the stowage plan complies with the company's standing rules on stowage planning for both under and on deck stowage ~~(see also V.2.3.2 and V.2.3.3).~~
- carrying out spot checks of actual loading against plan.
- ensuring that the ship is in a safe sailing condition when departing ports.

~~5.1.10.8~~5.1.9.8 The receiver of a CTU / consignee is "responsible" that

- the floor the CTU is not overstressed during unpacking operations;
- the CTU is sufficiently ventilated before entering;
- no hazardous atmosphere is present when entering;
- any detected damage to the CTU is notified to the forwarder/carrier;
- the CTU is returned to the forwarder/carrier completely empty and clean, unless otherwise agreed;
- irrelevant marks or placards for dangerous goods are removed.

~~5.2 Information~~

~~5.2.1 General~~

~~5.2.1.1 To ensure that the cargo is transported from originator to destination safety and securely, it is essential that those involved in the CTUs movements fully comply with the proper flow of information.~~

~~5.2.1.2 This includes the responsibility of the packer to identify all packages packed into a CTU and to~~

include it in all appropriate documentation.

5.2.1.3 Additionally it will include a responsibility for a declaration to be made on the actual mass of cargo carried within the CTU and any hazards that may be present for all or some of the journey.

5.2.1.4 Parties involved with transport should also ensure that documentation and information is provided in adequate time and using terms that are internationally accepted. This includes:

5.2.1.4.1 The use of proper shipping names

5.2.1.4.2 The correct orientation terms for packed items,

5.2.1.4.3 A general description that accurately describes the cargo.

5.2.2 Shipper

5.2.2.1 In most transport contracts the principle contacts are between the shipper and the carrier, others parties such as the terminal or haulier, though actively involved are responsible either of these parties. Therefore it is important to understand the relationship

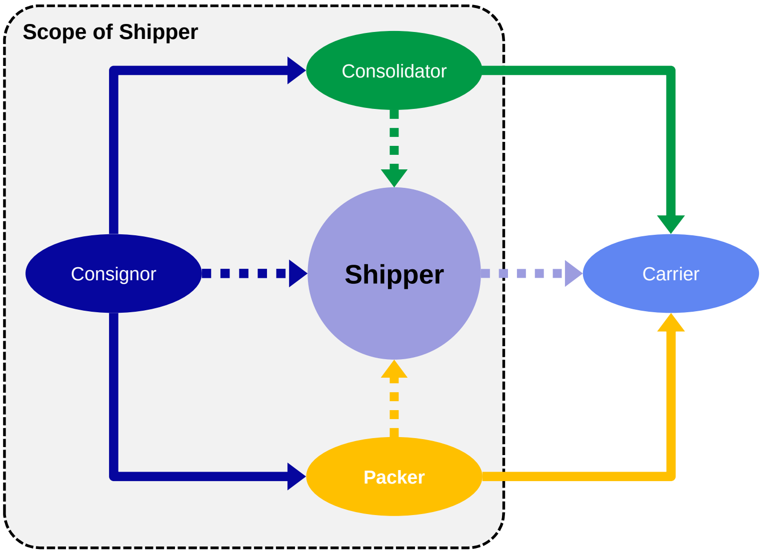


Figure 5-1 : Scope of shipper

5.2.2.2 Figure 5-1 shows the scope of the shipper. A shipper may act as the processor of information receiving information about the cargo and the packing details from the consignor and packer / consolidator respectively.

5.2.2.3 The shipper may also be the packer / consolidator receiving goods from the consignor and packing them into the CTU before despatching it to the carrier.

5.2.2.4 Finally the shipper may be the consignor, producing the goods, packing it into the CTU and then contracting the carrier to move the CTU to its destination.

5.2.2.5 There is a final combination, where the shipper combines the consignor, the packer and the carrier, however for the purposes of this Code of Practice, this combination will not be considered.

5.2.3 Contracts

5.2.3.1 Although applicable law may provide the necessary solutions when parties have not expressly agreed certain issues in their contract, this is sometimes undesirable or the applicable law is not sufficiently precise to solve the matter. It is therefore necessary to deal with those issues in the individual contract or by reference to a standard form of contract.

5.2.3.2 The International Chamber of Commerce provides assistance to the parties in this respect by a number of standard forms and rules now called Incoterms (International commercial terms). The chosen Incoterm rule is a term of the contract of sale and not the contract of carriage.

5.2.3.3 Goods have to be moved from the seller's location to the location selected by the buyer which generally requires some form of transport which is carried out by one or more third party carrier each of whom will require some form of payment for the service. This means that there are three parties involved; the seller, the buyer and the carrier.

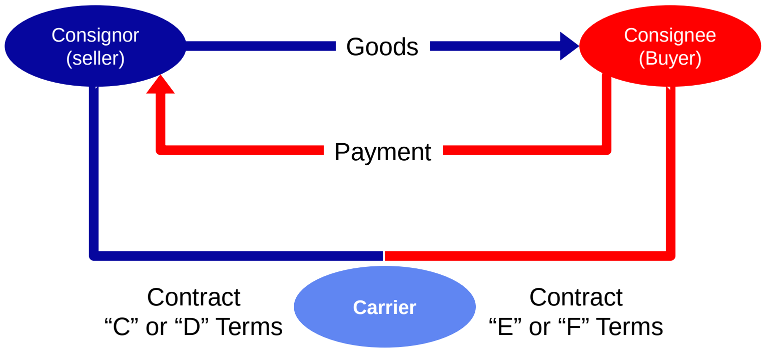


Figure 5-2 : contract schematic

5.2.3.4 Under the Incoterms starting with the letter C or D, it is for the seller to conclude the contract with the carrier. In contrast, under the terms starting with the letter E or F it is the buyer to do so.

5.2.3.5 When the seller contracts for carriage, it is important to ensure that the buyer is able to receive the goods from the carrier at the destination. This is particularly important with respect to shipment contracts. The buyer must receive a document from the seller - such as a bill of lading – that will enable him to receive the goods from the carrier by tendering an original of the document in return for the goods.

5.2.4 Transport Documents

5.2.4.1 The CMR note (Road transport)

The CMR is a consignment note with a standard set of transport and liability conditions, which replaces individual businesses' terms and conditions. It confirms that the carrier (i.e. the road haulage company) has received the goods and that a contract of carriage exists between the trader and the carrier. Unlike a bill of lading, a CMR is not a document of title or a declaration, although some States regard it as such. It does not necessarily give its holder and/or the carrier rights of ownership or possession of the goods, although some insurance is included.

5.2.4.2 Forwarders certificate of receipt (FCR) (Road Transport)

5.2.4.2.1 Increasingly, international trade journeys are intermodal, with freight forwarders playing a crucial coordinating role. Much road freight is organised in this way.

5.2.4.2.2 'Forwarders' documents' have been designed for these kinds of transactions. The FCR provides proof that a forwarder has accepted your goods with irrevocable instructions to deliver them to the consignee indicated on the FCR.

5.2.4.2.3 Using an FCR can speed up payment. For example, when selling overseas and your contract with the buyer states that the goods are collected from the factory and the buyer is responsible for arranging the freight, an FCR can be issued when your buyer's forwarder collects goods.

5.2.4.2.4 You can then present the FCR for payment, rather than having to wait until a non-negotiable or negotiable transport document (the proof of the goods having been loaded onto the transport conveyance for the main international carriage, if any) is issued, which may be some time later.

5.2.4.2.5 While an FCR is non-negotiable, another similar document, the Forwarders' Certificate of Transport, is negotiable. This means that the forwarder accepts responsibility to deliver to a destination you specify - not to an unchangeable destination as with the FCR.

5.2.4.3 CIM consignment note (Rail transport)

5.2.4.3.1 This document confirms that the rail carrier has received the goods and that a contract of carriage exists between trader and carrier.

5.2.4.3.2 Unlike a bill of lading, a CIM note isn't a document of title. It doesn't give its holder rights of ownership or possession of the goods.

~~5.2.4.3.3 Key details to be provided in the note include:~~

- ~~a description of the goods;~~
- ~~the number of packages and their weight; and~~
- ~~the names and addresses of the sender and recipient.~~

~~5.2.4.3.4 The consignor is responsible for the accuracy of CIM notes, and is liable for any loss or damage suffered by the carrier due to inaccurate information. Notes are used to calculate compensation if goods are lost or damaged.~~

~~5.2.4.4 Export Cargo Shipping Instruction (ECSI) (Sea transport)~~

~~This is the document is used to provide the shipping company with details of your goods and set out your instructions for the shipment. It follows up on the initial booking, when space will have been confirmed on particular sailings. The process is often concluded by telephone. Click here to view a copy of this instruction.~~

~~5.2.4.5 Standard Shipping Note (Sea transport)~~

~~If the goods are non-hazardous, a Standard Shipping Note is required. This gives the port of loading the information it needs to handle your goods correctly. It's also used by the shipping company to check the actual information about the goods once they have been loaded into the container with the predicted information supplied beforehand. Click here for an example of this note.~~

~~5.2.4.6 Dangerous Goods Note (Sea transport)~~

~~If however, the goods are considered to be dangerous as per the IMDG Code*, a Dangerous Goods Note (DGN) will also be required.~~

~~5.2.4.7 Bill of lading (Sea transport)~~

~~5.2.4.7.1 This is issued by the carrier and serves three purposes:~~

- ~~it shows that the carrier has received the goods;~~
- ~~it provides evidence of a contract of carriage; and~~
- ~~it serves as a document of title to the goods.~~

~~5.2.4.7.2 There are a number of different types of Bill of Lading some of which may be transmitted electronically.~~

~~5.2.4.8 Sea waybill (Sea transport)~~

~~This fulfils the same practical functions as the bill of lading, but does not confer title to the goods and is therefore quicker and easier to use. It's often used where there's a well-established trading relationship between buyer and seller or in transactions where ownership doesn't change hands, e.g. between divisions of a single company.~~

Chapter 6. General transport conditions

6.1 General

6.1 Within the supply transport chain, there are a number of different stresses acting on the cargo. These stresses may be grouped into mechanical and climatic stresses. Mechanical stresses are forces acting on the cargo under specific transport conditions. Climatic stresses are changes of climatic conditions including extremely low or high temperatures.

6.2 During transport various forces will act on the cargo. The force acting on the cargo is the mass of the cargo (m) which is measured in kg or ton, multiplied by the acceleration (a) which is measured in m/s².

$$\mathbf{F = m \cdot a}$$

Accelerations to be considered during transport are the gravitational acceleration (a = g = 9.81 m/s²) and accelerations caused by typical transport conditions such as by the braking of a road truck, by a rapid change of traffic lanes or by the motions of a ship in heavy sea. These accelerations are expressed as product of the gravitational acceleration (g) and a specific acceleration coefficient (c) e.g. a = 0.8 g.

6.3 The following tables provide the applicable acceleration coefficients for the different modes of transport and for the various securing directions. To prevent a cargo from movement, the cargo has to be secured in longitudinal and transverse direction according to the worst combination of accelerations in each direction for the intended voyage (see Chapter 10).

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]
Above values apply for normal transport conditions. Under abnormal conditions, c_x may increase to 1.0 and c_z may decrease to 0.7]				

[*Source: The Combisec project, see report on the following link: http://www.mariterm.se/FoU_Publikationer/combisec/Kombisäkring/CombiSec%20report%20ver%202011-02-24%20FINAL.pdf]

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Sea transport					
Significant 20-year 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

6.4 The effect of short term impact or vibrations should always be considered. Therefore, whenever the cargo cannot be secured by blocking, lashing is always required. The weight of the cargo alone, even when combined with a high friction coefficient (see Chapter 10 and Annex 3), does not sufficiently secure the cargo as the cargo can move due to vibrations.

6.5 The significant 20-years return wave height (H_s) is the average of the highest one-third of waves (measured from trough to crest) that is only exceeded once in 20 years. The allocation of geographic sea areas to the respective significant wave heights is shown in the following table.

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 Skagerrak 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)	Uunrestricted

Formaterat: Spanska (traditionell sortering)

Sources:
- *The Royal Netherlands Meteorological Institute (KNMI):*
  The KNMI/ERA-40 Wave Atlas, derived from 45 years of ECMWF reanalysis data (ed. S.Caires, A.Stern, G.Komen and V.Swail), last updated 2011,
  Hs 100-yr return values, 1958 - 2000

6.6 During longer voyages, climatic conditions (temperature, humidity) are likely to vary considerably. These may affect the internal conditions in a CTU which may give rise to condensation on cargo or internal surfaces (see Annex 2).

6.7 Whenever a specific cargo might be damaged when exposed to high or low temperatures during transport, the use of a CTU specially equipped for keeping the cargo temperature within acceptable limits should be considered (see Chapter 8).

Chapter 7. CTU Properties

7.1 Containers

7.1.1 General characteristics of containers

7.1.1.1 A container is a transport containment of permanent character with a structural strength that will resist repeated use. It is designed to facilitate the carriage of goods through one or more modes of transport without intermediate reloading and fitted with standardised corner fittings permitting easy handling, stacking and securing in the modes of transport sea, road and rail.

7.1.1.2 The outer dimensions of containers are standardized by ISO:

Outside length	10’	2,991 mm	Special purposes only	
	20’	6,058 mm	TEU standard	Generally 8’6” high
	30’	9,125 mm	Largely outdated	
	40’	12,192 mm	Standard length (2 TEU or 1 FEU)	
	45’	13,716 mm	Increasing used	Generally high cube
Outside height	8’	2,438 mm	Largely outdated	
	8’6”	2,591 mm	Standard height	
	9’6”	2,896 mm	High cube	
Outside width	8’	2,438 mm	Width at corner frame	

According to the standard for normal dry containers the free inner width shall be minimum 2,330 mm and the free inner length for a 40’ container shall be 11,998 mm and for a 20’ container 5,867 mm. Some container designs can offer somewhat larger inner dimensions.

The minimum door width shall according to the standard be 2,286 mm and the door height shall be; for 8’6” containers 2,261 mm and for 9’6” containers 2,566 mm.

Thermal and reefer containers normally have smaller inner dimensions and sometimes also smaller door openings.

7.1.1.3 The standard maximum gross mass for a 20’ container is 30,480 kg and 32,500 kg for the 40’ although there are variations either higher or lower for these and other lengths. The approved maximum gross mass is marked on the CSC safety approval plate along with the allowable stacking weight (see subsection 9.2.1).

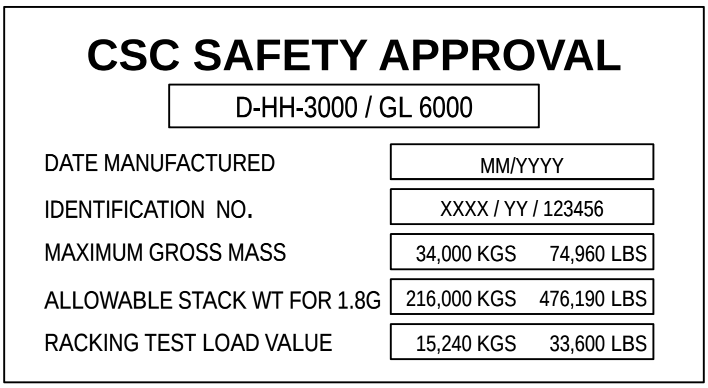

Figure 7-1 : CSC safety approval schematic

The tare mass of the container will be marked on the rear doors (or end) of the container along with the maximum gross mass. As a guide, the 20’ container has a tare mass of 2,100 to 2,400 and the 40’ high cube container 3,750 to 4,000 kg. The maximum payload ~~is~~ calculated by subtracting the tare mass from the maximum gross mass, is thus up to about 28 000 kg for a 20’ container and about 28 500 for a 40’. Also the pay load ~~and~~ may be marked on the rear end along with the maximum gross and tare masses.

Note: If there is a variation between the maximum gross mass on the doors and CSC safety approval plate, the value marked on the CSC safety approval plate shall be used.

7.1.1.4 With the exception of platforms (a container floor without walls), loaded containers are capable of being stacked. This is mainly used in land-based storage areas and on ships during a sea passage. The allowable stacking mass is displayed on the CSC safety approval plate and is generally greater than 192,000 kg. However, containers with reduced stacking mass, i.e. less than 192,000 kg, do also exist and require special attention when used for intermodal transport, in particular for the stowage in stacks on seagoing vessels (see subsections 8.3.1 and 9.2.1).

7.1.2 General cargo containers (ISO 1496-1)

7.1.2.1 General cargo containers are available as closed box containers, ventilated containers and open top containers.

7.1.2.2 A closed box container (also known as general purpose or dry container) is a container which is totally closed and weather-proof. It consists of a steel frame with a rigid bottom structure of transverse girders (crossbeams). The bottom structure is generally a floor of hard plywood supported by the crossbeams. The roof is a light steel plate construction while the side walls and the front wall are more rigid of corrugated steel. The door end has two swing doors, which may be structurally secured by four vertical locking bars.

7.1.2.3 The side walls are designed to withstand a uniform load equal to 60% of the permitted payload ~~without significant distortion~~. The front wall and the door end are designed to withstand 40% of the permitted payload. These limitations are applicable for a homogenous load to the relevant wall area and do not exclude the capability of absorbing higher forces by the framework of the container. The container is designed to sustain the total payload homogenously distributed over the bottom structure. This results to limitations for concentrated loads. For further details refer to subsection 10.3.1.

7.1.2.4 Most general cargo containers have a limited number of lashing rings or bars. When lashing rings are fitted, the anchor points at the bottom have a lashing capacity of at least 10 kN in any direction. The lashing points at the top side rails and in the corner posts have a lashing capacity of at least 5 kN.

7.1.2.5 Container floors are built to withstand a maximum wheel pressure corresponding to an axle load of a fork lift truck of ~~7,260~~ 5,460 kg or 2,730 ~~6,630~~ kg per wheel (references: ISO 1496 and CSC, Annex II). Such axle loads are typical for FLTs with a lifting capacity of ~~3~~ 2 to 2~~3~~.5 tonnes.

7.1.2.6 Closed box containers generally have labyrinth protected openings for venting (pressure compensation), but these openings do not measurably support air exchange with the ambient atmosphere. Special type "ventilated containers" have weatherproof ventilation grills built into the top and bottom side rails and the front top rail and bottom sill, through which the natural convection inside the container is intensified and a limited exchange of air and humidity with the ambient atmosphere is established.

7.1.2.7 An open top container is similar to a closed box container in all respects except that it has no permanent rigid roof. It may have a flexible and moveable or removable cover, e.g. of canvas, plastic or reinforced plastic material. The cover is normally supported by movable or removable roof bows. In some cases the removable roof is a compact steel construction suitable to be lifted off in one piece. The header (transverse top rail above the doors) is generally movable or removable (known as swinging headers). The header is part of the container strength and should be fitted to maintain the full strength of the container.

7.1.2.8 Open side containers have a curtain or canvas on one or both sides, a rigid roof and rear doors. While the strength of the end walls is similar to that of closed box containers, the side curtain provides limited or no restraint capability. Open side containers are not covered by the ISO standard.

7.1.3 Platform and platform based containers (ISO 1496-5)

7.1.3.1 Platforms and platform based containers are available in the lengths of 20', 40' and 45'. They are characterized by having no side superstructure except either fixed or folding end walls (flatracks) or are designed without any superstructure (platforms). The benefit of folding end walls is that the flatrack may be efficiently stacked when transported in empty condition on a ship for repositioning.

7.1.3.2 Flatracks and platforms have a bottom structure consisting of at least two strong longitudinal “I”-

beams, connected by transverse stiffeners and lined by solid wooden planks.

7.1.3.3 For securing of cargo units strong lashing brackets are welded to the outer sides of the longitudinal bottom beams with a lashing capacity of at least 30 kN (3 ton) according to the standard. In many cases the lashing points have a strength of 50 kN. Cargo may also be secured in longitudinal direction by shoring to the end walls of flatracks. These end walls may be additionally equipped with lashing points of at least 10 kN lashing capacity (MSL).

7.1.4 Thermal containers (ISO 1496-2)

7.1.4.1 The most common variant of the thermal container is the integrated refrigerated container, often referred to as “reefer”. The internal temperature is controlled by a refrigerating appliance such as a mechanical compressor unit or an absorption unit. The reefer consists of a container body with insulated walls, sides and roof plus insulated doors at the rear. The front of the container carries the refrigeration machinery.

7.1.4.2 The refrigeration machinery is generally powered by 3-phase AC electricity supplied by a cable that is to be connected to sockets on board ship or in the terminal. Where there is insufficient power capacity, freestanding “power packs” may be used. Power packs can also be used to supply power to a number of reefers being carried by rail. When the reefer is to be carried by road, unless the journey is relatively short, the shipper might require the reefer to be running and for this purpose trailer mounted generator sets are available. Another option is a reefer with a secondary power supply including a diesel generator.

7.1.4.3 The refrigeration process works by passing air through the container from bottom to top. In general, the "warm" air is drawn into the top of the refrigeration machinery from the top of the container, cooled in the refrigeration unit and then blown back in the container as cold air along the T-shaped floor grating. The gratings form an additional space between container floor and cargo, so forming a satisfactory air flow channel.

7.1.4.4 Thermal containers may be operated also to heat cargo which requires protection against extremely low ambient temperatures.

7.1.4.5 Thermal containers are designed for the transport of homogenously packed cargo, tightly stowed from wall to wall. Therefore, the side and end wall strength is similar to that of general cargo containers. However, thermal containers are generally not equipped with anchor and lashing points. When a cargo needs to be secured by lashings, specific fittings should be affixed to the “T” section gratings, thus providing the required anchor points.

7.1.4.6 In its basic form a thermal container is a container with insulating walls, doors, floor and roof. A simple design type is an insulated container without devices for cooling through a refrigerating system. Cooling is effected using expendable refrigerants such as "dry ice" (solid carbon dioxide) or liquefied gases.

7.1.4.7 A variation of this simple design is the porthole container, which is refrigerated by cold air from an external source introduced through a porthole.

7.1.4.8 However there are very few thermal / insulated or porthole containers in operation and are not seen in general circulation.

7.1.5 Tank containers (ISO 1496-3)

7.1.5.1 A tank container comprises two basic elements, the tank shell (or shells in case of a multiple-compartment tank container) and the framework. The framework is equipped with corner fittings and renders the tank suitable for intermodal transport.

7.1.5.2 In the shipping industry, the term "tank" or "tank container" usually refers to a 20' tank container consisting of a stainless steel pressure vessel supported and protected within a steel frame. However, also 30' or 40' tank containers are in use.

7.1.5.3 The frame shall comply with the requirements of CSC Convention. If dangerous goods are intended to be carried in the tank, the shell and all fittings such as valves and pressure relief devices must comply with the applicable Dangerous Goods Regulations.

7.1.6 Solid-bulk containers (ISO 1496-4)

7.1.6.1 A non-pressurised dry bulk container is a container especially designed for the transport of dry solids, capable of withstanding the loads resulting from filling, transport motions and discharging of non-packaged dry bulk solids, having filling and discharging apertures and fittings.

7.1.6.2 There are box type containers for tipping discharge, having filling and discharge openings and also a door. Therefore, these containers may be used also as a general purpose container. A variant is the hopper type for horizontal discharge, having filling and discharge openings but no doors. These containers cannot be used as general purpose containers.

7.1.6.3 The front and rear end walls of solid-bulk containers are reinforced and so constructed to bear a load equal to 60% of the payload. The strength of the side walls is similar to that of general purpose containers.

7.1.6.4 Loading hatches are generally round, 600 mm in diameter varying in number from one centrally up to six along the centre line. Discharge hatches come in a number of forms: Full width "letterbox" type either in the front wall or in the rear as part of the door structure or "cat flap" type hatches fitted into the rear doors.

7.2 Swap bodies

7.2.1 A swap body is a typical European transport containment of a permanent character designed for road and rail transport. Swap bodies are generally 2.5 m or 2.55 m wide and are subdivided into three length categories:

Class A 12.2 to 13.6 m long (maximum gross mass 34 tons)

Class B 30’ (9,125 mm) long

Class C: 7.15, 7.45 or 7.82 m long (maximum gross mass 16 tons).

7.2.2 Swap bodies are fixed and secured to the vehicles with the same devices as ISO containers, but owing to the size difference, these fittings are not always located at the swap body corners.

7.2.3 Stackable swap bodies have top fittings, where the external faces are 2.438 m (8’) when measured across the unit and 2.259 m between aperture centres. The placing of the top corner fittings is such that the container can be handled using standard ISO container handling equipment. Alternatively, the swap body may be handled using grappler arms, inserted into the four recesses in the bottom structure. Swap bodies not suitable for stacking can only be handled with grappler arms. Class C swap bodies can be transferred from the road vehicle to their supporting legs and returned to the vehicle by lowering or raising the carrier vehicle on its wheels.

7.2.4 The standard box type swap body has a roof, side walls and end walls, and a floor and has at least one of its end walls or side walls equipped with doors. Class C swap bodies complying with Standard EN 283 have a defined boundary strength: the front and the rear end are capable to withstand a load equal to 40% of the permitted payload, the sides are capable to withstand 30% of the permitted payload.

7.2.5 Floors of swap bodies are built to withstand corresponding axle loads of 4,400 kg and wheel loads of 2,200 kg (reference: EN 283). Such axle loads are typical for FLTs with a lifting capacity of 2.5 tonnes.

7.2.6 The open side swap body is designed similarly to a standard curtain side semi-trailer. It has an enclosed structure with rigid roof and end walls and a floor. The sides consist of removable canvas or plastic material. The side boundary may be enforced by battens.

7.2.7 A thermal swap body is a swap body that has insulating walls, doors, floor and roof. Thermal swap bodies may be insulated, but not necessarily equipped with mechanical device for cooling. A variant is the mechanically refrigerated swap reefer.

7.2.8 A swap tank is a swap body that consists of two basic elements, the tank or tanks, and the framework. The tank shell of a swap tank is not always fully enclosed by the frame work

7.2.9 A swap bulker is a swap body that consists of the containment for the dry solids in bulk without packaging. It may be fitted with one or more round or rectangular loading hatches in the roof and "cat flap" or "letter box" discharge hatches in the rear and/or front ends.

Swap bulkers are generally 30’ long and often have an elevated maximum gross mass up to 38,000 kg. They are not generally designed for stacking when loaded greater than two high, (one on one).

7.3 Roll trailers

7.3.1 Roll trailers are exclusively used for the transport of goods in ro-ro ships and are loaded or unloaded and moved in port areas only. They present a rigid platform with strong securing points at the sides, and occasionally brackets for the attachment of cargo stanchions. The trailer rests on one or two sets of low solid rubber tyres at about one third of the length and on a solid socket at the other end. This end contains a recess for attaching a heavy adapter, the so-called gooseneck. This adapter has the king-pin for coupling the trailer to the fifth wheel of an articulated truck.

7.3.2 The packing of a roll trailer with cargo or cargo units must be planned and conducted under the conception that the cargo must be secured entirely by lashings (see paragraph 10.4.3.2). However, roll trailers are available equipped with standardised locking devices for the securing of ISO containers and swap bodies.

7.4 Road vehicles

7.4.1 Vehicles with a closed superstructure are the primary choice for cargo that is sensitive against rain, snow, dust, sunlight, theft and other consequences of easy access. Such closed superstructure may consist of a solid van body or a canvas covered framework of roof stanchions and longitudinal battens, occasionally reinforced by side and stern boards of moderate height. In nearly all cases these vehicles have a strong front wall integrated into the closed superstructure. Closed superstructures of road vehicles may be provided with arrangements for applying approved seals.

7.4.2 Semi-trailers suitable for combined road/rail transport are generally equipped with standardised recesses for being lifted by suitable cranes, stackers or forklift trucks. This makes a lifting transfer from road to rail or vice versa feasible.

7.4.3 Solid van superstructures generally have two door wings at the end and will be packed or unpacked by forklift trucks, suitable for moving packages inside a CTU. Canvas covered vehicles may be packed or unpacked through the rear doors as well as from the side(s). The side operation is accomplished by forklift trucks operating at the ground level. The option of loading or unloading via the top is limited to vehicles where the canvas structure can be shifted to one or both ends of the vehicle.

7.4.4 Road vehicles are allocated a specific maximum payload. For road trucks and full trailers the maximum payload is a constant value for a given vehicle and should be documented in the registration papers. However, the maximum allowed gross mass of a semi-trailer may vary to some extent with the carrying capacity of the employed articulated truck as well as in which country it is operating. The total gross combination mass, documented with the articulated truck, must never be exceeded.

7.4.5 The actual permissible payload of any road vehicle depends distinctly on the longitudinal position of the centre of gravity of the cargo carried. In general, the actual payload must be reduced if the centre of gravity of the cargo is conspicuously off the centre of the loading area. The reduction should be determined from the vehicle specific load distribution diagram (see paragraph 10.3.1.8). Applicable national regulations on this matter must be observed. In particular ISO box containers transported on semi-trailers with the doors at the rear of the vehicle quite often tend to have their centre of gravity forward of the central position. This may lead to an overloading of the articulated truck if the container is loaded toward its full payload.

7.4.6 The boundaries of the loading platform of road vehicles may be designed and made available in a strength that would be sufficient – together with adequate friction – to retain the cargo under the specified external loads of the intended mode of transport. Such advanced boundaries may be specified by national or regional industry standards . However, a large number of road vehicles are equipped with boundaries of less resistivity in longitudinal and transverse direction, so that any loaded cargo must be additionally secured by lashings and/or friction increasing material. The rating of the confinement capacity of such weak boundaries may be improved if the resistance capacity is marked and certified for the distinguished boundary elements of the vehicle.

7.4.7 Road vehicles are generally equipped with securing points along both sides of the loading platform. These points may consist of flush arranged clamps, securing rails or insertable brackets and should be designed for attaching the hooks of web lashings and chains. The lashing capacity of securing points varies with the maximum gross mass of the vehicle. The majority of vehicles is fitted with points of a lashing capacity (LC) or maximum securing load (MSL) of 20 kN. Another type of variable securing devices are pluck-in posts, which may be inserted into pockets at certain locations for providing intermediate barriers to the cargo. The rating of the lashing capacity of the securing points may be improved if their capacity is marked and certified.

7.5 Railway wagons

7.5.1 In intermodal transport, railway wagons are used for two different purposes: First, they may be used as carrier unit to transport other CTUs such as containers, swap bodies or semi-trailers. Second, they may be used as a CTU themselves which is packed or loaded with cargo and run by rail or by sea on a railway ferry.

7.5.2 The first mentioned purpose is exclusively served by open wagons, which are specifically fitted with locking devices for securing ISO containers, inland containers and swap bodies or have dedicated bedding devices for accommodating road vehicles, in particular semi-trailers. The second mentioned purpose is served by multifunctional closed or open wagons, or wagons which have special equipment for certain cargoes, e.g. coil hutches, pipe stakes or strong lashing points.

7.5.3 On board ferries the shunting twin hooks are normally used for securing the wagon to the ships deck. These twin hooks have a limited strength and some wagons are equipped with additional stronger ferry eyes. These external lashing points should never be used for securing cargo to the wagon. Wagons which are capable for changing their wheel sets over from standard gauge to broad gauge or vice versa, are identified by the first two figures of the wagon number code.

7.5.4 The maximum payload is generally not a fixed value for the distinguished wagon, but allocated case by case by means of the intended track category (categories A, B, C, D) and the speed category (S: ≤ 100 km/h; SS: ≥ 120 km/h). These payload figures imply a homogeneous load distribution over the entire loading area.

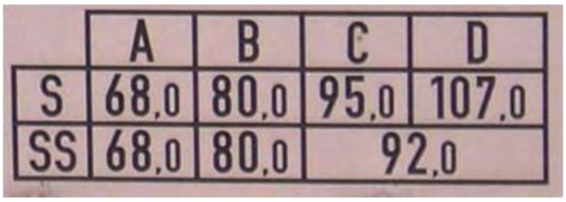

Figure 7-2 : Allocation of payload to a rail car

7.5.5 In case of concentrated loads a reduction of the payload is required, which depends on the loaded length and the way of bedding the concentrated load. The applicable load figures are marked in each wagon. Also any longitudinal or transverse eccentricity of concentrated loads is limited by the individual axle load capacity or the wheel load capacity.

Figure 7-3 : Reduction in payload due to concentrated load and bedding distance

7.5.6 Closed railway wagons are designed for the compact stowage of cargo. The securing of cargo should be accomplished by tight packing or blocking to the boundaries of the wagon. However, wagons equipped with sliding doors should be packed in a way that doors remain operable.

7.5.7 When a railway ferry is operating between railway systems of different gauges, wagons which are capable for changing their wheel sets over from standard gauge to broad gauge or vice versa are employed. Such wagons are identified by the first two figures of the wagon number code.

Chapter 8. CTU suitability

8.1 Suitability in general

8.1.1 Freight containers and some other types of CTU (e.g. swap bodies for rail transport in Europe) require type approval. In addition, depending on the type, the verification of a periodic or continuous examination scheme might be required as well. A CTU requiring approval (and examination) and not bearing a valid approval plate is not suitable for transport (see subsection 9.2.1).

8.1.2 Containers and swap bodies showing major defects in their structural components

(e.g. top and bottom side rails, top and bottom end rails, door sills and header, floor cross members corner posts and corner fittings) may place persons into danger and are therefore not suitable for transport (see subsection 9.2.2).

8.1.3 Road vehicles, semi-trailers and railway wagons showing deterioration in major struc-tural components or other obvious defects (e.g. tyres, brakes, light, steering) impede the safe traffic on road or rail and are therefore not suitable for transport.

8.2 Suitability for the cargo

8.2.1 All cargo which is sensitive against weather conditions such as rain, snow, dust, and sunlight or against theft and other consequences of easy access should be carried in a closed or sheeted CTU. Box containers, closed or sheeted swap bodies, semi-trailers and other road vehicles are suitable for most cargoes. Single packages such as cartons stacked by hand, drums or similar packages stacked by forklift truck or any kind of palletized cargo can be packed and preferably stowed from boundary to boundary. However, it depends on the type of CTU, whether such firm stowage alone provides sufficient cargo securing or whether additional securing is needed (see subsection 10.4.2).

8.2.2 Certain cargoes such as cocoa or other agricultural products are sensitive against cli-matic effects and could be damaged when the humidity in ~~the CTU~~a container is condensed due to a decrease of temperature. This effect is specific for long distance sea transport and can be con-trolled by appropriate ventilation. Standard box containers however allow only restricted air changes. Therefore, ventilated containers should be preferred for such sensitive cargo.

8.2.3 Certain foodstuffs, in particular deep frozen products, require transport at low temper-atures. Other products, e.g. certain chemicals, need to be protected from frost. Such commodi-ties should be transported in insulated and temperature controlled CTU which can be refriger-ated or heated as appropriate

8.2.4 Heavy items such as granite and marble blocks may also be packed into closed CTUs. However, this cargo cannot be simply stowed from wall to wall. Bracing and blocking against the frame of the CTU and/or lashing to the securing points is necessary (see subsection 10.4.3). As the lashing capacity of the securing points in general purpose containers is limited, such standard containers might not be appropriate for certain large and heavy cargo items. Instead, platforms or flatracks could be used.

8.2.5 Cargo items of extreme dimensions may not fit inside a standard ~~CTU~~ dry container as they exceed the inner width and perhaps also the height of the unit. Such cargo may be accommodated on a platform or on a flatrack. When the cargo is only “overhigh” but not “overwide” an open top CTU may also be suitable.

8.2.6 Heavy cargo items ~~lifted~~ handled by a fork lift truck may result in a front axle load of more than 5460 kg which exceeds the maximum permissible concentrated load inside a ~~CTU~~container. For such cargo, open top, open side container or platform ~~CTUs~~ should be used so that the cargo can be loaded from the top or from the side without a need to drive into the ~~CTU~~ container with the forklift truck. Alternatively other loading techniques to prevent overstressing of the container floor could be used. For load distribution see subsection 10.3.1.

8.2.7 Some cargoes such as scrap metal are usually handled by grabs or by conveyors. When this cargo is to be loaded into a ~~CTU~~ container and a conveyor is not available, the only suitable ~~CTU~~ container type is an open top ~~CTU~~ container capable to be loaded with grabs.

8.2.8 General purpose containers are not suitable for certain long, heavy and irregular cargo items such as timber logs, as the side walls of general purpose containers are not designed to withstand the acceleration forces of such cargo and may suffer bulging damages. Stowage in shape of a pyramid and securing by lashing is extremely difficult in a box container, because the securing points are not accessible after this cargo is loaded, unless the lashings are ar-ranged before loading. Therefore, such cargo should preferably be carried ~~only~~ on platforms or flatracks ~~CTUs~~.

8.2.9 Liquid and solid bulk cargoes should be preferably transported in tank CTUs or solid bulk CTUs. Under certain conditions, liquid bulk cargo may be carried in flexi-tanks which are stowed in box containers. Similarly, solid bulk may be carried in box containers which are equipped with a liner. However, containers used for such purposes should be suitably re-enforced and prepared, operational restrictions regarding the permissible payload should be observed (see Section 10.5).

8.3 Suitability for the transport mode

8.3.1 Freight containers approved under the CSC convention are basically suitable for all modes of transport. However, freight containers having an allowable stacking mass of less than 192 t marked on the approval plate (see subsection 9.2.1) require special stowage on board a ship, where the superimposed stacking mass will not exceed the permitted limits as marked on the plate. Furthermore, some freight containers may have a gross mass up to 34 tons; not all road chassis and not all railcars are capable to carry such heavy units (see subsections 7.4.4, 7.4.5 and 7.5.4) Therefore, especially for heavy weight containers, it is of utmost importance to arrange for an appropriate chassis and tractor vehicle or railcar, as applicable.

8.3.2 As the maximum permissible payload of a railcar is not a fixed value for the distinguished wagon but depends in addition on the track category of the railway network (see 7.5.4), the railway operator should be contacted when necessary, in order to prevent overloading.

8.3.3 Swap bodies and semi-trailers are designed for an easy change of the means of transport. In most cases this might be an interchange between different carrier vehicles for swap bodies or different tractor vehicles for semi-trailers. When an intermodal change from road to rail is intended, it should be ensured that the swap body or the semi-trailer is capable of being lifted by grappler arms and approved for rail transport.

8.3.4 When road vehicles or semi-trailers are intended to be transported on a Ro/Ro-ship, they should be equipped with securing points of a defined minimum strength in sufficient number according to the table below. ~~The minimum number of securing points and their minimum strength should be calculated according to following table[1] :~~

Gross vehicle mass (GVM (tonnes)	Minimum number of securing points on each side of the vehicle	Minimum strength of each securing point (kN)
3.5 ≤ GVM ≤ 20	2	$\frac{GVM \times 10 \times 1.2}{n}$
20 < GVM ≤ 30	3	
30 < GVM ≤ 40	4	
40 < GVM ≤ 50	5	
50 < GVM ≤ 60	6	

where *n* is the total number of securing points on each side of the vehicle

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8.3.5 For road trains, the table applies to each component. Semi-trailer towing vehicles are excluded from the table and should be provided with two securing points at the front of the vehicle. A towing coupling at the front may replace the two securing points.

8.3.6 When railway wagons are intended to be transported on a railway ferry, they should be capable to pass over the kink angle of the ferry ramp and to pass through the track curves on the ferry vessel. In general, there are more restrictions for wagons equipped with bogies than for wagons equipped with two wheel sets only. The details should be clarified with the ferry line operator.

8.3.7 Railway wagons should be equipped with securing points on both sides in sufficient number when used in ferry traffic. To determine the required number and strength of securing points, the ferry operator should be contacted ~~The minimum number of securing points~~

[1] See IMO Resolution A.581(14)

~~and their mini-mum strength can be calculated as described in 8.3.4, taking into consideration a possibly higher gross mass of a railway wagon.~~ The maximum permitted axle loads and maximum permitted loads per linear meter depend on the properties of the ferry ramp and of the characteristics of the ferry vessels employed in the respective ferry service.

Chapter 9. Arrival, checking and positioning of CTUs

9.1 CTU Arrival

9.1.1 The type of CTU used for the transport will influence:

- the process of confirming that it is fit for use;
- the CTU's positioning to suit the packing operation and timing;
- the planning of the cargo packing.

9.1.2 The CTU provider will advise of the estimated time of arrival and departure. The type of CTU may influence these timings:

- Rigid road vehicles will come with a driver and it would be expected that the time to pack the vehicle will be dictated by any time restrictions that local regulations may impose.
- Detachable CTUs, such as trailers and rail wagons may be left at the packer's facility and the tractor unit / motor unit permitted to depart if the packing procedure is extended.
- Class C swap bodies fitted with legs can be unloaded onto their legs and the tractor unit / engine unit plus trailer (if present) may be driven away.
- Containers and class A and B swap bodies can remain on the trailer or be unloaded and placed on the ground.
- CTUs remaining on trailers may be left for a period of time.

9.1.3 If the consignment requires more than one CTU then it is important to plan what packages go within each unit and how each CTU is managed: multiple units might be delivered all at once and the packer can manage positioning of each unit to suit the facility available. Another option is to deliver the units sequentially so that the container operator delivers an empty unit and picks up a fully packed one.

9.1.4 In both cases planning what packages go into each unit will be important. Demand at the destination may require particular packages to be packed in each CTU. However such demand can have an adverse effect on the load distribution, on possibility to secure the cargo properly, on the segregation of dangerous goods and also on volume utilisation. It is therefore important that a complete plan is generated for all packages and CTUs prior to the start of packing the first CTU.

9.2 CTU checks

9.2.1 Approval plates

9.2.1.1 Containers and, under certain conditions, ~~also swap bodies and road trailers~~ are required by applicable regulations to bear a safety approval plate.

9.2.1.2 Swap-bodies and road trailers destined for transport by rail within the European railway network require a marking as per EN 10344. This operational marking provides information for codification and for approval of the swap body or semi-trailer for rail transport.

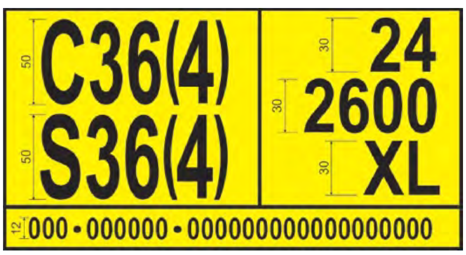


Figure 9-1 : Yellow operational mark for swap bodies

Figure 9-2 : Yellow operational mark for trailers

9.2.1.3 Under the International Convention for Safe Containers (CSC), containers are required to bear a safety approval plate permanently affixed to the rear of the container, usually the left hand door. On this plate, the most important information for the ~~packer~~ shipping line are the date of manufacture, the maximum gross mass and the allowable stacking mass. The maximum gross mass shall never be exceeded. Containers having an allowable stacking mass of less than 192,000 kg are not unrestrictedly suitable for sea transport (see subsection 8.3.1). For the packer the maximum pay load is of greatest interest. This information is normally found on the right container door.

9.2.1.4 The CSC convention requires containers to be thoroughly examined 5 years after manufacture and subsequently at least every 30 months. The date of the next periodic examination is stamped on the approval plate or affixed to it in form of a decal:

Figure 9-3 : CSC safety approval plate with next examination date

9.2.1.5 As alternative to such periodic inspections, the owner or operator of the container may execute an approved continuous examination programme where the container is frequently inspected at major interchanges. Containers operated under such programme shall be marked on or near to the safety approval plate with a mark starting "ACEP" followed by numerals and letters indicating the approval number of this continuous examination programme.

Figure 9-4 : Safety approval plate with ACEP mark

9.2.1.6 If there is no ACEP mark and if the next examination date is already elapsed, or is before the expected arrival time of the container at its destination, the container should not be used in intermodal or international traffic.

9.2.2 Exterior checks

9.2.2.1 The structural framework, the walls and roof of a CTU should be in good condition, and not significantly distorted, cracked or bent. Acceptable limits of damages in the structural framework of a freight container are shown in Annex 5.

9.2.2.2 The doors of a CTU should work properly and be capable of being securely locked and sealed in the closed position, and properly secured in the open position. Door gaskets and weather strips should be in good condition.

9.2.2.3 A folding CTU with movable or removable main components should be correctly assembled. Care should be taken to ensure that removable parts not in use are packed and secured inside the unit.

9.2.2.4 Any component that can be adjusted or moved, or a pin that can be engaged and withdrawn, should be checked to see that it can be moved easily and retained correctly. This is of particular importance for folding flatracks where the end-walls are retained in the upright position by a pin or shoot bolt which should be engaged and retained from accidentally pulling out by a retaining flap.

9.2.2.5 Removable or swinging headers of open top ~~CTUs~~ containers should be inspected. The header is generally supported by removable pins. Checks should be made to ensure that the pins are of the correct length and freely removable at both ends. Checks should also be made for signs of cracks around the hinges.

9.2.2.6 Road vehicles that are likely to be carried on rail wagons or on ro/ro-vessels should be provided with points for securing them. There should be equal numbers of lashing points on both sides of the vehicle and each point should be intact and free from serious corrosion or damage.

9.2.2.7 For sheeted vehicles or containers the side, top or all round covers should be checked as being in satisfactory condition and capable of being secured. Loops or eyes in such canvas which take the fastening ropes, as well as the ropes themselves, must be in good condition. All lashing strap ratchet tighteners must be able to be engaged and operate correctly.

9.2.2.8 Irrelevant labels, placards, marks or signs should be removed.

9.2.3 Interior checks

9.2.3.1 Before entering a box container, the doors should be opened and at least ten minutes should be elapsed, to allow the internal atmosphere to regularise with the ambient.

9.2.3.2 The CTU should be clean, dry and free of residue and / or persistent odours from previous cargo.

9.2.3.3 The CTU should be free from major damage, with no broken flooring or protrusions such as nails, bolts, special fittings, etc. which could cause injury to persons or damage to the cargo.

9.2.3.4 The CTU should not show liquids or persisting stains on flooring and side walls. There are a number of different materials and surface treatments used for flooring in CTUs. Sealed surfaces generally can be cleaned with absorbent materials. Where a stain can be transferred by wiping a gloved hand over it, the CTU should not be used and a replace CTU should be requested.

9.2.3.5 A CTU should be weatherproof unless it is so constructed that this is obviously not feasible. Patches or repairs to solid walls should be carefully checked for possible leakage by look for rusty streaks below patches. Repairs to side and roof sheets should have a fully stitched patch covering all of the hole with a substantial overlap.

9.2.3.6 Potential points of leakage may be detected by observing whether any light enters a closed unit. At least two persons are needed for this check; the person who remains outside must be fully aware of the process of shutting and opening the doors and be capable of doing so. To complete the check one person should enter the container and the doors may be closed but should not be locked. Holes or gaps will be evident by the light entering the CTU. In carrying out this check, care should be taken to ensure that no person becomes locked inside a unit.

9.2.3.7 Cargo tie-down cleats or rings, where provided, should be in good condition and well anchored. If heavy items of cargo are to be secured in a CTU, the container operator should be contacted for information about the cleat strength and appropriate action taken.

9.3 Positioning CTUs for packing

9.3.1 Wheeled operation

9.3.1.1 Road trailers and containers on chassis can be left at the packer's premises for a period of time without a tractor unit. When this happens, the correct positioning of the CTU is particularly important as a safe shifting of the CTU at a later stage might be difficult. After positioning, brakes should be applied and wheels should be chocked.

9.3.1.2 Trailers with end door openings and general purpose containers on chassis can be backed up to an enclosed loading bay or can be positioned elsewhere in the premises. For this type of operation a safe access to the CTU by means of suitable ramps is required.

9.3.1.3 When a semi-trailer or a container on a chassis is to be packed, care should be taken to ensure that the trailer or chassis cannot tip while a lift truck is being used inside the CTU.

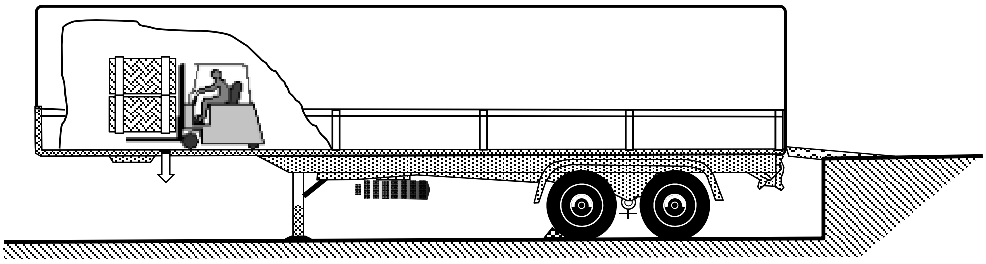


Figure 9-5 : Inadequate support of a trailer

If there is a risk for forward tipping the semi-trailer or chassis should be sufficiently supported by fixed or adjustable supports.

Figure 9-6 : Fixed support

Figure 9-7 : Adjustable support

9.3.2 Grounded operation

9.3.2.1 Containers may be unloaded from the delivery vehicle and be placed within secure areas for packing. The area should be level and have a firm ground. Proper lifting equipment is required (see Chapter 13).

9.3.2.2 When landing containers it should be ensured that the area is clear of any debris or undulations in the ground that may damage the under-structure (cross members or rails) of the container.

9.3.2.3 As container doors may not operate correctly when the ground is not level, the door end of the container should be examined. When one corner is raised off the ground, when the doors are out of line (see Figure 9-8) or when the anti racking plate is hard against one of the stops, the container doors should be levelled out by placing shims under one or other corner fitting, as appropriate.

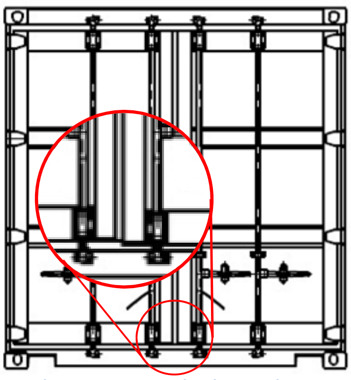


Figure 9-8 : Racked container

9.3.2.4 When a swap-body standing on its support legs is to be packed, particular care should be taken to ensure that the swap-body does not tip when a lift truck is used for packing. It should be checked that the support legs of the swap-body rest firmly on the ground and cannot shift, slump or move when forces are exerted to the swap-body during packing.

Figure 9-9 : Swap body landed on support legs

9.3.3 Access to the CTU

9.3.3.1 After the CTU has been positioned for packing, a safe access should be provided. For loading a CTU by means of fork lift trucks driven into the CTU, a bridging unit between the working ground or loading ramp and the CTU floor should be used. The bridging unit should have lateral boundaries and be safely connected to the CTU for avoiding dislocation of the bridging unit during driving operations.

9.3.3.2 If the CTU floor is at a height level different to that of the loading ramp, a hump may appear between the loading ramp and the bridging unit or between the bridging unit and the CTU floor. Care should be taken that the fork lift truck used keeps sufficient ground clearance over this hump. Lining the level differences with suitable timber material under the bridging unit should be considered.

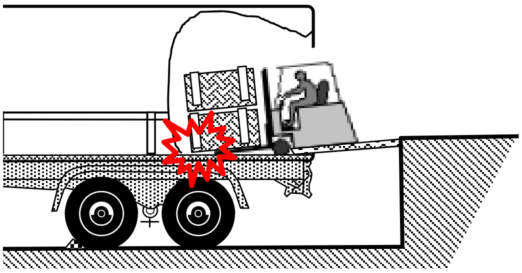


Figure 9-10 : Grounding on down slope

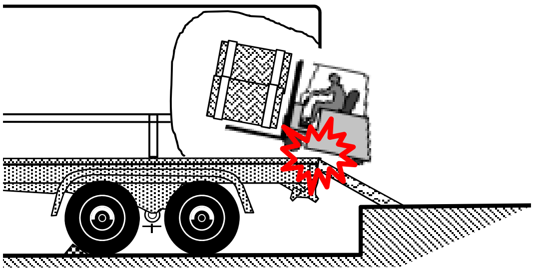


Figure 9-11 : Grounded on up slope

9.3.3.3 If fork lift trucks are employed for packing, any roofs or covers of the CTU should be opened if necessary. Any movable parts of such roofs or covers should be removed or suitably secured in order to avoid interference with the loading procedure.

9.3.3.4 Packing of CTUs in poor day-light conditions may require additional lighting. Electric lighting equipment should be used under the strict observance of relevant safety regulations, in order to eliminate the risk of electric shocks or incentive sparks from defective cables or heat accumulation from light bulbs.

Chapter 10. Packing cargo into CTUs

10.1 Planning of packing

10.1.1 When applicable, planning of packing should be conducted as early as possible and before packing actually commences. Foremost, the fitness of the envisaged CTU should be verified (see Chapter 8). Deficiencies should be rectified before packing may start.

10.1.2 Planning should aim at producing either a tight stow, where all cargo parcels are placed tightly within the boundaries of the side and front walls of the CTU, or a secured stow, where cargo units do not fill the entire space and must therefore be secured within the boundaries of the CTU by blocking and/or lashing.

10.1.3 The compatibility of all items of cargo and the nature, i.e., type and strength, of any packages or packaging involved should be taken into account. The possibility of cross-contamination by odour or dust, as well as physical or chemical compatibility, should be considered. Incompatible cargoes must be segregated.

10.1.4 In order to avoid cargo damage from moisture in closed CTUs during long voyages, care should be taken that other wet cargoes, moisture inherent cargoes or cargoes liable to leak are not packed together with cargoes susceptible to damage by moisture. Wet timber planks and bracings, pallets or packagings should not be used. In certain cases, damage to equipment and cargo by condensed water dripping from above may be prevented by the use of protective material such as polythene sheeting. However, such sheeting or wrapping may promote mildew and other water damage, if the overall moisture content within the CTU is too high. If drying agents shall be used, the necessary absorption capacity should be calculated. More information may be found in Annex 2 of this code.

10.1.5 Any special instructions on packages, or otherwise available, should be followed, e.g.:

- cargoes marked "this way up" should be packed accordingly;
- maximum stacking height marked should not be exceeded.

10.1.6 Consideration should be given to potential problems, which may be created for those persons who unpack the CTU at its destination. The possibility of cargo falling out when the CTU is opened must definitely be avoided.

10.1.7 The mass of the planned cargo should not exceed the maximum payload of the CTU. In the case of containers, this ensures that the permitted maximum gross mass of the container, marked on the CSC Safety Approval Plate, will not be exceeded. For CTUs not marked with their maximum permissible gross mass or payload, these values should be identified before packing starts.

10.1.8 Notwithstanding the foregoing, any limitation of height or weight along the projected route that may be dictated by regulations or other circumstances, such as lifting, handling equipment, clearances and surface conditions, should be complied with. Such weight limits may be considerably lower than the permitted gross weight referred to above.

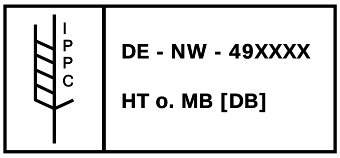
10.1.9 When a heavy cargo unit with a small "footprint" shall be shipped in a CTU, the concentrated load must be transferred to the structural transverse and longitudinal bottom girders of the CTU (see also Section 10.3 for details).

10.1.10 In longitudinal direction the centre of gravity of the packed cargo should be within allowed limits. In transverse direction the centre of gravity should be close to the half width of the CTU. In vertical direction the centre of gravity should be below half the height of the cargo space of the unit. If these conditions cannot be met, suitable measures should be taken to ensure the safe handling and transporting of the CTU, e.g. by external marking of the centre of gravity and/or by instructing forwarders/carriers. In case of CTUs, which shall be lifted by cranes or container bridges, the longitudinal centre of gravity should be close to a position at half the length of the CTU (see also Section 10.3 for details).

10.1.11 If the planned cargo of an open-topped or open-sided CTU will project beyond the overall dimensions of the unit, suitable arrangements should be made with the carriers or forwarders for accommodating compliance with road or rail traffic regulations or advising on special stowage locations on a ship.

10.1.12 When deciding on packaging and cargo-securing material, it should be borne in mind that some countries enforce a garbage and litter avoidance policy. This may limit the use of certain materials and imply fees for the recovery of packaging at the reception point. In such cases, reusable packaging and securing material should be used. Increasingly, countries require timber dunnage, bracings and packaging materials to be free of bark.

10.1.13 If a CTU is destined for a country with wood treatment quarantine regulations, care should be taken that all wood in the unit, packaging and cargo complies with the International Standards for Phytosanitary Measures, No. 15 (ISPM 15)[1]. This standard covers packaging material made of natural wood such as pallets, dunnage, crating, packing blocks, drums, cases, load boards and skids. Approved measures of wood treatment are specified in Annex I of ISPM 15. Wood packaging material subjected to these approved measures should display the following specified mark:



In this mark, the first line shows the ISO two letter country code (here: e.g. DE for Germany) followed by a unique number assigned by the national plant protection organization to the producer of the wood packaging material, who is responsible for ensuring that appropriate wood is used. The second line shows the abbreviation for the approved measure used (HT for heat treatment, MB for fumigation with methyl bromide). Where debarking has been done the letters DB should be added to the abbreviation of the approved measure.

10.1.14 Damaged packages should not be packed into a CTU, unless precautions have been taken against harm from spillage or leakage (see also Chapter 11 for dangerous goods). The overall capability to resist handling and transportation stresses must be ensured.

10.1.15 The result of planning the packing of a CTU may be presented to the packers by means of an oral or written instruction or by a sketch or even scale drawing, depending on the complexity of the case. Appropriate supervision and/or inspection should ensure that the planned concept is properly implemented.

10.2 Packing and securing materials

10.2.1 Dunnaging and separating material

10.2.1.1 Dunnaging materials should be used as appropriate for the protection of the cargo against water from condensed humidity, in particular by

- timber planks against water collecting at the bottom of the CTU,
- gunny cloth, paperboard or natural fibre mats against water dropping from the ceiling,
- timber planks or plywood against sweat water running down the sides of the CTU.

10.2.1.2 Timber planks or scantlings may also be used for creating gaps between parcels of cargo in order to facilitate natural ventilation, particularly in ventilated box containers. Moreover, the use of such dunnaging is indispensable, when packing reefer containers.

10.2.1.3 Timber planks, plywood sheets or pallets may be used to equalise loads within stacks of cargo parcels and to stabilise these stacks against dislocation or collapse. The same material may be used for separating cargo units, which may damage each other or even for installing a temporary floor in a CTU for eliminating inappropriate stack loads to the cargo.

[1] Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations: Guidelines for Regulation Woods Packaging Material in International Trade.

Figure 10-1 : temporary floor in a container

10.2.1.4 Cardboard or plastic sheathing may be used for protecting sensible cargo from dirt, dust or moisture, in particular while packing is still in progress.

10.2.1.5 Dunnaging material, in particular sheets of plastic or paper and fibre nets may be used for separating uniform cargo units, which are designated for different consignees.

10.2.1.6 The restrictions on the use of dunnaging materials with regard to quarantine regulations, in particular wood or timber, should be kept in mind (see paragraphs 10.1.2.12 and 10.1.2.13). More information on the use of dunnaging and separation materials may be found under www.containerhandbook.de.

10.2.2 Friction and friction increasing material

10.2.2.1 For handling and packing of parcels and pushing heavy units a low friction may be desirable. However, for minimising additional securing effort, a high friction between the cargo and the stowage ground of the CTU is of great advantage. Additionally, good friction between parcels or within the goods themselves, e.g. powder or granulate material in bags, will support a stable stow.

10.2.2.2 The magnitude of friction forces between a cargo unit and the stowage ground depends on the ~~weight~~ mass of the unit, the vertical acceleration factor (see chapter 6) and the~~a specific~~ friction coefficient μ, which may be obtained from the Annex 3 of this Code.

Friction force $\mathbf{F_F} = \mu \cdot \mathbf{m} \cdot \mathbf{c_z} \cdot \mathbf{g}$ [kN], with mass of cargo [t] and g = 9.81 [m/s^2].

The coefficients presented in Annex 3 are applicable for static friction between distinguished surface materials. These figures may be used for cargoes secured by blocking or by friction ~~lashings~~securings. For cargoes secured by direct ~~lashings~~securings, a dynamic friction coefficient should be used with 70% of the applicable static friction coefficient, because the necessary elongation of the lashings for attaining the desired restraint forces will go along with a little movement of the cargo. The friction values given in Annex 3 are valid for swept clean dry or wet surfaces free from frost, ice, snow, oil and grease. When a combination of contact surfaces is missing in the table in Annex 3 or if it's coefficient of friction can't be verified in another way, the maximum μ-static to be used in calculations is 0.3. If the surface contacts are not free from frost, ice and snow a static friction coefficient μ = 0.2 shall be used. For oily and greasy surfaces or when slip sheets have been used a static friction coefficient μ = 0.1 shall be used. The coefficient of friction for a material contact can be verified by static inclination or dragging tests. ~~(see Annex 6).~~ With an inclination test the friction is obtained as tangents for the sliding angle and with a dragging test the friction is the relation between the horizontal force at sliding and the vertical force. A number of tests should be performed to establish the friction for a material contact.

10.2.2.3 The friction force is widely independent from the extent of the area of contact, i.e. the friction force cannot be increased by providing a greater contact area. However, a too small contact area may diminish the friction coefficient due to high pressure effects to the materials involved. It is therefore prudent to provide a contact area of reasonable extent. A small contact area on wood normally increases the sliding resistance between the surfaces due to indentation in the wood. As friction coefficients may be ~~further~~ diminished, if the contact area is contaminated by sand, dust, traces of water, oil, grease, ice or snow, good cleaning of the stowage surface of a CTU before packing is important.

10.2.2.4 Friction increasing materials like rubber mats, sheets of structured plastics or special cardboard may provide considerably higher friction coefficients, which are declared and certified by the manufacturers. However, care should be taken in the practical use of these materials. Their

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certified friction coefficient may be limited to perfect cleanliness and evenness of the contact areas and to specified ambient conditions of temperature and humidity. The desired friction increasing effect will be obtained only if the weight of the cargo is fully transferred via the friction increasing material, this means only if there is no direct contact between the cargo and the stowage ground. Manufacturer's instructions on the use of the material should be observed.

10.2.3 Blocking and bracing material and arrangements

10.2.3.1 Blocking, bracing or shoring is a securing method, where e.g. timber scantlings, empty pallets or dunnage bags are filled into gaps between cargo and solid boundaries of the CTU or into gaps between different cargo units. Forces are transferred in this method by compression with minimal deformation. Inclined bracing or shoring arrangements bear the risk of bursting open under load and should therefore be properly designedavoided. In CTUs with strong sides, if possible, cargo units should be stowed tightly to the boundaries of the CTU on both sides, leaving the remaining gap in the middle. This reduces the forces to the bracing arrangement, because lateral g-forces from only one side will need to be transferred at a time.

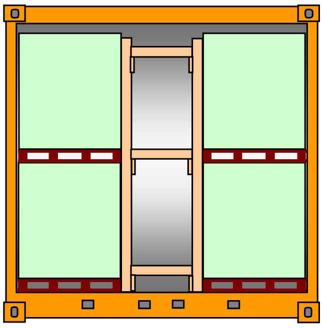


Figure 10-2 : Centre gap with transverse bracing

10.2.3.2 Forces being transferred by bracing or shoring need to be dispersed at the points of contact by suitable cross-beams, unless a point of contact represents a strong structural member of the cargo or the CTU. Cross-beams of conifer timber should be given sufficient overlaps at the shore contact points. For the assessment of bedding and blocking arrangements, the nominal strength of timber should be taken is shown infrom the table below:

	Compressive strength normal to the grain	Compressive strength parallel to the grain	Bending strength
Low quality	0.5 kN / cm²	2.0 kN / cm²	2.4 kN / cm²
Medium quality	0.5 kN / cm²	2.0 kN / cm²	3.0 kN / cm²

10.2.3.3 A bracing or shoring arrangement should be designed and completed in such a way that it remains intact and in place, also if compression is temporarily lost. This requires suitable uprights or benches supporting the actual shores, a proper joining of the elements by nails or cramps and the stabilising of the arrangement by diagonal braces as appropriate (see Figure 10-3 and Figure 10-4).

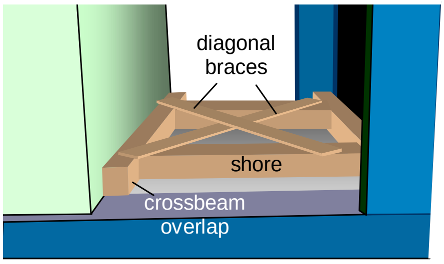


Figure 10-3 : Shoring arrangement showing cross beam overlap and diagonal braces

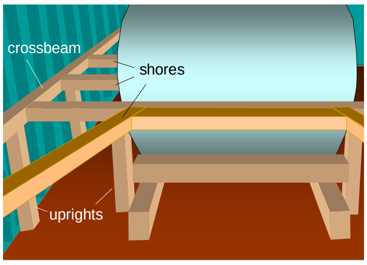


Figure 10-4 : Shoring arrangement with uprights and crossbeam

10.2.3.4 Transverse battens in a CTU, intended to restrain a block of cargo units in front of the door or at intermediate positions within the CTU, should be sufficiently dimensioned in their cross-section, in order to withstand the expected longitudinal forces from the cargo. The ends of such battens may be forced into solid corrugations of the side walls of the CTU. However, preference should be given to brace them against the frame structure, such as bottom or top rails or corner posts. Such battens act as beams, which are fixed at their ends and loaded homogeneously over their entire length of about 2.4 metres. Their bending strength is decisive for the force that can be resisted. The required number of such battens together with their dimensions may be identified by calculations, which is shown in Annex IV.

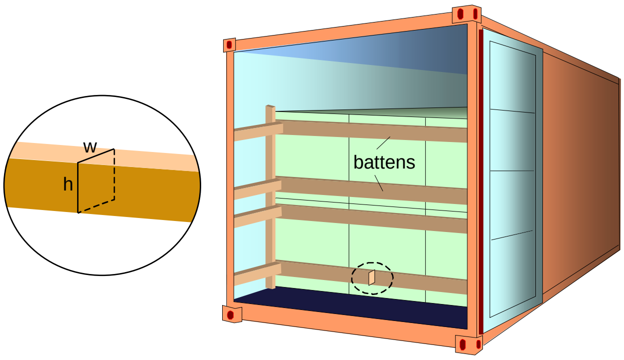


Figure 10-5 : General layout of fence battens for door protection in a container

10.2.3.5 Blocking by nailed on scantlings should be used for minor securing demands only. Depending on the size of the nails used, the shear strength of such a blocking arrangement may be estimated to take up a blocking force between 1 and 4 kN per nail. Nailed on wedges may be favourable for blocking round shapes like pipes. Care should be taken that wedges are cut in a way that the direction of grain supports the shear strength of the wedge. ~~Any such scantlings or wedges should only be nailed to dunnage or timbers placed under the cargo. Wooden floors of closed cargo transport units are generally not suitable for nailing. Nailing to the soft wood floor of flatracks or platforms may be acceptable with the consent of the owner or operator of the flatrack or platform.~~

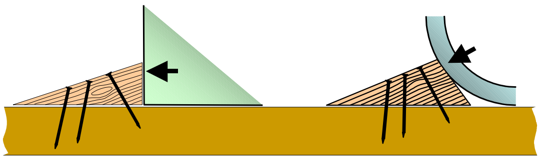
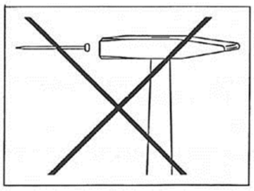


Figure 10-6 : Properly cut and nailed wedges

Nailing to the floor should not be done if the CTU is marked accordingly with a sign as shown below or if it is so agreed with the CTU supplier.

Formaterat: Normal, Indrag: Vänster: 0 cm, Hängande: 2 cm



Formaterat: Teckenfärg: Mörkblå
Formaterat: Normal, Centrerad, Indrag: Vänster: 0 cm, Hängande: 2 cm
Formaterat: Normal

10.2.3.6 Void spaces should be filled and may be favourably stuffed by empty pallets inserted vertically and tightened by additional timber scantlings as necessary. Material which may deform or shrink permanently, like rags of gunny cloth or solid foam of limited strength, should not be used for this purpose. Small gaps between unit loads and similar cargo items, which cannot be avoided and which are necessary for the smooth packing and unpacking of the goods, are acceptable and need not to be filled. The sum of void spaces in any direction should not exceed 15 cm. However, between dense and rigid cargo items, such as steel, concrete or stone, void spaces should be further minimized, as far as possible.

10.2.3.7 Gaps between cargo that is stowed on and firmly secured to pallets (by lashings or by shrink foil), need not to be filled, if the pallets are stowed tightly into a CTU and are not liable to tipping. Securing of cargo to pallets by shrink foil wrapping is only sufficient if the strength of the foil is appropriate for above purpose. It should be considered that in case of sea transport repetitive high loadings during bad weather may fatigue the strength of a shrink foil and thereby reduce the securing capacity.

Figure 10-7 : Cargo firmly secured to pallets by textile lashings

10.2.3.8 If dunnage bags are used for filling gaps, the manufacturer's instructions on filling pressure and the maximum gap width should be accurately observed. Dunnage bags should not be used as a means of filling the space at the doorway, unless precautions are taken to ensure that they cannot cause the door to open violently when the doors are opened. If the surfaces in the gap are uneven with the risk of damage to the dunnage bags by chafing or piercing, suitable measures have to be taken for smoothing the surfaces appropriately. The blocking capacity of dunnage bags should be estimated by multiplying the nominal burst pressure with the contact area to one side of the blocking arrangement and with a safety factor of 0.75 for single use dunnage bags and 0.5 for re-usable dunnage bags (see Annex ~~4~~ IV and Annex VII~~7~~).


Figure 10-8 :Gap filled with a central dunnage bag


Figure 10-9 : Irregular shaped packages blocked with dunnage bags

10.2.3.9 The restrictions on the use of blocking and bracing materials with regard to quarantine regulations, in particular for wood or timber, should be kept in mind (see paragraphs 10.1.2.12 and 10.1.2.13). More information on practical aspects of blocking and bracing may be found under www.containerhandbook.de.

10.2.4 Lashing materials and arrangements

10.2.4.1 Lashings transfer tensile forces. The strength of a lashing may be declared by its breaking strength or breaking load (BL). The maximum securing load (MSL) is a specified proportion of the breaking strength and denotes the force that should not be exceeded in securing service. The term lashing capacity (LC), used in national and regional standards, corresponds to the MSL. Figures of BL, MSL or LC are indicated in units of force, i.e. kilo-Newton (kN) or deka-Newton (daN).

10.2.4.2 The relation between MSL and the breaking strength is shown in the table below. The figures are consistent with Annex 13 of the IMO CSS-Code. Corresponding relations according to standards may differ slightly.

Material	MSL
shackles, rings, deck eyes, turnbuckles of mild steel	50 % of breaking strength
fibre ropes	33 % of breaking strength
web lashings	50 % of breaking strength
wire ropes (single use)	80 % of breaking strength
wire rope (re-useable)	30 % of breaking strength
steel band (single use)	70 % of breaking strength
chains	50 % of breaking strength
web lashing (single use)	75 % of breaking strength[1]

[1] Max allowed elongation 7% at MSL
Relation between MSL and BL

10.2.4.3 Lashings transfer forces under a certain elastic elongation only. They act like a spring. If loaded more than the specific MSL, elongation may become permanent and the lashing will fall slack. New wire and fibre ropes or belts may show some permanent elongation until gaining the desired elasticity after repeated re-tensioning. Lashings should be given a pre-tension, in order to minimise cargo movement. However, the initial pre-tension should never exceed 50% of the MSL.

10.2.4.4 Fibre ropes of the materials manila, hemp, sisal or manila-sisal-mix and moreover synthetic fibre ropes may be used for lashing purposes. If their MSL is not supplied by the manufacturer or chandler, rules of thumb may be used for estimating the MSL with d = rope diameter in cm:

Natural fibre ropes: $MSL = 2 \cdot d^2$ [kN]

Polypropylene ropes: $MSL = 4 \cdot d^2$ [kN]

Polyester ropes: $MSL = 5 \cdot d^2$ [kN]

Polyamide ropes: $MSL = 7 \cdot d^2$ [kN]

Composite ropes made of synthetic fibre and integrated soft wire strings provide suitable stiffness for handling, knotting and tightening and less elongation under load. The strength of this rope is only marginally greater than that made of plain synthetic fibre.

10.2.4.5 There is no strength reduction to fibre ropes due to bends at round corners. Rope lashings should be attached as double, triple or fourfold strings and tensioned by means of wooden turn sticks. Knots should be of a professional type, e.g. bowline knot and double half hitch. Fibre ropes are highly sensitive against chafing at sharp corners or obstructions.

10.2.4.6 Synthetic ~~fibre belt~~web lashings are mainly re-usable devices with integrated ratchet tensioner or one-way yard ware, available with combined tensioning and locking devices. The permitted securing load is generally labelled and certified as lashing capacity LC~~, which should be taken as MSL~~. There is no rule of thumb available for estimating the MSL due to different base materials and fabrication qualities. The fastening of web lashing ~~belts~~ by means of knots reduces their strength considerably and should therefore not be applied.

10.2.4.7 The elastic elongation of web lashings~~synthetic fibre belts~~, when loaded to their specific MSL, is generally around 5% of the length and shall not exceed 7% according to European standards[2]. Web lashings should be protected against chafing at sharp corners, against mechanical wear and tear in general and against chemical agents like solvents, acids and others.

10.2.4.8 Wire rope used for lashing purposes in CTUs for sea-transport consists of steel wires with a nominal BL of around 1.6 kN/mm^2 and the favourite construction 6 x 19 + 1FC, i.e. 6 strands of 19 wires and 1 fibre core. If a certified figure of MSL is not available, the maximum securing load for one-way use may be estimated by MSL = 40 · d^2 kN. Other available lashing wire constructions with a greater number of fibre cores and less metallic cross-section have a considerably lesser strength related to the outer diameter. The elastic elongation of a lashing wire rope is about 1.6% when loaded to one-way MSL, but an initial permanent elongation must be expected after the first tensioning, if the wire rope is new.

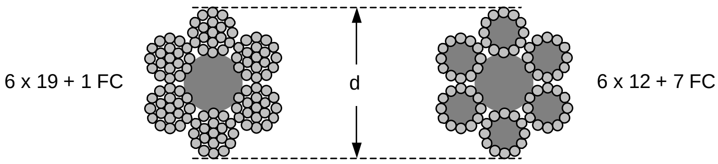


Figure 10-10 : Typical lashing wire rope construction

10.2.4.9 Narrow rounded bends reduce the strength of wire ropes considerably. The residual strength of each part of the rope at the bend depends on the ratio of bend diameter to the rope diameter as shown in the table below.

ratio: bend diameter / rope diameter	1	2	3	4	5
residual strength with rope steady in the bend	65%	76%	85%	93%	100%

Bending a wire rope around sharp corners, like passing it through the edged hole of an eye-plate, reduces its strength even more. The residual MSL after a 180° turn through such an eye-plate is only about 25% of the MSL of the plain rope, if steady in the bend.

10.2.4.10 Wire rope lashings in sea-transport are usually assembled by means of wire rope clips. It is of utmost importance that these clips are of appropriate size and applied in correct number, direction and tightness. Recommended types of such wire rope lashing assemblies are shown in Figure 10-11. A typical improper assembly is shown in Figure 10-12.

[2] EN 12195-2:2000

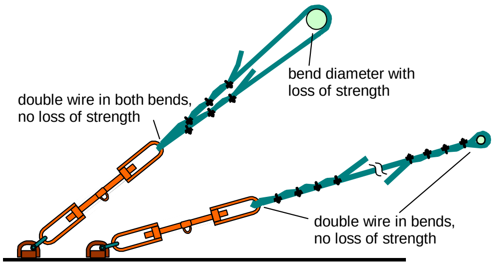


Figure 10-11 : Recommended assemblies for wire rope lashing

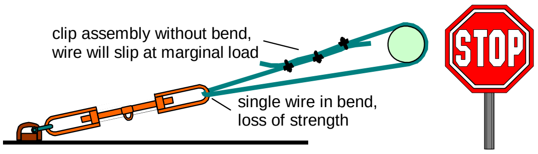


Figure 10-12 : Improper assembly for wire rope lashing

10.2.4.11 Tensioning and joining devices associated to wire rope lashings in sea-transport are generally not standardised. The MSL of turnbuckles and lashing shackles should be specified and documented by the manufacturer and at least match the MSL of the wire rope part of the lashing. If manufacturer information is not available, the MSL of turnbuckles and shackles made of ordinary mild steel may be estimated by MSL = $10 \cdot d^2$ [kN] with d = diameter of thread of turnbuckle or shackle bolt in cm.

10.2.4.12 Wire rope lashings in road transport according to European standards[3] are specified as re-usable material of distinguished strength in terms of lashing capacity (LC), which should be taken as MSL. Connections elements like shackles, hooks, thimbles, tensioning devices or tension indicators are accordingly standardised by design and strength. The use of wire rope clips for forming soft eyes has not been envisaged. Assembled lashing devices are supplied with a label containing identification and strength data. When using such material, the manufacturer's instructions should be observed.

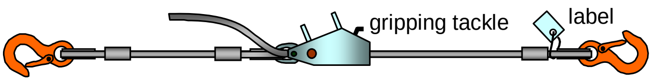


Figure 10-13 : Standard wire lashing used in road transport with gripping tackle

10.2.4.13 Lashing chains [used in sea-transport] are generally long link chains of ~~13 mm steel diameter and MSL = 100 kN for~~ 8 grade steel. A 13 mm chain of grade 8 has a MSL of 100 kN, t~~T~~he MSL for other dimensions and steel qualities should be obtained from the manufacturer's specification. The elastic elongation of the above long link chains is about 1% when loaded to their MSL. Long link chains are sensitive against guiding them around bends of less than about 10 cm radius. The favourite tensioning device is a lever with a so-called climbing hook for re-tightening the lashing during service. Manufacturer's instructions and, when existing, national regulations on the use of the tensioning lever and re-tensioning under load should be strictly observed.

3 EN 12195-4:2003

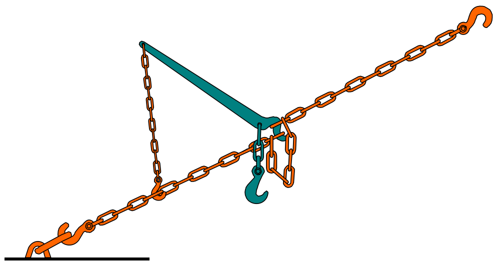


Figure 10-14 : Long link lashing chain with lever tensioner

10.2.4.14 Chain lashings used in road and rail transport according to European standards[4] are mainly short link chains. Long link chains are reserved for the transport of logs. Short link chains have an elastic elongation of about 1.5%, when loaded to their LC. The standard includes various systems of tensioners, specially adapted hooks, damping devices and devices to shorten a chain to the desired loaded length. Chain compound assemblies may be supplied with a label containing identification and strength data. Manufacturer's instructions on the use of the equipment should be strictly observed.

Figure 10-15 : Standard chain lashing with shortening hook

10.2.4.15 Steel band for securing purposes is generally made of high tension steel with a normal breaking strength of 0.8 to 1.0 kN/mm^2. Steel bands are most commonly used for compacting cargo units to form greater blocks of cargo. ~~[~~In sea transport, such steel bands are also used to "tie down" cargo units to flatracks, platforms or roll-trailers.~~]~~ The bands are tensioned and locked by special manual or pneumatic tools. Subsequent re-tensioning is not possible. The low flexibility of the band material with about 0.3% elongation, when loaded to its MSL, makes steel band sensitive for loosing pre-tension if cargo shrinks or settles down. Therefore, the suitability of steel band for cargo securing is limited and national restrictions on their use in road or rail transport should always be considered. The use of steel bands for lashing purposes should be avoided on open CTUs as a broken lashing could be of great danger if it hangs outside the CTU.

Figure 10-16 : Metal ingots compacted by steel banding (securing not completed)

10.2.4.16 Twisted soft wire should be used for minor securing demands only. The strength of soft wire lashings in terms of MSL is scarcely determinable and their elastic elongation and restoring force is poor.

10.2.4.17 Modular lashing systems with ready-made ~~synthetic fibre belt~~web lashings are available in particular for general cargo containers, to secure cargo against movement towards the door. The belts are connected to the lashing points of the container with special fittings and are pre-tensioned by means of cam-buckles and a tensioning tool. The number of ~~belts~~ lashings is to be calculated depending on the mass of the cargo, the MSL ~~lashing capacity~~ of the lashings~~belts~~,

4 EN 12195-3:2001

the lashing angle and the capacity of the lashing points in the container (see paragraph 7.1.2.4). Due to the limited strength of lashing points in containers the arrangement should be used for light cargo only or for preventing cargo from falling out when the doors are opened. More information may be obtained from the producers or suppliers of such modular systems.

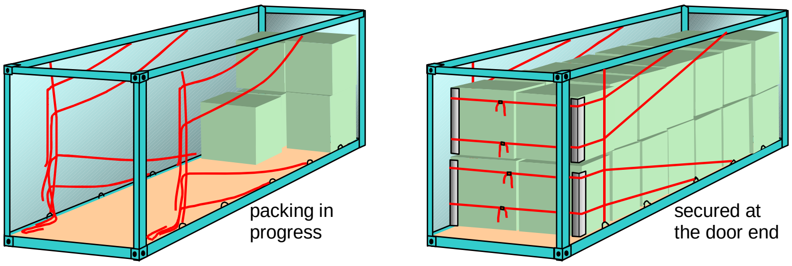


Figure 10-17 : Modular belt lashing system :

10.3 Principles of packing

10.3.1 Load distribution

10.3.1.1 Containers, flatracks and platforms are designed according to ISO standards amongs others in such a way that the permissible payload P, if homogeneously distributed over the entire loading floor, can safely be transferred to the four corner posts under all conditions of carriage. This includes a safety margin for temporary weight increase due to vertical accelerations during a sea-passage. When the payload is not homogeneously distributed over the loading floor, the limitations for concentrated loads have to be considered. It might be necessary to transfer the weight to the corner posts and to support the cargo by strong timber beams or by steel beams, as appropriate.~~If the payload cannot be homogeneously distributed over the loading floor, the weight must either be reduced or the weight transfer to the corner posts must be supported by timber or steel beams placed under the cargo.~~

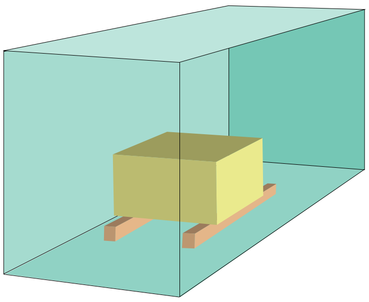


Figure 10-18 : Load transfer beams

10.3.1.2 The bending strength of the beams must be sufficient for the purpose of load transfer of concentrated loads. The arrangement, the required number and the strength of timber beams or steel beams may be identified by calculations shown in the Annex 4IV.

10.3.1.3 Concentrated loads on platforms or flatracks should be similarly expanded by bedding on longitudinal beams or the load must be reduced against the maximum payload. The permissible load may be determined by calculations shown in the Annex IV4.

10.3.1.4 Where containers, including flatracks or platforms, shall be lifted and handled in an even state during transport, the cargo should be so arranged and secured in the container that its joint centre of gravity is close to the mid-length and mid-width of the container. In order to comply with restrictions like the observation of axle loads of road vehicles (see 10.3.1.7) and/or the avoidance of overloading the transverse bottom structure of the CTU, the eccentricity of the centre of gravity should not exceed ±5% in general. Under particular circumstances if agreed with the carrier (e.g. for CTU used in the sea mode only, without road or rail transport involved) an eccentricity of up to ±10% could be accepted, as advanced spreaders for handling ISO containers are capable of adjusting such eccentricity. The precise longitudinal position of the centre of gravity of a loaded CTU may be determined by calculation (see Annex IV4). In no case should more than 60% of the actual load be concentrated in less than half the length of a container and not less than 40% in the other half.

10.3.1.5 Roll trailers have structural properties similar to ISO platforms, but are less sensible against concentrated loads due to the usual wheel support at about 3/4 of their length from the gooseneck tunnel end. As they are generally handled without lifting, the longitudinal position of the cargo centre of gravity is not critical as well.

10.3.1.6 Swap bodies have structural properties similar to ISO box-containers, but in most cases less tare weight and less overall strength. They are normally not stackable. The loading instructions given under 10.3.1.2 and 10.3.1.5 should be applied to swap bodies as appropriate.

10.3.1.7 Road trucks and road trailers are in particular sensitive regarding the position of the centre of gravity of the cargo loaded in them, due to specified axle loads for maintaining steering and braking ability. Such vehicles may be equipped with specific diagrams, which show the permissible pay load as a function of the longitudinal position of its centre of gravity. Generally, the maximum pay load may be used only when the centre of gravity is positioned within narrow boundaries about half the length of the loading space.

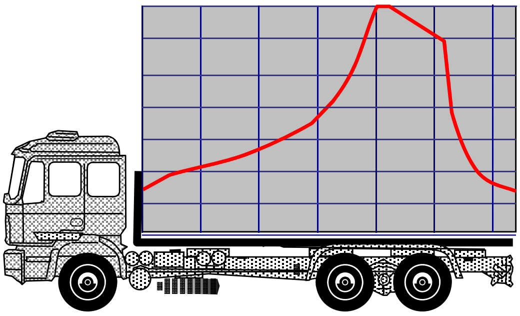


Figure 10-19 : Typical load distribution diagram for rigid truck

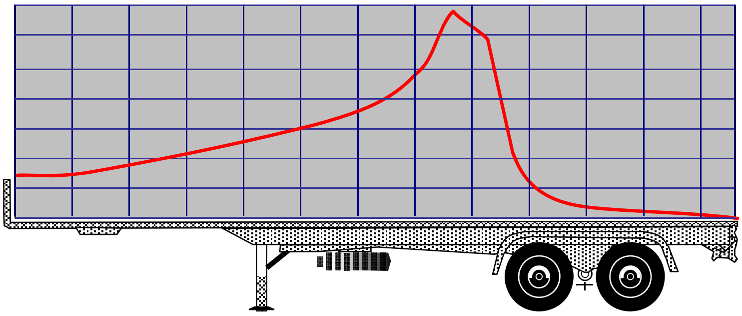


Figure 10-20 : Typical load distribution diagram for semi-trailer

10.3.1.8 Railway routes are classified into line categories, by which permissible axle loads and loads per metre length of cargo space are allocated to each railway wagon. The applicable figures must be observed in view on the intended route of the wagon. Tolerable concentrated loads are graded depending on their bedding length. The appropriate load figures are marked on the wagons. The transverse and longitudinal deviation of cargo centre of gravity from wagon centre-lines is limited by defined relations of transverse wheel loads and longitudinal axle/bogie loads. The proper loading of railway wagons should be supervised by specifically trained persons.

10.3.2 General stowage/packing techniques

10.3.2.1 Stowage and packing techniques should be suitable to the nature of the cargo with regard to weight, shape, structural strength and climatic sensibility. This includes the proper use of dunnage material (see subsection 10.2.1), the selection of the appropriate method of mechanical handling and the proper stowage of vented packages. The concept of stowage should incorporate the feasibility of smooth unloading.

10.3.2.2 Any marking on parcels should be strictly observed. Cargoes marked "this way up" should not only be stowed upright but also kept upright during entire handling. Goods which may be subject to inspection by the carrier or by authorities, like dangerous goods or goods liable to customs duty, should if possible be stowed at the door end of the CTU.

10.3.2.3 When packing mixed cargoes, their mutual compatibility should be observed. Irrespective the regulations for the stowage of dangerous goods (see Chapter 11) the following general rules are applicable:

- Heavier cargoes should not be stowed on top of lighter cargoes. This will also provide for the centre of gravity of the CTU in a level not exceeding half the height of the CTU.
- Heavy units should not be stowed on top of fragile parcels.
- Sharp-edged pieces should not be stowed on top of units with weak surfaces.
- Liquid cargoes should not be stowed on solid cargoes.
- Dusty or dirty cargoes should not be placed near to clean and easily soiled cargoes like foodstuff in porous packing.
- Cargoes emitting moisture should not be stowed on or near to cargoes sensible to moisture.
- Smelling cargoes should not be stowed in the vicinity of cargoes easily assimilating odour.
- Mutually incompatible cargoes should be loaded into the same CTU only, if their stow is appropriately separated and/or the goods are effectively protected by suitable sheathing material.

10.3.2.4 Stacking of sensible parcels of uniform size and shape should be precise in a way that the weight from above is transferred to the vertical boards of the parcels below. If necessary, e.g. due to lateral leeway of the stack in the CTU, intermediate sheets of fibreboard, plywood or pallets should be placed between layers of the stack. Parcels of irregular shape and/or size should be stacked only with due consideration of their structural hardiness. Gaps and irregularities of level should be stuffed or equalised by means of dunnage.

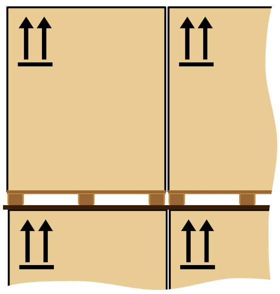


Figure 10-21 : With Intermediate board

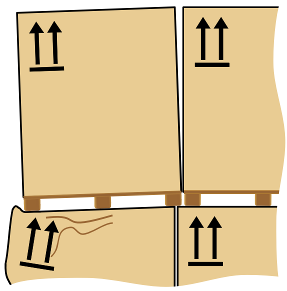


Figure 10-22 : Without intermediate board

10.3.2.5 Parcels with a less defined shape like bags or bales may be stacked in an interlocking pattern, also called cross-tie, thereby creating a solid pile that may be secured by blocking or fencing. Round longish units like pipes may be stacked into the grooves of the layer below. However, care should be taken of the lateral forces produced by top layers in the grooves of the bottom layers, which may locally overload the side walls of the CTU if the friction between the pipes is low.

Figure 10-23 : Cross-tie stowage

10.3.2.6 Uniform parcels like drums or standardised pallets should be packed in a way that minimises lost space and provides a tight stow at the same time. Drums may be stowed either in regular lines, also called "soldier stowage", or into the vertical grooves, also called "offset stowage". With small drums the offset packing is more effective, while with greater drum diameters the advantage may be with the soldier stow. Pallet dimensions are widely standardised and adapted to the inner width and length of cargo spaces in road trucks, road trailers and swap bodies, but not throughout to the inner dimensions of ISO containers.

Figure 10-24 : Mixed stow, dry over wet goods

Figure 10-25 : Mixed stow, use of pallets

10.3.2.7 Near to completion of packing a CTU, care should be taken to build a firm face of the cargo so as to prevent a "fall out" when the CTU is opened. If there is any doubt about the stability of the face, further steps should be taken such as strapping top layers of cargo back to securing points or building a timber fence between the rear posts in a container (see paragraph 10.2.3.4). It should be borne in mind, that a container on a trailer usually inclines towards the doors aft and that cargo may move against the doors due to vibration induced shift or by jolts during transport.

10.3.3 Cargo handling

10.3.3.1 Relevant regulations on the use of personnel protection equipment (helmet, shoes, gloves and clothing) should be adhered to. Personnel should have been instructed on ergonomic aspects of manual lifting of weighty parcels. Weight limitations of parcels to be lifted and carried by persons should be observed.

10.3.3.2 FLTs, used for driving inside roofed CTUs, should have a short lifting mast and a low driver's overhead guard. If the lift truck operates inside a CTU care should be taken of the exhaust gases and equipment with electric power supply or similar should be used. FLTs operated by a combustion engine should comply with national combustion emission standards. FLTs with engines burning LPG-fuel should not be used below the ground level, in order to prevent the accumulation of explosive gas mixtures from unexpected leaks.

10.3.3.3 Driving FLTs into swap-bodies, semi-trailers or other supported CTUs should be done slowly, in particular with careful starting and braking, in order to avoid dangerous horizontal forces to the supports of the CTU.

10.3.3.4 If CTUs are to be loaded with FLTs from the side, significant lateral impact forces to the CTU must be avoided. Such forces may particularly appear, when cargo units are pushed across the loading area. If there is a~~The~~ risk of overturning the CTU it could be considered to ~~may be minimised by~~ either load~~ing~~ from both sides to the centre line of the CTU or to~~by~~ us~~e~~~~ing~~ FLTs with higher capacity and long forks, which make pushing dispensable.

10.3.3.5 If the roof of a CTU must be entered by persons, e.g. for filling the CTU with a free-flowing bulk cargo, the load-bearing capability of the roof should be observed. Roofs of containers are designed for and tested with a load of 300 kg (660 lbs), which acts uniformly on an area of 600 x 300 mm (24 x 12 inches) in the weakest region of the roof (reference: CSC, Annex II). Practically, no more than two persons should work on a container roof simultaneously.

10.3.3.6 When loading or unloading heavy parcels with C-hooks through doors or from the sides of a CTU, care should be taken, that the transverse or longitudinal girders of the roof or side walls are struck neither by the hook nor the cargo. The move of unit should be controlled by appropriate means, e.g. guide ropes. Relevant regulations for the prevention of accidents should be observed.

10.4 Securing of cargo in CTUs

10.4.1 Aims and principles of securing

10.4.1.1 Arrangements or stacks of cargo items shall be packed in a way so as to remain in place and upright by their static friction and by their inherent tilting stability, while packing or unpacking a CTU is in progress. This guarantees the safety of packers before additional securing devices are put in place or after such devices have been removed for unloading.

10.4.1.2 During transport the CTU may be subjected to vertical, longitudinal and transverse accelerations, which cause forces to each cargo item, which are proportional to its mass. It should not be assumed, that because a cargo unit is heavy, it will not move during transport. The relevant accelerations are outlined in Chapter 6 of this Code in units of g, indicating the corresponding forces in units of weight of the distinguished cargo item. These forces may easily exceed the capability of static friction and tilting stability, so that cargo items may slide or tilt over. In addition, the CTU may be simultaneously subjected to temporary vertical accelerations, which cause a weight decrease, thereby reduce the friction and the inherent tilting stability, thus promoting sliding and tipping. Any securing of cargo must aim at the avoidance of such unwanted cargo behaviour. No part of the cargo shall slide or tip in transverse or longitudinal direction under the stipulated accelerations of the CTU during the intended route of transport.

10.4.1.3 Practical securing of cargo may be approached by three distinguished principles, which may be used individually or combined as appropriate:

- Direct securing is effected by the immediate transfer of forces from the cargo to the CTU by means of blocking, lashings, shores or locking devices. The securing capacity is proportional to the MSL of the securing devices.
- Friction securing is achieved by so-called tie-down or top-over lashings which, by their pre-tension, increase the apparent weight of the cargo and thereby the friction to the loading ground and also the tilting stability. The securing effect is proportional to the pre-tension of the lashings. Anti-slip material in the sliding surfaces considerably increases the effect of such lashings.
- Compacting cargo by bundling, strapping or wrapping is an auxiliary measure of securing that must always be combined with measures of direct securing or friction securing.

10.4.1.4 Lashings used for direct securing will inevitably elongate over time, thus permitting the package a degree of movement. To minimise this movement, (horizontal or lateral sliding, tipping or racking) ensure that:

- the lashing material has appropriate load-deformation characteristics (see subsection 10.2.4);
- the length of the lashing is kept as short as practicable; and
- the direction of the lashing is as close as possible to the direction of the intended restraining effect.

A good pre-tension in lashings will also contribute to minimising cargo motions, but the pre-tension should never exceed 50% of the MSL of the lashing. Direct securing by stiff pressure elements (shores or stanchions) or by locking devices (locking cones or twist-locks) will not imply significant cargo motion and should therefore be the preferred method of direct securing.

10.4.1.5 Lashings used for friction securing should be able to maintain the vital pre-tension for a longer period and should not fall slack from minor settling or shrinking of the cargo. Therefore synthetic fibre web lashings should be preferred to e.g. chains or steel band lashings. The pre-tension of tie-down lashings does in principle not fall under the limitation stated above for direct lashings, but will generally not be greater than 20% of the MSL of the lashing with manually operated tensioners. Care should be taken to establish this pre-tension on both sides of the lashing as far as practically~~, in particular if a tensioning device is applied on one side only. Good transfer of pre-tension to the other side may be achieved by placing sliding pads under the lashing at the edges of the cargo~~. Edges of sensitive cargo parcels should be stabilised by sufficiently dimensioned edge beams. For assessing a friction securing arrangement by calculation, the labelled standard pre-tension[5] should be used. If such marking is not available, a figure of 10% of the breaking strength of the lashing, but not more than 10 kN, should be used for calculation.

10.4.1.6 Arrangements of direct securing devices should be homogeneous in a way that each device in the arrangement takes its share of the restraining forces appropriate to its strength. Unavoidable differences in load distribution within complex arrangements may be compensated by the application of a safety factor. Nevertheless, devices of diverging load-deformation

[5] Standard tension force S_{TF} according to EN-12195-2

properties should not be placed in parallel, unless used for the distinguishable purposes of sliding prevention and tipping prevention. If, for instance, timber blocking and direct web lashing is used in parallel against sliding, the stiffer timber blocking must be dimensioned so as to resist the expected load alone. This restriction does not apply to the combination of tie-down lashings and e.g. timber blocking.

10.4.1.7 Any cargo securing measures should be applied in a manner that does not affect or impair the cargo or the CTU. Permanent securing equipment incorporated into a CTU should be used whenever possible or necessary.

10.4.1.8 During transport, in particular at suitable occasions of a multi-modal transport route, securing arrangements in CTUs should be checked and upgraded if necessary and as far as practicable. This includes re-tightening of lashings and wire rope clips and adjusting of blocking arrangements.

10.4.2 Tightly arranged cargoes

10.4.2.1 A vital prerequisite of cargo items for a tight stowage arrangement is their insensibility against mutual physical contact. Cargo parcels in form of cartons, boxes, cases, crates, barrels, drums, bundles, bales, bags, bottles, reels etc. or pallets containing the aforesaid items are usually packed into a CTU in a tight arrangement in order to utilise the cargo space, to beware cargo items from tumbling around and to enable measures of common securing against transverse and longitudinal movement during transport.

10.4.2.2 A tight stow of uniform or variable cargo items should be planned and arranged according to principles of good packing practice, in particular observing the advice given in subsection 10.3.2 above. If coherence between items or tilting stability of items is poor, additional measures of compacting may be necessary like hooping or strapping batches of cargo items with steel or plastic tape or plastic sheeting. Gaps between cargo items or between cargo and CTU boundaries should be filled as necessary (see paragraphs 10.2.3.6 to 10.2.3.8). Direct contact of cargo items with CTU boundaries may require an interlayer of protecting material (see subsection 10.2.1).

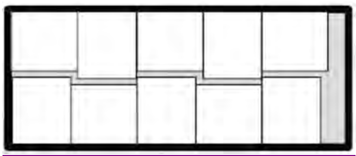


Figure 10.23: Packing 1000 x 1200 mm unit loads in a 20 ft container – void spaces (grey colour) to be filled

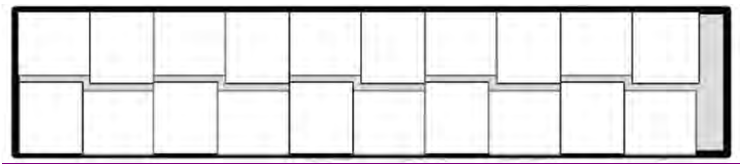


Figure 10.24: Packing 1000 x 1200 mm unit loads in a 40 ft container – void spaces (grey colour) to be filled

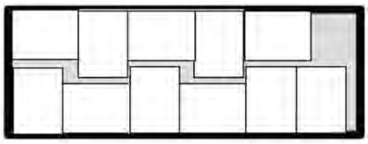


Figure 10.25: Packing 800 x 1200 mm unit loads in a 20 ft container – void spaces (grey

Formaterat: Indrag: Vänster: 1,5 cm, Ingen numrering

Formaterat: Justerat, Indrag: Vänster: 1,5 cm, Ingen numrering

Formaterat: Engelska (USA)

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Formaterat: Engelska (USA)

colour) to be filled

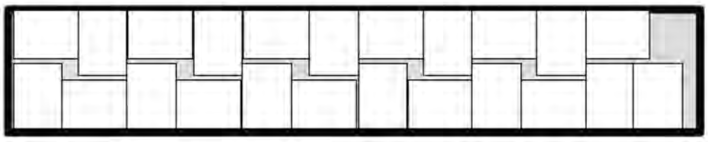


Figure 10.26: Packing 800 x 1200 mm unit loads in a 40 ft container – void spaces (grey colour) to be filled

10.4.2.3 CTUs with **strong cargo space boundaries** may inherently satisfy transverse and longitudinal securing requirements in many cases, depending on the type of CTU, the intended route of transport and appropriate friction among cargo items and between cargo and stowage ground. The following balance demonstrates the confinement of tightly stowed cargo within strong cargo space boundaries:

$$c_{x,y} \cdot m \cdot g \le r_{x,y} \cdot P \cdot g + \mu \cdot c_z \cdot m \cdot g \quad [kN]$$

$c_{x,y}$ = horizontal acceleration coefficient in the relevant mode of transport (see Chapter 6),

m = mass of cargo loaded [t],

g = gravity acceleration 9.81 m/s^2,

$r_{x,y}$ = CTU wall resistance coefficient (see Chapter 7),

P = maximum payload of CTU [t],

μ = applicable friction coefficient between cargo and stowage ground (see Annex III~~3~~),

c_z = vertical acceleration coefficient in the relevant mode of transport (see Chapter 6).

10.4.2.4 Critical situations may arise, e.g. with a fully loaded ISO box-container in road transport, where longitudinal securing must be able to withstand an acceleration of 0.8 g. The longitudinal wall resistance factor of 0.4 must be combined with a friction coefficient of at least 0.4 for satisfying the securing balance. If a balance cannot be satisfied, the mass of cargo must be reduced or the longitudinal forces must be transferred to the main structure of the container. The latter can be achieved by intermediate transverse fences of timber battens (see paragraph 10.2.3.4) or by other suitable means. Another option is the use of friction increasing material.

10.4.2.5 When the door end of a CTU is designed to provide a defined wall resistance (e.g. the doors of a general cargo container, see paragraph 7.1.2.3) the doors may be considered as a strong cargo space boundary, provided the cargo is stowed ~~practically with contact to the door. In case of any void space between the cargo and the door, the cargo needs to be secured against movement towards the door by blocking and bracing (see paragraph 10.2.3.4) or by appropriate lashing (see paragraph 10.2.4.17),~~ to avoid impact loads to the door end and to prevent the cargo from falling out when the doors are opened.

Formaterat: Indrag: Vänster: 1,5 cm, Ingen numrering

Formaterat: Justerat, Indrag: Vänster: 1,5 cm, Ingen numrering

Formaterat: Engelska (USA)

Formaterat: Indrag: Vänster: 1,5 cm

Formaterat: Teckenfärg: Blå, Engelska (USA), Kontrollera inte stavning eller grammatik

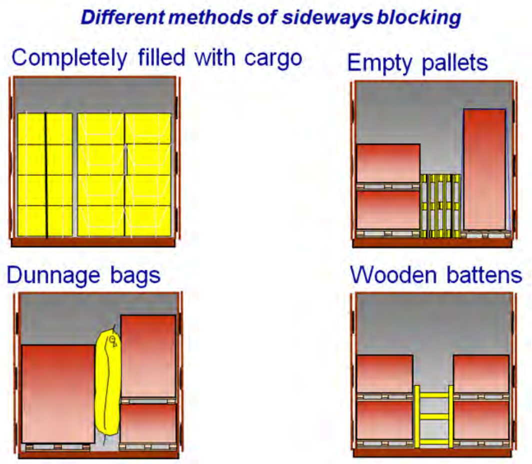


Figure 10.27: Different methods of sideways blocking

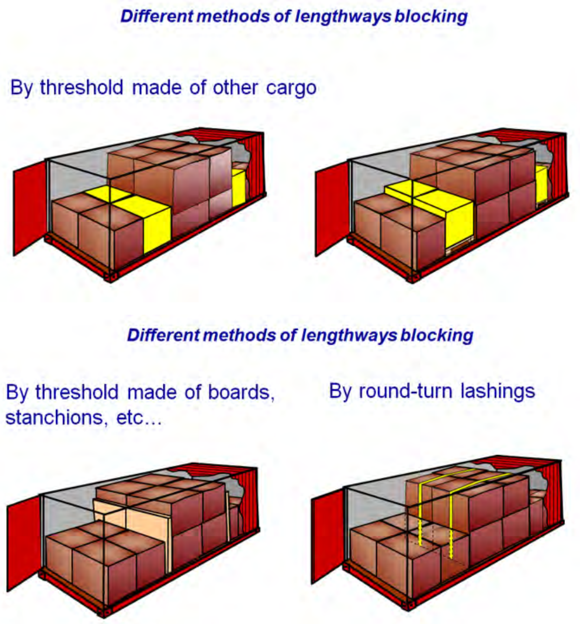


Figure 10.28: Different methods of lenthways blocking

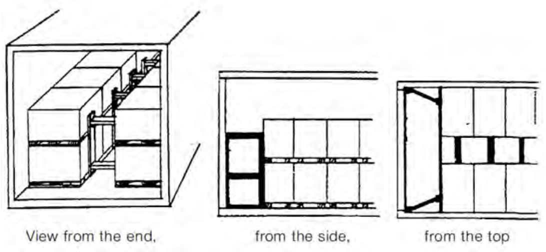


Figure 10.29: Blockinng cargoes in a strong-walled CTU *(really needed?)*

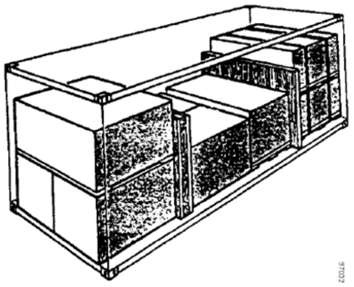


Figure 10.30: Cargo securing by vertical separator *(really needed?)*

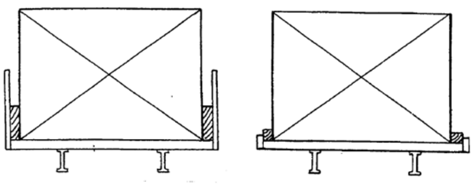
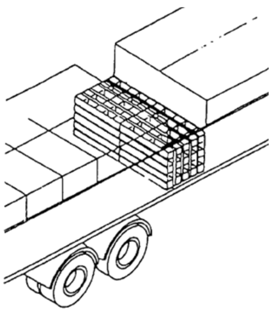


Figure 10.31: Blocking against strong sideboards



Figugure 10.34: Longitudinal blocking by empty pallets

10.4.2.6 CTUs with **weak cargo space boundaries** like certain road vehicles and swap bodies will regularly require additional securing measures against sliding and tipping of a block of tightly stowed cargo. These measures should also contribute to compacting the block of cargo. The favourite method in this situation is friction-securing by so-called top-over lashings. For obtaining a reasonable securing effect from friction lashings, the friction coefficient between cargo and stowage ground should be sufficient and the inherent elasticity of the lashings should be able to maintain the pre-tension throughout the course of transport. The following balance demonstrates the confinement of tightly stowed cargo within weak cargo space boundaries and an additional securing force against sliding:

$$c_{x,y} \cdot m \cdot g \leq r_{x,y} \cdot P \cdot g + \mu \cdot c_z \cdot m \cdot g + F_{sec} \text{ [kN]} \qquad (F_{sec} = \text{additional securing force})$$

If a wall resistance coefficient is not specified for the distinguished CTU, it should be set to zero. Further options of additional securing may consist of blocking the base of the cargo against stronger footing of the otherwise weak cargo space boundary or bracing the block of cargo against stanchions of the cargo space boundary system. Such stanchions may be interconnected by pendants above the cargo for increasing their resistance potential. F_{sec} per top-over lashing is: $F_V \cdot \mu$, where F_V is the total vertical force from the pre-tension. For vertical lashings F_V is ~~1.8~~2 times the pre-tension in the lashing.

10.4.2.7 On CTUs **without boundaries** the entire securing effect must be accomplished by securing measures like top-over lashings, friction increasing material and, if the CTU is a flatrack, by longitudinal blocking against the end-walls. The following balance demonstrates the securing of tightly stowed cargo on a CTU without cargo space boundaries:

$$c_{x,y} \cdot m \cdot g \leq \mu \cdot c_z \cdot m \cdot g + F_{sec} \text{ [kN]} \qquad (F_{sec} = \text{additional securing force})$$

For F_{sec} see 10.4.2.6. It should be noted that even in case of a friction coefficient that outnumbers the external acceleration coefficients, without cargo space boundaries a minimum number of top-over lashings is imperative for avoiding migration of the cargo due to shocks or vibration of the CTU during transport.

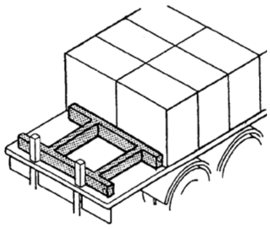


Figure: 10.32 Blocking against strong stanchions at aft

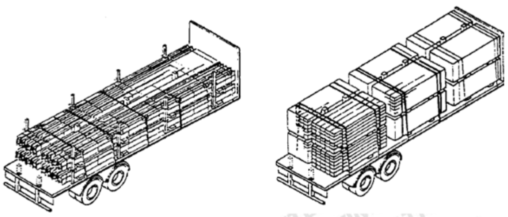


Figure 10.33: Blocking by stanchions combined with top-over lashing

10.4.3 Individually secured cargo units

10.4.3.1 Cargo units of greater size, mass or shape or units with sensible exterior facing, which does not allow direct contact to other units or CTU boundaries, must be individually secured. The securing arrangement must be designed to prevent sliding and, where necessary, tipping, both in the longitudinal and transverse direction. Securing against tipping is necessary, if the following condition is true:

$$c_{x,y} \cdot d \geq c_z \cdot b \text{ [kN]}$$

$c_{x,y}$ = horizontal acceleration coefficient in the relevant modes of transport (see Chapter 6),

d = vertical distance from centre of gravity of the unit to its tipping axis [m],

c_z = vertical acceleration coefficient in the relevant modes of transport (see Chapter 6).

b = horizontal distance from centre of gravity to tipping axis [m].

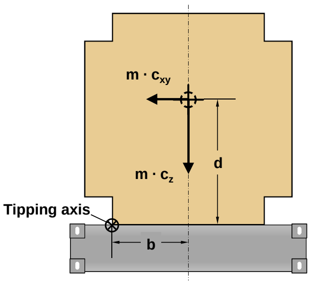


Figure 10-26 : Tipping criterion

10.4.3.2 Individually secured cargo units should preferably be secured by a direct securing method, i.e. by direct transfer of securing forces from the cargo unit to the CTU by means of lashings, shores or blocking.

A direct lashing will be between fixed fastening points on the package and the CTU and the effective strength of such a lashing is limited by the weakest element within the device, which includes fastening points on the package as well as fastening points on the CTU.

For sliding prevention by lashings the vertical lashing angle should preferably be in the range of 30° to 60°. For tipping prevention the lashings should be positioned in a way that provides effective levers related to the applicable tipping axis.

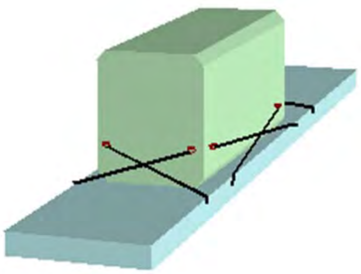


Figure 10-27 : Direct lashing against sliding

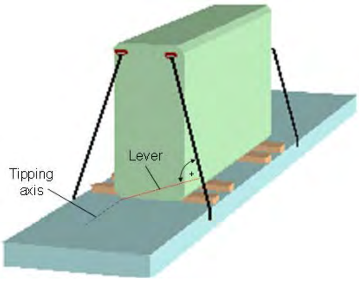


Figure 10-28 : Direct lashing against tipping

10.4.3.3 Cargo units without securing points should be either secured by shoring or blocking against solid structures of the CTU or by ~~over the~~ top-over, half-loop or spring lashings.

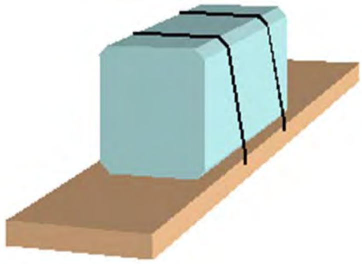


Figure 10-29 : ~~Over the t~~Top-over lashing

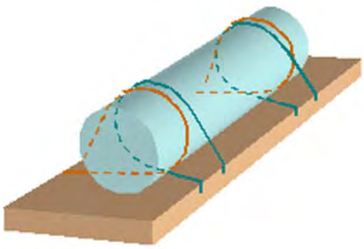


Figure 10-30 : Vertical half-loop lashing

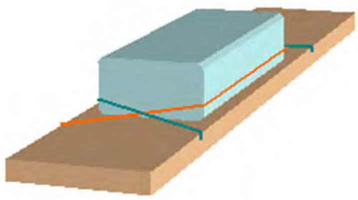


Figure 10-31 : Horizontal half-loop lashing

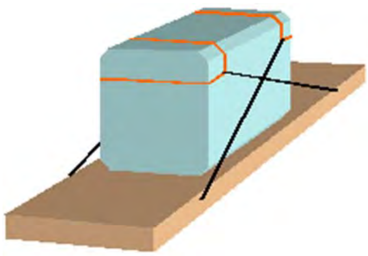


Figure 10-32 : Spring lashing

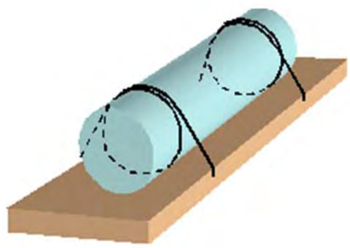


Figure 10-33 : Silly-loop lashing

Loop lashings with their ends fastened to either side (see Figure 10-33), also called "silly-loops", do not provide any direct securing effect and may permit the package to roll and therefore are not recommended.

Any lashing method adopted will require that the lashing material stretches in order to develop a restraining force. As the material relaxes the tension in the lashing will slowly reduce, therefore it is important that the guidance given in 10.4.1.4 should be followed.

10.4.3.4 CTUs with **strong cargo space boundaries** favour the method of blocking or shoring for securing a particular cargo unit. This method will minimise cargo mobility. Care should be taken that the restraining forces are transferred to the CTU boundaries in a way that excludes local overloading. Forces acting to CTU walls should be transferred by means of load spreading cross beams (see paragraphs 10.2.3.1 to 10.2.3.3). Very heavy cargo units, e.g. steel coils or blocks of marble, may require a combination of blocking and lashing, however with observation of the restrictions lined out in paragraph 10.4.1.6. Cargo units with sensible surface may rule out the blocking method and must be secured by lashings only.

Figure 10-34 : Transverse blocking of steel slab

10.4.3.5 Individual securing of cargo units in CTUs with **weak cargo space boundaries** and in CTUs **without boundaries** requires predominantly the method of lashing. Where applicable, blocking or shoring may be additionally applied, but if used in parallel with lashings, the restrictions lined out in paragraph 10.4.1.6 should be observed. Although the provision of good friction in the bedding of a cargo unit is recommended in any case, the use of ~~over the~~ top-over lashings for sliding prevention is discouraged unless the cargo has limited mass. ~~Over the t~~Top-over lashings may~~, however,~~ be suitable for tipping prevention. In particular over-width packages, often shipped on flat bed CTUs, should not be secured solely by top-over lashings. The use of half loops and/or spring lashings is strongly recommended (see Figure 10-35 to Figure 10-37).

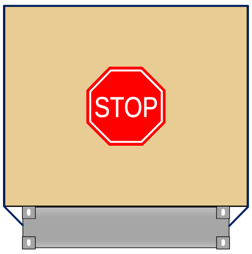


Figure 10-35 : Over the top lashing

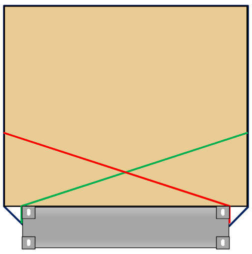


Figure 10-36 : Over the top and horizontal half-loop

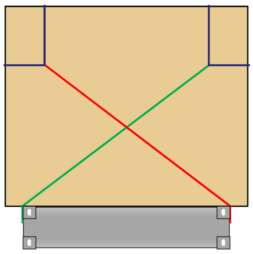


Figure 10-37 : Transverse spring lashing

10.4.3.6 Alternatively an over-width unit can be secured by half loops over the corners as shown in the figure below.

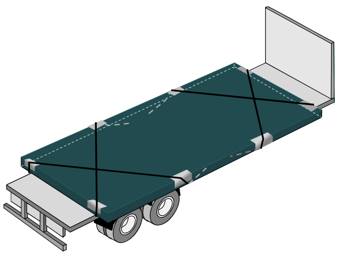


Figure 10-38 : Over-width package secured bt diagonal half-loops

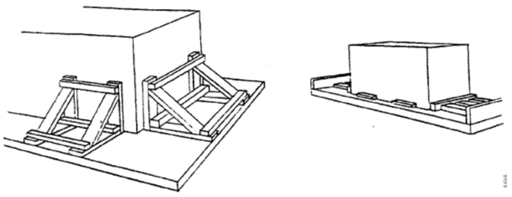


Figure 10.41: Blocking of individual cargo by battens

10.4.4 Evaluation of securing arrangements

10.4.4.1 Evaluation of securing arrangements means making up a balance of expected external forces and moments against the securing potential of the planned or implemented securing arrangement. Expected external forces should be determined by multiplying the applicable acceleration coefficient, given in Chapter 6 of this Code, with the weight of the cargo unit or block of cargo units in question.

$$F_{x,y} = m \cdot g \cdot c_{x,y} \text{ [kN]}$$

$F_{x,y}$ = expected external force [kN],

m = mass of cargo to be evaluated [t],

g = gravity acceleration 9.81 m/s^2,

$c_{x,y}$ = horizontal acceleration coefficient in the relevant mode of transport (see Chapter 6).

Chapter 6 distinguishes three modes of transport, road, rail and sea. The sea transport mode is further subdivided into three categories of severity of ship motions, aligned to the significant wave height of distinguished sea areas. Therefore the selection of the applicable acceleration factor requires the full information on the intended mode and route of transport. Due consideration should be given to possible multi-modal transport, in order to identify the acceleration figures for the most demanding mode or leg of the transport route. These figures should be finally used for the evaluation of the securing arrangement.

10.4.4.2 The assessment of the securing potential includes the assumption of a friction coefficient, based on the combination of materials (Annex III3) and the character of the securing arrangement (paragraph 10.2.2.2), and, if applicable, the determination of the inherent tilting stability of the cargo (paragraph 10.4.3.1). Any other securing devices used for blocking, shoring or lashing should be estimated by their strength in terms of MSL and relevant application parameters like securing angle and, pre-tension and elasticity. These figures are required for evaluating the securing arrangement. The elasticity of the securing device should also be considered.

10.4.4.3 In many cases the evaluation of a securing arrangement may be accomplished by means of a simple rule of thumb. However, such rules of thumb may be applicable for certain distinguished conditions of transport only, e.g. for sea transport, and may overshoot or fall short in other conditions. It is therefore advisable to phrase such rules of thumb for distinguished modes of transport and use them accordingly. Any phrasing of a rule of thumb should undergo a first-time check by means of an advanced assessment method.

10.4.4.4 Standardised assessment methods for the evaluation of securing arrangements may consist of appropriate pre-calculated tables, based on balance calculations, which give quick answers regarding the adequacy of a securing arrangement. Such methods may be directed to distinguished modes of transport, see Annex VIII8 with Quick Lashing Guides A, B, C.

10.4.4.5 The evaluation of securing arrangements may be carried out by balancing forces and moments by an elementary calculation. However, the method used should be approved and suitable to the purpose. References:

- IMO CSS-Code, Annex 13, for sea transport,
- European Standard EN 12195-1:2010, for road transport,
- International Union of Railways (UIC), Agreement governing the exchange and use of wagons between Railway Undertakings (RIV 2000) Annex II, for rail transport.

10.4.4.6 The suitability of a specific securing arrangement may be evaluated and approved by a type-test. A simple form of such a type-test is the tilting test, which may be carried out by means of a dump truck or a platform and a crane. The test may be used to demonstrate resistance against any specified external acceleration. The corresponding test-angle depends on the existing friction coefficient for a sliding resistance test, or on the relation B~~b~~/H~~d~~ for a tipping resistance test (see Annex 6).

10.5 Packing bulk material

10.5.1 Non-hazardous liquids in tank containers

10.5.1.1 Tank CTUs to be transported by road, rail or sea should be filled to at least 80% of their volume for avoiding dangerous surging, but never more than 95% of their volume, unless specified otherwise. [A filing ratio of maximum 20% is also accepted. A filling ratio of more than 20% and less than 80% is only permitted when the tank shell is subdivided, by partitions or surge plates, into sections of not more than 7500 l capacity.]

10.5.1.2 The tank shell and all fittings, valves and gaskets should be compatible with the goods to be carried in that tank. In case of doubt, the owner or operator of the tank should be contacted. All valves should be correctly closed and checked for leak tightness.

10.5.1.3 For the transport of food stuff, the tank should comply with the following requirements:

- all parts of the tank which are in direct contact with the food stuff should be so conditioned that the overall food-grade property of the tank is guaranteed,
- the tank should be easily accessible and suitable for cleaning and disinfection,
- inspection of the interior should be possible,
- the exterior should be conspicuously marked with a marking “FOR FOOD STUFF ONLY” or with a similar wording.

10.5.2 Non-hazardous liquids in flexi-tanks

10.5.2.1 Flexi-tanks used for the transport of bulk liquids by road, rail or sea should carry a label that confirms the type approval by a recognised consultative body. The transportation of dangerous goods in flexi-tanks is prohibited.

10.5.2.2 During transport the contents of a flexi-tank will be subject to dynamic forces without significant retention from friction. These forces will act upon the boundaries of the CTU and may cause damage or complete failure. Therefore the payload of a CTU should be appropriately reduced, when it is used for carrying a loaded flexi-tank. The reduction depends on the type of CTU and on the mode of transport. When a flexi-tank is loaded into a general purpose ISO box container, the mass of the liquid in the flexi-tank should not exceed [50%] of the payload of the container, to prevent the container from suffering bulging damages.

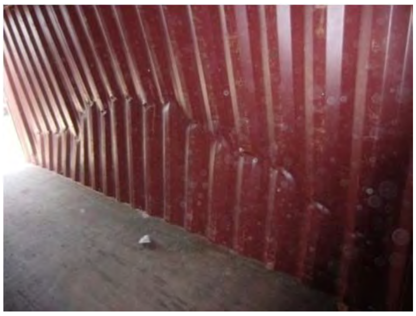


Figure 10-39 : Damaged CTU side wall

10.5.2.3 Road vehicles intended to carry loaded flexi-tanks should have boundaries of a certified strength that is sufficient to confine the weight of the cargo under the accepted load assumptions. The certification of fitness of the vehicle should explicitly address the bulk transport of liquid under the assumption of zero-friction. Nevertheless, the lining of the bottom of the loading area with friction increasing material and the application of over-the-top fibre belt lashings every two metres is recommended for stabilising the position and the strength of the flexi-tank.

10.5.2.4 Before being fitted with a flexi-tank, the CTU should be carefully inspected for structural integrity and fully functional locking bars for each door panel. The CTU should then be prepared by thorough cleaning, removing of all obstacles like protruding nails and by lining the bottom and walls with cardboard. [In 40'-containers plywood should be used for lining of the side walls in order to avoid bulging damage.] The door end of the CTU should be reinforced by battens, fitted into suitable recesses, and by a strong lining of cardboard or plywood. If the flexi-tank is equipped with a bottom connection tube, this lining should have an aperture matching with the position of the tube in way of the right hand door. The empty flexi-tank should be unfolded and laid out accurately to facilitate a smooth filling process.

Figure 10-40 : Container fitted with flexitank

10.5.2.5 For filling an empty flexi-tank the left hand door of the CTU should be firmly closed so that the inserted barrier is appropriately supported. The flexi-tank should be filled at a controlled rate. The use of spill protection devices like collecting bag or drip tray is recommended. After filling and sealing the tank the door of the CTU should be closed and a warning label should be attached on the left hand door panel.

Figure 10-41 : Flexitank warning label

10.5.2.6 For unloading a flexi-tank, the right hand door of the CTU should be opened carefully for getting access to the top or bottom connection tube of the flexi-tank. The left hand door must be kept closed until the flexi-tank is substantially empty. The use of spill protection devices like collecting bag or drip tray is recommended. The empty flexi-tank should be disposed according to applicable regulations.

10.5.3 Non-hazardous solid bulk cargoes

10.5.3.1 Non hazardous solid bulk cargoes may be loaded into a CTU provided the boundaries of the cargo space are capable to withstand the static and dynamic forces of the bulk material under the foreseeable transport conditions (see Chapter 6). ISO box containers are equipped with shoring slots in the door corner posts which are suitable to accommodate transverse steel bars of 60 mm square cross section. This arrangement is particularly designed to strengthen the container door end for taking a load of 0.6 P, as required for solid bulk cargoes. These bars should be properly inserted. The relevant transport capability of the CTU should be demonstrated by a case-related certificate issued by a recognised consultative body or by an independent cargo surveyor. This requirement applies in particular to multi-purpose ISO box containers and to similar closed CTUs on road vehicles, which are not explicitly designed to carry bulk cargoes. It may be necessary to reinforce side and front walls of the CTU by plywood or chipboard facing in order to protect them from bulging or scratching.

Figure 10-42 : Lined 40' container

10.5.3.2 The CTU intended to carry a bulk cargo should be cleaned and prepared adequately as described under paragraph 10.5.2.4, in particular if a cargo-specific liner shall be used for accommodating bulk cargoes like grain, coffee beans or similar sensible materials.

Figure 10-43 : Container with bulk material liner

If crude or dirty material shall be transported, the CTU boundaries should be lined with plywood or chipboard for avoiding mechanical wastage of the CTU. In all cases an appropriate door protection should be installed consisting of battens fitted into suitable recesses and complemented by a strong plywood liner.

Figure 10-44 : Lined container loaded with scrap

10.5.3.3 Scrap and similar waste material to be carried in bulk in a CTU should be sufficiently dry to avoid leakage and subsequent contamination of the environment or other CTUs, if stacked ashore or transported in a vessel.

10.5.3.4 Depending on the internal friction and the angle of repose of the solid bulk cargo, the CTU may be inclined to a certain degree, to facilitate the loading or unloading operation. However, it should always be ensured that the walls of the CTU are not overstressed by the filling operation. It is not acceptable to turn a CTU by 90° to an upright position for filling, unless the CTU is especially approved for this method of handling.

Chapter 11. Additional advice on the packing of dangerous goods

11.1 General

11.1.1 The advice of this section applies to cargo transport units in which dangerous goods are packed. It should be followed in addition to the advice given elsewhere in this Code of Practice.

11.1.2 International (and often national) transport of dangerous goods may be subject to several dangerous goods transport regulations, depending on the origin, final destination and the modes of transport used.

11.1.3 For intermodal transport, involving different modes of transport other than by sea, the rules and regulations applicable depend on whether it is a national movement or international transport or transport within a political or economic union or trading zone.

11.1.4 Transport of dangerous goods by road, rail or inland waterways may be subject to various regulations and agreements. Examples are:

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID); and
- Title 49 of the Code of Federal Regulations of the United States.

11.1.5 Most national and international regulations are based on the United Nations Recommendations on the Transport of Dangerous Goods (Orange Book). However, national rules, applicable to domestic transport, may differ from international regulations.

11.1.6 For maritime transport, the provisions of the International Maritime Dangerous Goods Code (IMDG Code) apply. The IMDG Code provides detailed provisions on all aspects of the transport of packaged dangerous goods by sea.

11.1.7 Dangerous Goods are classified into hazard classes. Some of these are subdivided into divisions. All details are set forth in the applicable dangerous goods regulations as mentioned above. The shipper is responsible that packages with dangerous goods bear the appropriate labels and marks.

11.1.8 Under certain conditions, the dangerous goods regulations provide exemptions from some requirements if the dangerous goods are transported in "limited quantities" or "excepted quantities". Further details are set forth in the applicable dangerous goods regulations.

11.2 Before packing

11.2.1 The IMDG Code and other international and national regulations require that the consignor provides transport information on each dangerous substance, material or article. This information shall include at least the following basic items:

- the UN Number;
- the Proper Shipping Name (including the technical name, as applicable);
- the class and/or division (and the compatibility group letter for goods of class 1);
- subsidiary risks when assigned;
- the packing group when assigned;
- the total quantity of dangerous goods (by volume or mass, and for explosives the net explosive content); and
- the number and kind of packages.

Other items of information may be required, depending on the mode of transport and the classification of the goods (e.g., flashpoint for transport by sea). The various items of information required under each regulation and applicable during intermodal transport operations should be provided so that appropriate documentation may be prepared for each shipment.

11.2.2 The consignor shall also ensure that dangerous goods are classified, packaged, packed and marked in accordance with the applicable regulations. A declaration by the consignor that this has been carried out is normally required. Such a declaration may be included with the required transport information.

11.2.3 The forwarder/carrier should ensure that the goods to be transported are authorized for transport by the modes to be used during the transport operation. For example, self-reacting substances and organic peroxides requiring temperature control are not authorized for transport by rail under the RID regime. Certain types of dangerous goods are not authorized to be transported on board passenger ships and therefore the requirements of the IMDG Code should be carefully studied.

11.2.4 Current versions of all applicable regulations should be easily accessible and referred to during packing to ensure compliance.

11.2.5 Dangerous goods should only be handled, packed and secured by trained personnel. Supervision is required by a responsible person who is familiar with the legal provisions, the risks involved and the measures that should be taken in an emergency.

11.2.6 Suitable measures to prevent fires should be taken, including the prohibition of smoking in the vicinity of dangerous goods.

11.2.7 Packages of dangerous goods should be examined and any found to be damaged, leaking or sifting should not be packed. Packages showing evidence of staining, etc., should not be packed without first determining that it is safe and acceptable to do so. Water, snow, ice or other matter adhering to packages should be removed before packing. Substances that have accumulated on drum heads should initially be treated with caution in case they are the result of leakage or sifting of contents. If pallets have been contaminated by spilt dangerous goods, they should be destroyed by appropriate disposal methods to prevent use at a later date.

11.2.8 If dangerous goods are palletized or otherwise unitized they should be compacted so as to be regularly shaped, with approximately vertical sides and level at the top. They should be secured in a manner unlikely to damage the individual packages comprising the unit load. The materials used to bond a unit load together should be compatible with the substances unitized and retain their efficiency when exposed to moisture, extremes of temperature and sunlight.

11.2.9 An overpack and unit load should be marked and labelled, as required for packages, for each item of dangerous goods contained in the overpack or unit load unless markings and labels representative of all dangerous goods in the overpack or unit load are clearly visible. An overpack, in addition, should be marked with the word "OVERPACK" unless markings and labels representatives of all dangerous goods as required for packages in the overpack are visible.

11.2.10 The stowage and method of securing of dangerous goods in a cargo transport unit should be planned before packing is commenced.

11.3 Packing

11.3.1 Special care should be taken during handling to avoid damage to packages. However, if a package containing dangerous goods is damaged during handling so that the contents leak out, the immediate area should be evacuated until the hazard potential can be assessed. The damaged package should not be shipped. It should be moved to a safe place in accordance with instructions given by a responsible person who is familiar with the risks involved and knows the measures that should be taken in an emergency.

11.3.2 If a leakage of dangerous goods presents safety or health hazards such as explosion, spontaneous combustion, poisoning or similar danger, personnel should immediately be moved to a safe place and the Emergency Response Organization notified.

11.3.3 Dangerous goods should not be packed in the same cargo transport unit with incompatible goods. In some instances even goods of the same class are incompatible with each other and should not be packed in the same unit, e.g., acids and alkalis of class 8. The requirements of the IMDG Code concerning the segregation of dangerous goods inside cargo transport units are usually more stringent than those for road and rail transport. Whenever an intermodal transport operation does not include transport by sea, compliance with the respective inland transport regulations may be sufficient. However, if there is any possibility that a part of the transport operation will be by sea, the segregation requirements of the IMDG Code should be strictly complied with.

11.3.4 Some dangerous goods have to be segregated from foodstuffs by a certain distance within the cargo transport unit or are even prohibited in the same unit. More advice is to be found in the applicable dangerous goods regulations.

11.3.5 When dangerous goods are being handled, the consumption of food and drink should be prohibited.

11.3.6 Packages marked with the orientation arrows “this way up” should be handled and packed with the arrows pointing upwards. Vented packages should be packed in such a way that the vents will not be blocked.

11.3.7 Drums containing dangerous goods should always be stowed in an upright position unless otherwise authorized by the Competent Authority.

11.3.8 Standard packagings such as drums, jerricans and boxes approved for the transport of dangerous goods are tested for a stacking height of 3 meters. The stacking test is carried out with the static gravity of 1 *g* (9.81 m/s²). In case of sea transport it should be considered that, due to the dynamic variation of vertical acceleration, the maximum value could be up to 1.8 *g* (see section 6.3). Therefore, it may be necessary to ensure stability of such stack by introducing dunnage or solid flooring between tiers of such stow. Intermediate bulk containers (IBC) are not all suitable for stacking. IBC which are manufactured or repaired after 1 January 2011 are marked with a pictogram showing either the maximum permitted stack load or an indication that the IBC cannot be stacked, as follows:

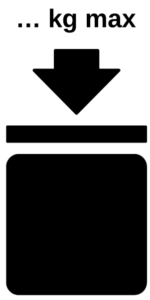


Figure 11-1 : Stacking limited by mass

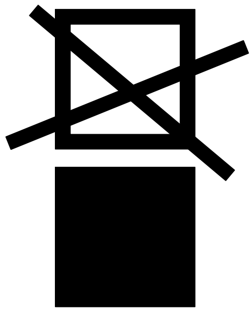


Figure 11-2 : Do not stack

For IBC manufactured before that date, the approval marking on the IBC should be checked to find out whether the IBC can be stacked and, if so, for what stacking load it was tested. More details can be found in [chapter 6.5 of] the applicable dangerous goods regulations.

11.3.9 Dangerous goods consignments which form only part of the load of a cargo transport unit should, whenever possible, be packed adjacent to the doors with markings and labels visible. Particular attention is drawn to 10.3.2.7 concerning the securing of cargo at the doors of a unit.

The number of packages containing dangerous goods in excepted quantities in any cargo transport unit is limited to a maximum of 1,000.

Chapter 12. On completion of packing

12.1 Closing the CTU

12.1.1 After closing the CTU, it should be ensured that all closures are properly engaged and secured. If doors of a cargo transport unit are locked, the means of locking shall be such that, in case of emergency, the doors can be opened without delay. Where cargo transport units have hinged or detachable fittings, a check should be made that they are properly secured, with no loose equipment likely to cause a hazard during transport.

12.1.112.1.2 CTUs in international trade should be sealed with a seal bearing a unique identification number when so required. Many countries require by national legislation that such seals shall meet the standard of ISO 17712:2010. This standard establishes uniform procedures for the classification, acceptance and withdrawal of acceptance of mechanical seals on freight containers, bulk railcars and truck trailers. It provides a single source of information on mechanical seals which are acceptable for securing cargo transport units in international commerce. The purpose of mechanical seals is, as part of a security system, to determine whether a cargo transport unit has been tampered with, i.e. whether there has been unauthorized entry into the cargo transport unit through its doors. Seals meeting the standard of ISO 17712:2010 shall comply with certain criteria for strength and durability so as to prevent accidental breakage, early deterioration (due to weather conditions, chemical action, etc.) or undetectable tampering under normal usage.

12.1.112.1.3 Where security devices, beacons or other tracking or monitoring equipment are used, they should be securely installed to the CTU and, when equipped with a source of energy, they should be of a certified safe type . It should be noted that the International Convention for the Safety of Life at Sea (SOLAS) requires that during sea transport no sources of ignition shall be present in enclosed cargo spaces where highly flammable dangerous goods are stowed.

12.2 Marking and placarding

12.2.1 The applicable dangerous goods regulations require that placards (enlarged labels), marks and other signs are affixed to the surfaces of a cargo transport unit. The specifications of these placards, marks and signs and the locations where they have to be affixed are described in detail in the applicable dangerous goods regulations.

12.2.112.2.2 The applicable dangerous goods regulations may require specific warning signs for cargo transport units which contain solid carbon dioxide (CO_2 – dry ice) or other expendable refrigerant used for cooling purposes. The sign aims to warn of the possibility of an asphyxiating atmosphere.

12.2.112.2.3 The applicable dangerous goods regulations may require specific warning signs for cargo transport units under fumigation. The details of marking and further instructions for the handling of such cargo transport units are set forth in the applicable dangerous goods regulations.

12.3 Documentation

12.3.1 In particular for sea transport, the packer should calculate the ~~correct~~ pay load of the loaded cargo transport unit. When possible the tare weight should be included and the gross mass should be declared. For this purpose he should obtain from the shipper a detailed packing list stating the masses of all packages and other cargo items. The gross mass of the cargo transport unit is the sum of the masses of all cargo items which have been packed, the mass of all stowage and securing material, such as pallets, dunnage or timber used for blocking, and the tare mass of the cargo transport unit. Alternatively, the gross mass of the loaded cargo transport unit may be verified by weighing the unit on a calibrated scale.

12.3.112.3.2 The packer of the CTU should inform the forwarder or the carrier on the identification number of the CTU (container number or vehicle number as appropriate), on the pay load or gross mass of the unit and on the identification number of the seal (if applicable), thus to ensure that the gross masses and the identification numbers are included in all transport documents, such as bills of lading, way bills, consignment notes or cargo manifests.

12.3.112.3.3 Whenever the cargo projects beyond the overall dimensions of the CTU the information described in 12.3.2 should state the exact over-height, over-width or over-length, as appropriate.

12.3.112.3.4 If a container having an allowable stacking mass of less than 192 t marked on the safety approval plate (see subsection 9.2.1) is intended to be carried by ship, the carrier supplier of the container should be informed all involved parties accordinglyon the reduced stacking capability of that container.

12.3.112.3.5 In addition, whenever dangerous goods are packed into a CTU intended for sea transport, the IMDG Code and other transport regulations require that those responsible for the packing of the cargo transport unit shall provide a "container/vehicle packing certificate" specifying the identification number of the CTUcontainer or the vehicle and certifying that the packing operation was carried out in accordance with the requirements of the applicable dangerous goods regulations. For all details of documentation, the relevant dangerous goods regulations shall be referred to.

12.3.112.3.6 [Cargo transport units for which a packing certificate for dangerous goods is not required and which are intended to be loaded onto a ship in maritime trade should be provided with a "cargo stowage and securing declaration", stating that the cargo in the cargo transport unit has been properly stowed and secured for the intended sea voyage. This declaration should state

- the identification number of the cargo transport unit
- the place and date of loading
- a short description of the commodity(ies)
- the verified gross mass of the cargo transport unit
- if applicable, any over-heights, over-width or over-length,
- the wording "I hereby declare that the cargo in the above-mentioned cargo transport unit has been properly stowed and secured for transport by sea, taking into account the Code of Practice for packing of cargo in transport units and that the gross mass of the unit has been properly calculated or verified by weighing."
- the name of signatory
- place and date; and
- signature on behalf of the packer.

Such declaration may be presented by means of EDP or EDI transmission techniques, the signature may be an electronic signature or may be replaced by the name in capitals of the person authorized to sign.]

12.3.7 The "container/vehicle packing certificate" mentioned in 12.3.5 is a mandatory document for dangerous goods under SOLAS chapter VII regulation 4. For other cargoes not meeting the definition of dangerous goods in SOLAS chapter VII, the provisions of SOLAS chapter VI regulation 5 apply, where it is required that cargo and cargo units shall be so packed and secured within a cargo transport unit as to prevent, throughout the sea voyage, damage or hazard to the ship and persons on board. The "cargo stowage and securing declaration" mentioned in 12.3.6 is not a mandatory document under SOLAS convention. Such declaration is recommended in chapter 2 of the Code of Safe Practice for Cargo Stowage and Securing of the International Maritime Organization, only when road vehicles are used as cargo transport units. However, individual carriers might require this declaration from shippers to provide evidence that the packer of a cargo transport unit complied with the requirements of SOLAS Chapter VI regulation 5.]

Chapter 13. Basic principles for safe handling and securing CTUs

13.1 General

13.1.1 CTUs are designed for intermodal transport. They are capable to be transferred from one mode of transport to another by rolling or lifting. A swap body can be carried on a road vehicle or on a railway wagon. A container can be carried on a road vehicle, on a railway wagon, on an inland barge or on a sea going vessel. A road vehicle can be carried on a railway wagon, on an inland barge or on a sea going vessel (ro/ro-vessel). A railway wagon can be carried on a sea going vessel (railway ferry).

13.1.2 When CTUs are handled, it should be ensured that all handling devices such as lifting appliances and internal movement equipment are in good condition and suitable for the intended purpose.

13.1.3 On completion of handling, CTUs have to be secured to the means of transport as appropriate for the specific transport mode.

13.2 Transfer by rolling

13.2.1 Swap bodies are carried by road on special swap carrier vehicles. The carrier vehicle is capable to be lowered on its wheels and to roll under the swap body standing on its supports. By lifting the vehicle to its normal operating position, the swap body is taken onto the chassis of the carrier vehicle. Then the support legs are retracted.

13.2.2 Road vehicles may be rolled onto a ship driven by their own engine. Semi-trailers are normally carried on board ships without tractor unit. They are loaded to and unloaded from the ships by specific port internal movement vehicles. The drivers' cab should provide good all-round visibility, with minimal obstruction of the driver's view. The movement of persons on foot on the ramp should be strictly controlled and minimized.

13.2.3 The cargo decks of railway ferries are normally equipped with several rail tracks which can be accessed by a movable ramp which is fitted with rails, capable to be connected to the rail tracks on board. The maximum permissible kink angle between the ramp and the level of the rail deck in the ship is restricted and depends on the type of wagons shunted into the ship. In specific cases this angle may be as low as 1.5°.

13.3 Transfer by lifting

13.3.1 Before lifting a CTU, the handling staff should ensure that the lifting equipment is safely attached to the CTU and that all securing, fixing and lashing devices have been released.

13.3.2 Swap bodies for combined road/rail transport and also purpose built semi-trailers for combined road/rail transport are equipped with standardised recesses for being lifted at four points by grappler arms attached to the spreader of a crane or reach stacker. Thus they can be transferred from road to rail and vice versa.

13.3.3 Lifting of containers (refer to ISO 3874)

13.3.3.1 The most appropriate method to lift a containers is the use of a top lift spreader. The spreader is locked by twistlocks to the top corner fittings of the container. This method can be used for all container sizes fitted with top corner fittings, in an empty or loaded state. When the spreader cannot be attached directly to the corner fittings, e.g. in case of overheight cargo, slings or chains can be used and connected to the spreader so that the lifting force remains vertical.

13.3.3.2 The side-lift frame is designed to lift a container by the two top corner fittings of one side and to take the reaction forces on the bottom corner fittings of the same side or on suitable corner post areas above those corner fittings. This method can be used on all sizes of empty box containers. In case of loaded containers, this method is suitable for 20ft and 10ft box containers only.

13.3.3.3 The end-lift frame is suitable only for the handling of 20ft and 10ft empty box containers. The frame is designed to lift a container by the two top corner fittings of one end and to take reaction forces on the bottom corner fittings of the same end or on suitable corner post areas above those corner fittings.

13.3.3.4 A top lift sling can be used for empty box containers of all sizes. The container is lifted by all four top corner castings with forces applied other than vertically. Lifting devices need to be properly engaged, hooks always be placed in an inward to outward direction. In the loaded state, this method is suitable only for 10ft containers, provided that the lifting forces are applied at an angle not less than 60° to the horizontal.

13.3.3.5 A bottom sling is used in connection with a cross beam spreader bar. The container is lifted from the side apertures of four bottom corner fittings by means of slings which are connected to the corner fittings by means of locking devices. Hooks are not suitable for this connection. This method can be used for all container sizes in an empty or loaded state. For loaded containers the angle between the sling and the horizontal should not be less than 30° for 40ft containers, 45° for 20ft containers and 60° for 10ft containers.

13.3.3.6 When a container is provided with fork pockets, it can be lifted by means of forks under certain conditions. The forks should, ideally, extend the whole width of the container, but under no circumstances should they extend less than 1,825 mm into the fork pockets. This method can be used on 20ft and 10ft containers in an empty or loaded state with the exception of tanks and pressurized bulk containers which should not be lifted by fork trucks at all. Where there are no fork pockets, the container should not be lifted by forks in any state.

13.3.4 Railway wagons may be lifted and may change bogies when the railway ferry operates between countries where the gauge of the track is different. In such cases, the railway wagons must be suitable for an easy exchange of bogies. The involved ferry ports provide specific equipment for this operation.

13.4 Stacking on ground and terminal operation with containers

13.4.1 The ground should be a firm, flat and drained surface. On the ground, the container should be supported by the four bottom corner fittings only. When stacking containers, the bottom surfaces of the lower corner fittings of the upper container should have complete contact with upper surfaces of top container fittings of the lower container. A shift of up to 25 mm laterally and 38 mm longitudinally may be tolerated.

13.4.2 A container stack may be subject to forces by heavy wind. This might lead to sliding and toppling of containers. Stacks of empty containers will be more subject to such dangers than stacks of loaded containers. The critical wind speed is higher for multiple rows than for a single row. Wind effect can be reduced by limiting the stacking height, by block stowage or by a combination of both. A recommended minimum number of rows for different number of tiers as well as container sizes ~~combination~~ is shown in the table below:

Number of tiers	20ft standard	40ft standard	40ft high cube
2	2 rows	2 rows	3 rows
3	2 rows	3 rows	3 rows
4	2 rows	3 rows	3 rows
5	3 rows	3 rows	4 rows
6	4 rows	4 rows	5 rows

Above recommendation is applicable for a wind speed up to 20 m/s (8 Bft). In case of higher wind speeds, additional measures should be considered, such as changing the block to a stepped pyramid or securing containers with lashings to the ground.

13.4.3 Containers should be moved within a terminal area only by use of suitable equipment, such as van carriers, reach stackers or trailers. Trailers should be so constructed that the containers are supported by their corner fittings. For operation within the designated terminal area, tie down devices are not required, provided that the container is correctly loaded on the trailer and prevented from moving horizontally. Therefore, trailers which are not equipped with stacking cones or twistlocks should be fitted with substantial corner plates or other restraints of sufficient height to retain the container in position.

13.5 Securing of CTU

13.5.1 Swap bodies are carried by road on dedicated carrier vehicles. The corner fittings of the swap body fit onto cones of locking devices (twistlocks) which, by turning the cones, provide a form closure between the swap body and the vehicle structure.

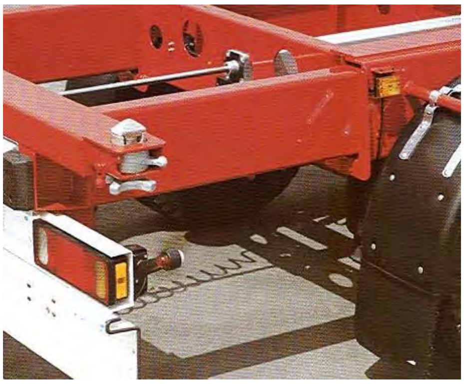


Figure 13-1 : Twistlock on road vehicle

13.5.2 Containers are normally carried by road on purpose built container chassis, where the container is supported by the four corner fittings. The corner fittings of the container fit onto the twistlocks cones of the chassis, similar to the securing devices described in 13.5.1

13.5.3 When carried by rail, swap bodies and containers are loaded on open wagons which are specifically fitted with stacking or locking devices. Semi-trailers may be carried on wagons equipped with dedicated bedding devices for accommodating road vehicles.

13.5.4 Container vessels are specifically constructed for the carriage of containers. Cargo spaces under deck or cargo spaces on hatchless container vessels are equipped with cell guides, where the containers are stacked, obtaining sufficient hold and securing. Twenty-foot containers may be stowed in forty-foot cell guides, provided that suitable stacking cones are inserted into the corner fittings of the containers. Containers carried on deck are affixed to the ships structure by means of twistlocks. Twistlocks are used also to interconnect containers stowed one on top of another. In addition, container stacks on deck may be secured to the ships structure by means of lashing rods and tensioning devices (bottle screws). Details of the securing arrangement are described in the Cargo Securing Manual of the individual ship.

Figure 13-2 : Cell guides and lashing rods

13.5.5 When carried on general cargo ships which are not specifically constructed for the carriage of containers, the containers are secured to the ships structure by means of lashing chains or wire ropes and tensioning devices (see CSS Code Annex 1). Further details are described in the Cargo Securing Manual of the individual ship.

13.5.6 When vehicles are loaded in a vehicle deck of a Ro/Ro-ship, the parking brakes should be applied and locked, engines should be in gear. Uncoupled semi-trailers should not be supported on their landing legs but preferably supported by a trestle or similar device. Lashings which are attached to the securing points of the vehicle should be connected with hooks or other devices so designed that they cannot disengage from the aperture of the securing point if the lashing slackens during the voyage. Only one lashing should be attached to any one aperture of the securing point on the vehicle. Vehicles shall be secured on board according to the instructions~~Further details are described~~ in the Cargo Securing Manual of the individual ship.

13.5.7 The wheels of railcars shunted into the rail deck of a railway ferry should be chocked on the rail with appropriate steel chocks. The wagons should be secured to the ships structure with chains and tensioning devices (bottle screws). In case of severe weather conditions, the spring system of the wagons should be released by use of specific jacks. Railway wagons shall be secured on board according to the instructions ~~Further details are described~~ in the Cargo Securing Manual of the individual ship.

This version of chapter 14 should be deleted

Chapter 14. Advice on receipt and unpacking of CTUs (Option 1)

14.1 General

14.1.1 When receiving a CTU, the consignee should:

14.1.1.1 confirm that the unit is as specified on the transport documentation, checking the CTU identification reference as shown in **Fel! Hittar inte referenskälla.**~~Figure 14-1.~~ If the identification reference shown on the documentation is not the same as that on the CTU, do not accept it until confirmation is received from the shipper that the CTU is destined for you.

Figure 14-1 : Three examples of CTU identification references

14.1.1.2 inspect the seal, if fitted. Inspecting a seal requires visual check for signs of tampering, comparison of the seal's identification number with the cargo documentation, and noting the inspection in the appropriate documentation. If the seal is missing, or shows signs of tampering, or shows a different identification number than the cargo documentation, then a number of actions are necessary:

14.1.1.2.1 The consignee should bring the discrepancy to the attention of the carrier and the shipper. The consignee should also note the discrepancy on the cargo documentation and notify Customs or law enforcement agencies, in accordance with national legislation. Where no such notification requirements exist, the consignee should refuse custody of the CTU pending communication with the carrier until such discrepancies can be resolved.

14.1.1.2.2 Seals may be changed on a container for legitimate reasons. Examples include inspections by an exporting Customs administration to verify compliance with export regulations; by a carrier to ensure safe blocking and bracing of the shipment; by an importing Customs administration to confirm cargo declarations; and by law enforcement officials concerned with other regulatory or criminal issues.

14.1.1.2.3 If public or private officials should remove a seal to inspect the shipment, they should install a replacement in a manner that meets the requirements specified below, and note the particulars of the action, including the new seal number, on the cargo documentation.

14.1.1.3 check the exterior of, and for any signs of leakage from, the CTU. Specific attention should be paid to:

14.1.1.3.1 signs of recent damage such as impact dents or punctures where the area of the impact appears cleaner that the surround area, or where expose metal can be seen without rust or corrosion. Such damages should be marked on the interchange document and notified to the carrier.

14.1.1.3.2 impact or puncture damages that may have altered the condition of the cargo within the unit;

Chapter 14. Advice on receipt and unpacking of CTUs ~~(Option 2)~~

14.1 General Precautions

14.1.1 When applicable the consignee or the receiver of a CTU should check whether the unit is externally in good condition and without damage. When damage is found, the receiver should document and notify it to the carrier and/or to the forwarder, as appropriate. Specific attention should be paid to damage that may have influenced the condition of the cargo within the unit.

14.1.2 Where a seal number is stated on the transport documentation, the seal should be checked. When the reference number on the seal differs from the documentation or when the seal appears to be damaged, this could indicate that the CTU has been opened during transport. In such case the carrier and/or forwarder should be contacted.

14.1.3 If a CTU shows signs of abnormally high temperatures it should be moved to a safe place and the fire services notified. Care should be taken to ensure that the fire-fighting methods used are suitable for the cargo in the unit.

14.1.4 Persons opening a CTU should be aware of the risk of cargo falling out (for details see 14.2.2).

14.1.5 Some cargoes may evolve harmful fumes. Especially after long sea voyages, it has been repeatedly realized that apparently non hazardous goods such as shoes, textile products, furniture or the like evolved harmful substances to an extent making the atmosphere in the CTU dangerous. Therefore, any CTU should be ventilated before allowing personnel to enter, preferably by mechanically forced ventilation. If this is not available, at least sufficient natural ventilation should be provided, be leaving the doors open for at least 30 minutes before entering.

14.1.6 CTUs with expandable refrigerants or containing fumigated cargo present a particular risk of a toxic or asphyxiant atmosphere (see subsections 12.2.2 and 12.2.3). Before entering such unit, it should be ascertained by measurement that no harmful atmosphere is present in the CTU.

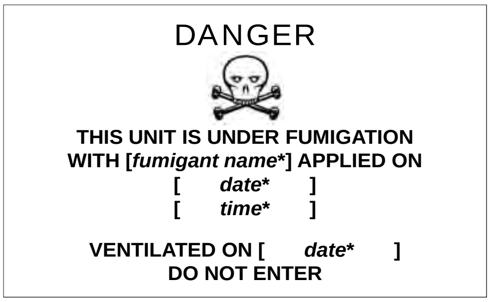


Figure 14-1 : Fumigant warning sign

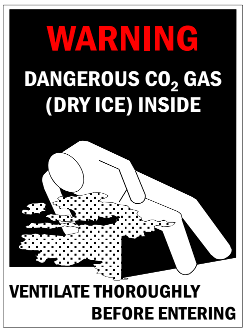


Figure 14-2 : Dry ice warning sign

14.1.7 If there is a particular reason to suspect damage to packages with dangerous goods, expert advice should be sought before unpacking of the unit starts. When possible, a material safety data sheet should be required from the consignor, to determine appropriate measures and necessary personal protection equipment

14.2 Unpacking a CTU

14.2.1 For the positioning of a CTU section 9.3 applies. Where access to the roof of the CTU is required, e.g. to remove the canvas of an open top unit, mobile steps or a gantry platform should be provided. Access to the doors of a CTU should be made by using ramps or platforms if required (see subsection 9.3.3).

14.2.2 Persons opening CTUs should be aware of the risk of cargo falling out. To reduce the risk of personal injury from shifted cargo coming out when doors are opened, the use of a safety strap is encouraged. The strap should be secured around the inner locking rods of a CTU to minimize the free movement of the door which is first opened. Movement of the cargo within sheeted CTUs may also present a risk to those opening the side curtains of open sided units.

14.2.3 Suitable unpacking equipment and techniques should be used (see subsection 10.3.3), so that persons involved are not placed at risk.

14.2.4 When removing lashing or blocking devices or other cargo securing material, care should be taken to ensure that cargo items do not move when released. The valve of inflatable dunnage bags should be opened and the air released.

14.2.5 It should be considered that items with low friction such as piles of steel plates may suddenly shift and that unstable items may topple when retaining straps are removed.

14.2.6 When any damage is detected during the unloading of the CTU, this should be documented and notified to the carrier and/or forwarder as appropriate. If a package containing dangerous goods is found to be so damaged that the contents leak out, the immediate area should be evacuated until the hazard potential has been assessed. When possible, a material safety data sheet should be required from the consignor, to determine appropriate measures and necessary personal protection equipment

14.3 Returning the unloaded CTU

14.3.1 The consignee or the receiver of the CTU should consider his obligation to return the CTU, after unloading, clean and suitable for the transport of any kind of cargo. This requires all cargo residues to be swept out, all packing, lashing and securing material to be removed and all debris to be cleaned up as agreed.

14.3.2 When disposing of cargo residues and cargo associated waste, the applicable environmental regulations should be considered. Wherever practicable, dunnage bags and other securing materials should be recycled. When wood quarantine requirements apply, timber bracings and packing/securing material of natural wood, not bearing the appropriate IPPC marking, (see paragraph 10.1.13) should be disposed of as especially required by national or local plant protection regulations.

14.3.3 After a CTU with dangerous goods has been unpacked, particular care should be taken to ensure that no hazard remains. This may require special cleaning, particularly if spillage of a toxic or corrosive substance has occurred or is suspected. In case of doubt with regard to appropriate cleaning measures, the owner or operator of the CTU should be contacted.

14.3.4 When the CTU offers no further hazard, the dangerous goods placards, orange plates and other markings referring to dangerous goods should be removed, masked or otherwise obliterated.

Chapter 15. Training on packing of cargo in CTUs

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Chapter 15.

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15.1 Regulatory authorities

15.1.1 The regulatory authority should establish minimum requirements for training and, where appropriate, qualifications for each person involved, directly or indirectly, in the packing of cargo in CTUs, particularly in relation to dangerous cargoes.

15.1.2 Regulatory authorities involved in the development or enforcement of legal requirements relating to the supervision of the safety of the transport by road, rail and sea should ensure that their personnel are adequately trained, commensurate with their responsibilities.

15.2 Management

Management should ensure that all personnel involved in the packing of cargo in CTUs or in the supervision thereof are adequately trained and appropriately qualified, commensurate with their responsibilities within their organization.

15.3 Personnel

All persons engaged in the transport or packing of cargo in CTUs should receive training on the safe packing of cargo in CTUs, commensurate with their responsibilities.

15.4 Training

15.4.1 General awareness/familiarisation training

All persons should receive training on the safe transport and packing of cargo, commensurate with their duties. The training should be designed to provide an appreciation of the consequences of badly packed and secured cargo in CTUs, the legal requirements, the magnitude of forces which may act on cargo during road, rail and sea transport, as well as basic principles of packing and securing of cargoes in CTUs.

15.4.2 Function-specific training

All persons should receive detailed training concerning specific requirements for the transport and packing of cargo in CTUs which are applicable to the functions that they perform.

15.2 Verification

The adequacy of the knowledge of any person to be employed in work involving the packing of cargo in CTUs should be verified or appropriate training provided. This should be supplemented by periodic training, as deemed appropriate by the regulatory authority.

15.5 Recommended course syllabus - overview

The adequacy of the knowledge of any persons to be employed in work involving the packing of cargo in CTUs should be verified, in the absence of which appropriate training is considered essential and should be provided. The function-specific training should be commensurate with the duties required to be performed by an individual in the packing and securing of cargo in CTUs. Topics for consideration, to be included in the training as appropriate, are given in annex ?.

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15.1 Qualification of planners and packers

15.1.1 Persons responsible for planning and supervision of packing should be fully knowledgeable about all technical, legal and commercial requirements of this task and on all risks and dangers involved. They should know the customary terminology in order to communicate effectively with consignors, forwarders and the persons who do the actual packing.

15.1.2 Personnel engaged in the actual packing should be trained and skilled in doing this work and understand the relevant terminology in order to comply with the instructions of the planner. They should be aware of the risks and dangers involved.

15.1.3 Persons responsible for planning and supervision of packing as well as personnel responsible for the actual packing should receive appropriate education and training for their tasks before they do the work with immediate responsibility.

15.1.4 The management of a facility where CTUs are packed is responsible to ensure that all personnel involved in the packing of cargo in CTUs or in the supervision thereof are adequately trained and appropriately qualified, commensurate with their responsibilities within their organization.

15.2 Regulatory authorities

15.2.1 The regulatory authority should establish minimum requirements for training and, where appropriate, qualifications for each person involved, directly or indirectly, in the packing of cargo in CTUs, particularly in relation to dangerous cargoes.

15.2.2 Regulatory authorities involved in the development or enforcement of legal requirements relating to the supervision of the safety of the transport by road, rail and sea should ensure that their personnel are adequately trained, commensurate with their responsibilities.

15.3 Training

15.3.1 All persons should receive training on the safe transport and packing of cargo, commensurate with their duties. The training should be designed to provide an appreciation of the consequences of badly packed and secured cargo in CTUs, the legal requirements, the magnitude of forces which may act on cargo during road, rail and sea transport, as well as basic principles of packing and securing of cargoes in CTUs.

15.3.2 All persons should receive detailed training concerning specific requirements for the transport and packing of cargo in CTUs which are applicable to the functions that they perform. Such training should be followed by a sufficient period of practical assistance to experienced planners and packers.

15.3.3 The adequacy of the knowledge of any person to be employed in work involving the packing of cargo in CTUs should be verified or appropriate training provided. This should be supplemented by periodic training, as deemed appropriate by the regulatory authority.

15.3.4 Topics for consideration, to be included in the training as appropriate, are specified in the table below (to follow).

Topics to be included in a training programme	
1	Consequences of badly packed and secured cargo - Injuries to persons and damage to the environment - Damage to chips and CTUs - Damage to cargo - Economic consequences
2	Liabilities - Different parties involved in cargo transport - Legal responsibility - Goodwill responsibility - Quality assurance
3	Forces acting on the cargo during transport - Road transport - Rail transport - Sea transport
4	Basic principles for cargo packing and securing

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	- Prevention from sliding - Prevention from tipping - Influence of friction - Basic principles for cargo securing - Dimensions of securing arrangements for combined transportation
5	CTUs – types - Containers - Flats - Swap-bodies - Road vehicles - Rail-cars/wagons
6	Cargo care consciousness and cargo planning - Choice of transport means - Choice of CTU type - Check of CTU prior to packing - Cargo distribution in CTUs - Requirements from the receiver of cargo regarding cargo packing - Condensation risks in CTUs - Symbols for cargo handling
7	Different methods for cargo packing and securing - Lashing - Blocking and bracing - Increasing friction
8	Equipment for securing and protection of cargo - Fixed equipment on CTUs - Reusable cargo-securing equipment - One-way equipment - Inspection and rejection of securing equipment

Topics to be included in a training programme	
9	Packing and securing unitized cargo - Cases - Palletized cargoes - Bales and bundles - Bags on pallets - Big bags - Slabs and panels - Barrels - Pipes - Cartons
10	Packing and securing of non-unitized cargo - Different types of packaged cargoes loaded together - Packing of heavy and light cargoes together - Packing of rigid and non-rigid cargoes together - Packing of long and short cargoes together - Packing of high and low cargoes together - Packing of liquid and dry cargoes together
11	Packing and securing of paper products - General guidelines for the packing and securing of paper products

	- Vertical rolls - Horizontal rolls - Sheet paper on pallets
12	Packing and securing of cargo requiring special techniques - Steel coils - Cable drums - Wire rolls - Steel slabs - Steel plates - Big pipes - Stone blocks - Machines
13	Packing and securing of dangerous cargoes - Regulations for the transport of dangerous goods - Definitions - Packing regulations - Packing, separation and securing - Labelling and placarding - Information transfer when transporting dangerous cargoes - Liabilities

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Annex I. Acronyms

FCL	Full container load
FD	Free Discharge.
FDA	Food and Drug Administration.
FDIS	Final Draft International Standard
FEPORT	Federation of European Private Port Operators
FEU	Forty-foot Equivalent Unit
FFE	Forty-Foot Equivalent unit
FIATA	International Federation of Freight Forwarders Associations
FIFO	First In, First Out
FIFO	Free In – Free Out see FIO
FIO	Free In and Out
FLT	Forklift truck
FMC	Federal Maritime Commissions
FMCSA	Federal Motor Carrier Safety Administration
FO	Free Out
FOB	Free On Board
FOR	Free on Rail.
FPA	Free of Particular Average.
FPPI	Foreign Principal Party of Interest.
FTA	Freight Transport Association
GATT	General Agreement on Tariffs and Trade.
GBL	Government Bill of Lading.
GDSM	General Department Store Merchandise.
GMPH	Gross Moves per Hour
GO	General Order
GOH	Garment on Hanger
GP	General Purpose
GRI	General Rate Increase
GSF	Global Shippers' Forum
GT	Gross Tonnage
GVW	Gross Vehicle Weight
HNS	Hazardous and Noxious Substances Convention
HS	Harmonized System of Codes
HSE	Health and Safety Executive
I.T.	In-Transit Entry
IA	Independent Action
IACS	International Association of Classification Societies
IAEA	International Atomic Energy Authority
IAPH	International Association of Ports and Harbours

IATA	International Air Transport Association
IBC	Intermediate Bulk Container
IBC	See BIC
IBTA	International Bulk Terminals Association
ICAO	International Civil Aviation Organisation
ICC	International Chamber of Commerce
ICC	Interstate Commerce Commission (US)
ICGB	International Cargo Gear Bureau, Inc.
ICHCA	ICHCA International Limited
ICS	International Chamber of Shipping
IE	Immediate Exit
IFA	International Freight Association
IFCOR	International Intermodal Freight Container Reporting Organisation
IFM	Inward Foreign Manifest
IFPTA	International Forest Products Transport Association
IHMA	International Harbour Masters Association
IICL	Institute of International Container Lessors
IIMS	International Institute of Marine Surveyors
IISPCG	Inter Industry Shipping & Ports Contact Group
ILA	International Longshoremen's Association
ILO	International Labour Organisation
ILWU	International Longshoremen's and Warehousemen's Union
IMC	Intermodal Marketing Company
IMCO	International Maritime Control Organisation. See IMO.
IMDG	International Maritime Dangerous Goods
IMMTA	International MultiModal Transport Association
IMO	International Maritime Organisation. Formally IMCO.
IOSH	Institute of Occupational Safety and Health
IPI	Inland Point Intermodal
IRU	International Road Transport Union
ISA	Information System Agreement
ISO	International Organization for Standardization
ISP	International Safety Panel of ICHCA
ISPS	International Ship and Port Facility Security Code
ISTDG	International Symposium on the Transport of Dangerous Goods by Sea and Inland Waterways
IT	Immediate Transport
IT	Information Technology
IT Entry	Immediate Transportation Entry

ITCO	International Tank Container Owners Association
ITF	International Transport Workers' Federation
ITF	International Transport Forum
ITIGG	International Transport Implementation Guidelines Group.
IUMI	International Union of Marine Insurers
JIT	Just in Time
JOC	Journal of Commerce
KD	Knocked Down
KT	Kilo tonne
L/C	Letter of Credit.
LASH	Lighter Aboard Ship.
Lbs	Pounds (mass)
LC	Letter of Credit
LC	Lashing capacity
LCL	Less than a container load
LIFO	Last In First Out
LNG	Liquefied natural Gas
LOLO	Lift on Lift Off
LR	Lloyds Registry
LT	Long Ton
LTL	Less than Trailer Load
MAIIF	Marine Accident Investigators' International Forum
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978
MCA	Maritime and Coastguard Agency (UK)
MCFS	Master Container Freight Station. (see CFS)
MDA	Maritime Domain Awareness
MEPC	Marine Environment Protection Committee
MGM	Maximum Gross Mass
MHD	Mechanical handling device
MLB	Mini Land Bridge
MMFB	Middlewest Motor Freight Bureau (US)
MOU	Memorandum of Understanding
MSA	Maritime Security Act.
MSC	Maritime Safety Committee (IMO)
MSD	Musculoskeletal disorders
MSL	Maximum securing load
MSSIS	Maritime Security and Safety Information System
MT	Metric Ton

SL/W	Shippers load and count
SOLAS	International Convention for the Safety of Life at Sea (SOLAS), 1974
SPA	Subject to Particular Average
SPI	Ship Port Interface
SS	Steamship.
SSHEX	Saturdays, Sundays and Holidays Excepted
ST	Short Ton
STB	Surface Transportation Board
STC	Said to Contain.
STCC	Standard Transportation Commodity Code
S_{TF}	Standard tension force
STW	Said to weigh.
SWIFT	Society for Worldwide Interbank Financial Telecommunication
SWL	Safe Working Load
T	Tare
T&E	Transportation and Exportation.
T&E	Transportation and Exit
TBN	To Be Nominated (when the name of a ship is still unknown).
TC104	International Standards Organization Technical Committee 104 –freight containers
TEU	Twenty-foot Equivalent Unit
THC	Terminal Handling Charge
TIR	Transport Internationaux Routiers System
TL	Trailer Load
TOA	Technical and Operational Advice document
TOFC	Trailer on Flat Car Rail
TOS	Terms of Sale (i.e. FOB/CIF/FAS).
TRC	Terminal Receiving Charge
TREMCARD	Transport Emergency Card issued by CEFIC (Intended to comply with the “instructions in writing” requirements in certain road transport regulations, eg: ADR)
TSR	Top Side Rail
TT Club	Through Transport Mutual Insurance Association Limited
TWIC	Transportation Worker Identification Credential
UCP	Uniform Customs and Practice for Documentary Credits
UFC	Uniform Freight Classification
UIC	Union Internationale de Chemins de Fers
UIRR	Union Internationale des Societes de Transport Combine Rail-Route
ULCC	Ultra Large Crude Carrier
UN	United Nations
UN ECE	United Nations Economic Commission for Europe

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Annex III. Friction coefficients

III.1 Different material contacts have different coefficients of friction. The table below shows recommended values for the coefficient of friction. The values are valid provided that both contact surfaces are "swept clean" and free from any impurities. The values are valid for the static friction. In case of direct lashings, where the cargo has to move little before the elongation of the lashings provides the desired restraint force, the dynamic friction applies, which is to be taken as 70% of the static friction.

Material combination in contact surface	Dry	Wet
SAWN TIMBER/WOODEN PALLET		
Sawn timber/wooden pallet against plywood/plyfa/wood	0.5	0.45
Sawn timber/wooden pallet against grooved aluminium	0.4	0.4
Sawn timber/wooden pallet against stainless steel sheet	0.4	0.3
Sawn timber/wooden pallet against shrink film	0.3	-
PLANE WOOD		
Plane wood against fabric base laminate/plywood	0.3	0.3
Plane wood against grooved aluminium	0.25	0.25
Plane wood against smooth steel	0.3	0.3
PLASTIC PALLETS		
Plastic pallet against plywood/plyfa/wood	0.2	0.2
Plastic pallet against grooved aluminium	0.15	0.15
Plastic pallet against smooth steel sheet	0.15	0.15
CARDBOARD (UNTREATED)		
Cardboard against cardboard	0.5	-
Cardboard against wooden pallet	0.5	-
BIG BAG		
Big bag against wooden pallet	0.4	-
STEEL AND SHEET METAL		
Flat steel against sawn timber	0.5	-
Unpainted metal with rough surface against sawn timber	0.5	-
Painted metal with rough surface against sawn timber	0.5	-
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	

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Material combination in contact surface	Dry	Wet
STEEL CRATES		
Steel crate against plywood/plyfa/wood	0.45	0.45
Steel crate against grooved aluminium	0.3	0.3
Steel crate against smooth steel	0.2	0.2
CONCRETE		
Concrete with rough surface against sawn wood	0.7	0.7
Concrete with smooth surface against sawn wood	0.55	0.55
ANTI-SLIP MATERIAL		
Rubber against other materials when contact surfaces are clean	0.6	0.6

~~Combination of materials in the contact surface~~	~~Friction coefficient μ~~
~~**Sawn wood**~~	
~~Sawn wood – fabric base laminate / plywood~~	~~0.45~~
~~Sawn wood – grooved aluminium~~	~~0.4~~
~~Sawn wood – shrink film~~	~~0.3~~
~~Sawn wood – stainless steel sheet~~	~~0.3~~
~~**Plane wood**~~	
~~Plane wood – fabric base laminate / plywood~~	~~0.3~~
~~Plane wood – grooved aluminium~~	~~0.25~~
~~Plane wood – stainless steel sheet~~	~~0.2~~
~~**Plastic pallet**~~	
~~Plastic pallet – fabric base laminate / plywood~~	~~0.2~~
~~Plastic pallet – grooved aluminium~~	~~0.15~~
~~Plastic pallet – stainless steel sheet~~	~~0.15~~
~~**Steel**~~	
~~Steel crate – fabric base laminate / plywood~~	~~0.45~~
~~Steel crate – grooved aluminium~~	~~0.3~~
~~Steel crate – stainless steel sheet~~	~~0.2~~
~~**Concrete**~~	
~~Concrete rough – sawn wood battens~~	~~0,7~~
~~Concrete smooth – sawn wood battens~~	~~0.55~~
~~**anti – slip mat**~~	
~~Rubber~~	~~0.6~~
~~Other material~~	~~As certified~~

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~~III.1~~III.2 It has to be ensured, that the used friction coefficients are applicable to the actual transport. When a combination of contact surfaces is missing in the table above or if it's coefficient cannot be verified in another way, the maximum allowed μ static to be used is 0.3. If the surface contacts are not ~~swept clean,~~ free from frost, ice and snow a friction coefficient larger than μ = 0.2 shall not be used[1]. For oily and greasy surfaces or when slip sheets have been used, a static friction of μ = 0.1 applies.

[1] For sea transport see CSS Code annex 13 subsection 7.2.

ANNEX 4

SPECIFIC PACKING AND SECURING CALCULATIONS

1. Resistivity of transverse battens (paragraph 10.2.3.4)

The attainable resistance forces F of one such batten may be estimated by the formula:

$$F = \frac{w^2 \cdot h}{28 \cdot L} \text{ [kN]}$$

w = thickness of batten [cm]
h = height of batten [cm]
L = free length of batten [m]

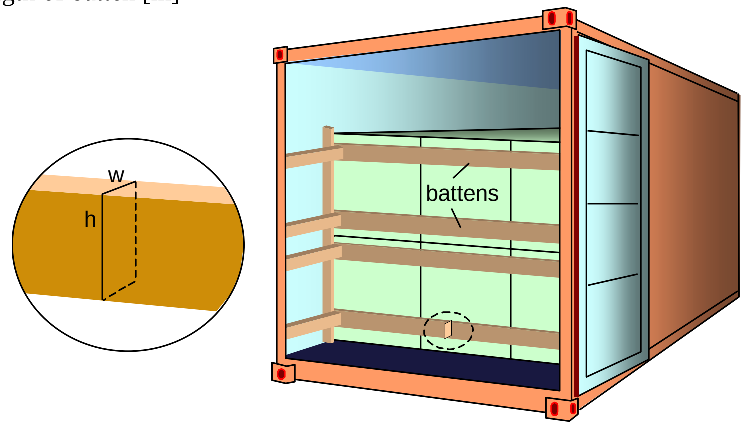


Figure 1: Transverse batten in an ISO box container

This formula presumes a homogeneously distributed load F over the length L of the batten. The battens are assumed to be slightly clamped at their ends. The permissible bending stress of the timber is assumed with 2.4 kN/cm^2. This applies to lower quality conifer timber.

Calculated example: A fence of four battens has been arranged. The battens have a free length L = 2.2 m and the cross-section w = 4.5 cm, h = 19 cm. The total attainable resistance force is:

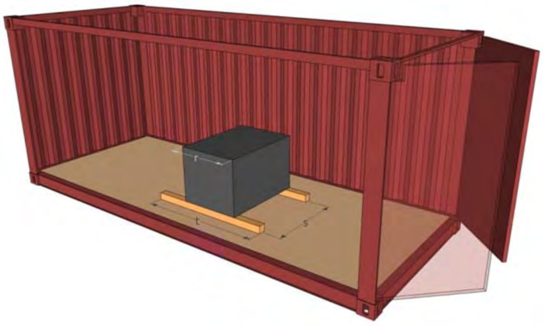
$$F = n \cdot \frac{w^2 \cdot h}{28 \cdot L} = 4 \cdot \frac{4.5^2 \cdot 19}{28 \cdot 2.2} = 23.7 \text{ kN}$$

This force of 23.7 kN would be sufficient to restrain a cargo mass of 7.5 t, subjected to accelerations in sea area 3 with longitudinal container stowage and μ = 0.4, by the following balance calculation:

$$0.4 \cdot m \cdot g < \mu \cdot m \cdot 0.2 \cdot g + F \quad \text{[kN]}$$
$$0.4 \cdot 7.5 \cdot 9.81 < 0.4 \cdot 7.5 \cdot 0.2 \cdot 9.81 + 23.7 \quad \text{kN}$$
$$29.4 < 5.9 + 23.7 \quad \text{kN}$$
$$29.4 < 29.6 \quad \text{kN}$$

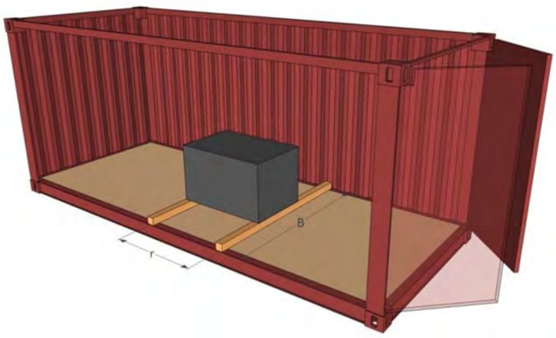
2. Beams for bedding a concentrated load in an ISO box-container (paragraph 10.3.1.2)

~~[~~Short or narrow cargoes may overload the floor structure. This may be prevented either by using longitudinal support beams underneath the cargo to distribute the load over more transverse flooring beams, or by the use of transverse beams, to distribute the load towards the strong side structures of the container.



Narrow cargo placed on longitudinal support beams.

When longitudinal support beams are used, their minimum length should be calculated in accordance with chapter 2.1 below. The beams should be placed as far apart as possible, near the edge of the cargo.



Narrow cargo placed on transverse support beams with a length equal to the inner width of the container.

When transverse support beams are used, their length should equal the inner width of the container.

2.1 Required length of longitudinal support beams ~~]~~

~~[If loaded in a 20' container], t~~The minimum length t of longitudinal beams shall be the greater of the two values of t_1 or t_2 to be determined as follows:

$t_1 = r$ [m] (for supporting the length of the cargo unit)

$t_2 = 0.1 \cdot f_{dyn} \cdot m \cdot (2.3 - s)$ [m] (for satisfying transverse strength requirements)

~~[If loaded in a 40' or 45' container, the longitudinal strength must be observed as well. The minimum length t of beams shall not be less than the value of t_3.~~

$$t_3 = L \cdot (2 - \frac{1.8 \cdot P}{f_{dyn} \cdot m})$$ [m] (for satisfying longitudinal strength requirements)]

r = bottom length of cargo unit in the container (footprint) [m]
m = mass of cargo unit [t]
P = payload of container [t]
s = spacing distance of beams [m]
t = length of beams [m]
L = inner length of container [m] (12.0 m for 40' and 13.7 m for 45')
f_{dyn} = vertical acceleration factor
f_{dyn} = 1.0 for road and rail transport
f_{dyn} = 1.5 for sea area A
f_{dyn} = 1.7 for sea area B
f_{dyn} = 1.8 for sea area C

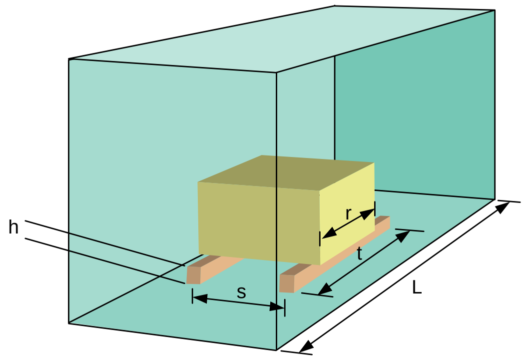


Figure 2: Bedding beams for concentrated loads in an ISO box container

Calculated example: A cargo unit of m = 18 t and a bottom length r = 1.8 m shall be placed into a 20' box container. The beams are placed at a transverse distance s = 1.4 m in the container. The transport route includes sea area 3 with f_{dyn} = 1.8.

$$t_1 = r = 1.8 \text{ m}$$

$$t_2 = 0.1 \cdot f_{dyn} \cdot m \cdot (2.3 - s) = 0.1 \cdot 1.8 \cdot 18 \cdot 0.9 = 2.9 \text{ m}$$

The observation of the longitudinal strength requires a length of beams t = 2.9 m.

Calculated example: A cargo unit of m = 24 t and a bottom length r = 3.8 m shall be placed into a 40' box container with a payload P = 28 t. The beams are placed at a transverse distance s = 1.2 m in the container. The transport route includes sea area B with f_{dyn} = 1.7.

$$t_1 = r = 3.8 \text{ m}$$

$$t_2 = 0.1 \cdot f_{dyn} \cdot m \cdot (2.3 - s) = 0.1 \cdot 1.7 \cdot 24 \cdot 1.1 = 4.5 \text{ m}$$

$$t_3 = L \cdot (2 - \frac{1.8 \cdot P}{f_{dyn} \cdot m}) = 12 \cdot \left(2 - \frac{1.8 \cdot 28}{1.7 \cdot 24}\right) = 9.2 \text{ m}$$

The observation of the longitudinal strength requires a length of beams t = 9.24.5 m.

3. Permissible concentrated loads on flatracks (paragraph 10.3.1.4)

If a cargo unit is placed with its entire foot print over the length r on the flatrack or platform, the permissible load m is:

$$m = \frac{1.8 \cdot P}{f_{dyn}} \cdot \frac{L}{2 \cdot L - r} \quad [t]$$

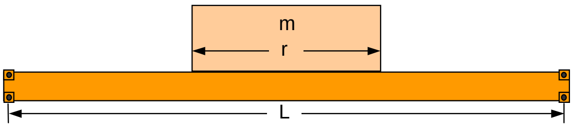


Figure 3: Concentrated load on an ISO platform

If the cargo unit is stiff and stowed on transverse beddings that bridge the distance r on the flatrack or platform, the permissible load m is:

$$m = \frac{1.8 \cdot P}{f_{dyn}} \cdot \frac{L}{2 \cdot L - 2 \cdot r} \quad [t]$$ (Note: m must not exceed P in this formula.)

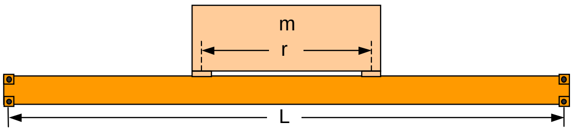


Figure 4: Concentrated load bridging the distance r

If the cargo unit is stowed on longitudinal beams that expand the bedding distance on the flatrack or platform, the necessary length t of those beams is:

$$t = L \cdot \left(2 - \frac{1.8 \cdot P}{f_{dyn} \cdot m}\right) \quad [m]$$ (Note: m must not exceed P in this formula.)

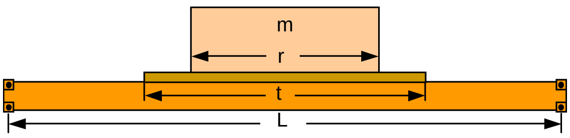


Figure 5: Bedding beams under a concentrated load

P = declared payload [t]
m = concentrated load [t]
L = full length of loading floor [m]
r = length of cargo foot print or bridging distance[m]
t = length of bedding beams[m]
f_{dyn} = vertical acceleration factor
- f_{dyn} = 1.0 for road and rail transport
- f_{dyn} = 1.5 for sea area A
- f_{dyn} = 1.7 for sea area B
- f_{dyn} = 1.8 for sea area C

Calculated example: A flatrack of a loading length L = 12 m and a payload of P = 40 t shall be loaded with a cargo unit of m = 28 t and a length r = 3.8 m. The transport route includes sea area B with f_{dyn} = 1.7. The permissible mass of a unit of that length would be:

$$m = \frac{1.8 \cdot P}{f_{dyn}} \cdot \frac{L}{2 \cdot L - r} = \frac{1.8 \cdot 40}{1.7} \cdot \frac{12}{24 - 3.8} = 25.2 \ t$$

This result shows that loading of 28 t is not permissible. If the same unit is placed on two transverse boards of a distance r = 3.6 m, the permissible mass of the cargo unit would be:

$$m = \frac{1.8 \cdot P}{1.7} \cdot \frac{L}{2 \cdot L - 2 \cdot r} = \frac{1.8 \cdot 40}{1.7} \cdot \frac{12}{24 - 7.2} = 30.2 \text{ t}$$

If this is not feasible because the cargo unit is not stiff enough to bridge the distance of 3.6 metre, the weight must be placed on longitudinal bedding beams with a length t as follows:

$$t = L \cdot \left(2 - \frac{1.8 \cdot P}{f_{dyn} \cdot m}\right) = 12 \cdot \left(2 - \frac{1.8 \cdot 40}{1.7 \cdot 28}\right) = 5.8 \text{ m}$$

4. Bending strength of beams (paragraph 10.3.1.3)

[4.1 Longitudinal support beams]

If the cargo unit is flexible, so that it will rest over its entire length on the bedding beams, the required bending strength of beams should be determined by the formula:

$$n \cdot W = \frac{123 \cdot f_{dyn} \cdot m \cdot (t - r)}{\sigma_{perm}} \text{ cm}^3$$

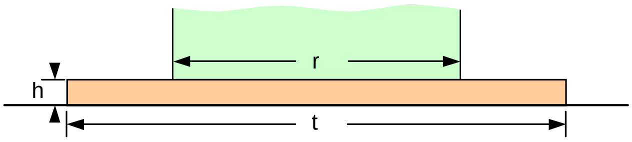


Figure 6: Beam for load spreading under a flexible cargo unit

If the cargo unit is rigid, so that it will bridge a distance on the bedding beams, the required bending strength of beams should be determined by the formula:

$$n \cdot W = \frac{123 \cdot f_{dyn} \cdot m \cdot (t - r)^2}{\sigma_{perm} \cdot t} \text{ cm}^3$$

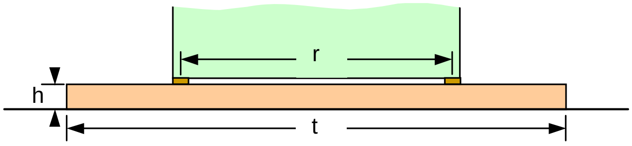


Figure 6: Beam for load spreading under a rigid cargo unit

W = section modulus of one beam [cm^3]
n = number of parallel beams
m = mass of cargo unit [t]
t = length of beam [m]
r = loaded length of beam (footprint) or bridging distance [m]
σ_{perm} = permissible bending stress in beam [kN/cm^2]
f_{dyn} = vertical acceleration factor

- f_{dyn} = 1.0 for road and rail transport
- f_{dyn} = 1.5 for sea area A
- f_{dyn} = 1.7 for sea area B
- f_{dyn} = 1.8 for sea area C

The permissible bending stress σ should be taken as 2.4 kN/cm^2 for timber beams and 22 kN/cm^2 for steel beams. The section modulus for a single beam should be obtained from supplier's documents. The following tables may serve as a quick reference:

timber: dimensions [cm]	10 x 10	12 x 12	15 x 15	20 x 20	25 x 25
section modulus [cm^3]	152	260	508	1236	2450

steel: dimensions [cm]	12 x 12	14 x 14	16 x 16	18 x 18	20 x 20
section modulus [cm^3]	144	216	311	426	570

~~[The overlap of the beams from the cargo base at each end should not exceed five times the base height h of timber beams or ten times the base height h of the steel beams.]~~

Calculated example: A flexible cargo unit of m = 18 t and a bottom length r = 1.8 m shall be placed on timber beams of a length t = 3.2 m (see example above) for a sea passage in sea area A with f_{dyn} = 1.5. The overlap on each end is 0.75 m. Therefore the beams should have a minimum base height h = 0.75 / 5 = 0.15 m. The aggregate section modulus of the timber beams is:

$$n \cdot W = \frac{123 \cdot f_{dyn} \cdot m \cdot (t - r)}{\sigma_{perm}} = \frac{123 \cdot 1.5 \cdot 18 \cdot 1.4}{2.4} = 1937 \ \text{cm}^3$$

Four beams of 15 x 15 cm cross-section would be sufficient.

If the cargo unit were rigid so that it can bridge a distance of r = 1.5 metres, the demanded strength of the bedding beams is reduced:

$$n \cdot W = \frac{123 \cdot f_{dyn} \cdot m \cdot (t - r)^2}{\sigma_{perm} \cdot t} = \frac{123 \cdot 1.5 \cdot 18 \cdot 1.7^2}{2.4 \cdot 3.2} = 1250 \ \text{cm}^3$$

Three beams of 15 x 15 cm cross-section would be sufficient.

~~[~~4.2 Transverse support beams

The required bending strength of transverse bedding beams should be determined by the following formulae:

Rigid cargo: $$W = \frac{250 \cdot f_{dyn} \cdot m \cdot (2.3 - s) - 2650 \cdot l_{effective}}{n \cdot \sigma_{perm}}$$

~~$$W = \frac{590 \cdot m \cdot (2.3 - s) - 3270 \cdot l_{effective}}{n \cdot \sigma_{perm}}$$~~

Flexible cargo: $$W = \frac{120 \cdot f_{dyn} \cdot m \cdot (4.6 - s) - 2650 \cdot l_{effective}}{n \cdot \sigma_{perm}}$$

~~$$W = \frac{220 \cdot m \cdot (4.6 - s) - 2450 \cdot l_{effective}}{n \cdot \sigma_{perm}}$$~~

Where:

W = *Section modulus of support beams [cm^3]*
n = *Number of support beams*
m = *Cargo weight, [ton]*
s = *Cargo width, [m]*
σ_{perm} = *Allowed stress in support beams, [kN/cm^2]*
f_{dyn} = *Vertical acceleration factor*
f_{dyn} = *1.0 for road and rail transport*
f_{dyn} = *1.5 for sea area A*

Formaterat: Teckensnitt:Kursiv
Formaterat: Indrag: Första raden: 1,25 cm, Tabbstopp: 2 cm, Till vänster + 3,25 cm, Till vänster
Formaterat: Teckensnitt:Kursiv
Formaterat: Teckensnitt:Kursiv
Formaterat: Teckensnitt:Kursiv

f_{dyn} = 1.7 for sea area B
f_{dyn} = 1.8 for sea area C

Formaterat: Teckensnitt:Kursiv
Formaterat: Teckensnitt:Kursiv

$l_{effective}$ = *Contributing length of container floor [m], taken as minimum of*
Beams spaced ***more*** *than 0.84 m apart:* $l_{effective} = 3 \cdot n \cdot 0.28$
Beams spaced ***less*** *than 0.84 m apart:* $l_{effective} = r + 0.56$]

5. Longitudinal position of the centre of gravity of a CTU (paragraph 10.3.1.5)

The longitudinal position of the centre of gravity within the inner length of a loaded container is at the distance d from the left end, obtained by the formula:

$$d = \frac{T \cdot 0.5 \cdot L + \sum(m_i \cdot d_i)}{T + \sum m_i}$$

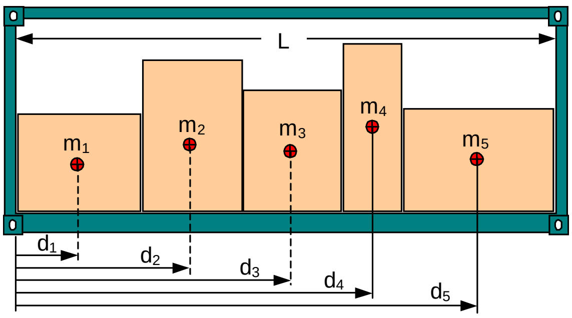


Figure 8: Determination of longitudinal centre of gravity

d = distance of common centre of gravity from left end of stowage area [m]
T = tare mass of CTU [t]
L = length of stowage area (inner length) [m]
m_i = mass of individual cargo unit or group of units [t]
d_i = distance of centre of gravity of mass m_i from left end of stowage area [m]

Calculated example: A 20' container with inner length L = 5.9 m and tare mass T = 2.3 t is loaded with five groups of cargo parcels as follows

	m_i [t]	d_i [m]	$m_i \cdot d_i$ [t·m]
1	3.5	0.7	2.45
2	4.2	1.4	5.88
3	3.7	3.0	6.70
4	2.2	3.8	8.36
5	4.9	5.1	24.99
	Σm_i = 15.5		$\Sigma(m_i \cdot d_i)$ = 48.38

$$d = \frac{T \cdot 0.5 \cdot L + \sum(m_i \cdot d_i)}{T + \sum m_i} = \frac{2.3 \cdot 0.5 \cdot 5.9 + 48.38}{2.3 + 15.5} = \frac{55.17}{17.8} = 3.10 \text{ m}$$

~~[6. Assessment of the load capacity of dunnage bags (paragraph 10.2.3.8)~~

~~Dunnage bags are usually delivered with a certified burst pressure given in units of bar = 1 daN/cm² or 0.01 kN/cm². This information may be used to assess the equivalent "breaking strength" of a dunnage bag by multiplying the burst pressure with the contact area to one side of the blocking arrangement. This contact area may be taken as (h – 20) · (w – 15) cm², where h = height and w = width of the dunnage bag.~~

Calculated example: A dunnage bag of h x w = 1.2 x 0.6 m provides a contact area of (120 – 20) · (60 – 15) = 100 x 45 = 4500 cm^2. The certified burst pressure is 2 bar. = 0.02 kN/cm^2. The equivalent breaking strength of this dunnage bag is 0.02 · 4500 = 90 kN. The MSL for single use is 0.75 · 90 = 67.5 kN, the MSL for multiple use is 0.5 · 90 = 45 kN.]

Annex V. Inspection criteria for freight containers

V.1 Damages which might affect the cargo in the CTU or impede effective transport

V.1.1 General:

- odour, infestation, debris
- vents blocked, not weathertight or missing

V.1.2 Floor:

- delamination of floor planks
- holes other than nail holes

V.1.3 Side panels, front panel, roof:

- dents into cube which reduce the internal width of a container by more than 50 mm from inner corrugation or more than 70 mm from the floor to roof inner corrugation
- dents exceeding the outer face of corner castings more than 40 mm
- panels holed, torn or cut

V.1.4 Lashing rings:

- rings broken, cracked, missing or non-functional

V.1.5 Door:

- door holed, torn or broken
- missing or broken parts affecting door operation or weathertightness

V.1.6 Understructure:

- cross members bowed up by more than 50 mm or below line of corner castings

V.2 Damages which might impede safe transport of the CTU (structural deficiencies)

V.2.1 Top rail:

- local deformation to the rail in excess of 40 mm
- separation or cracks or tears in the rail material in excess of 10 mm in length.

V.2.2 Bottom rail:

- local deformation perpendicular to the rail in excess of 60 mm
- separation cracks or tears in the rail's material:
  a) of flange in excess of 25 mm in length or
  b) of web in any length

V.2.3 Header:

- local deformation to the header in excess of 50 mm
- cracks or tears in excess of 10 mm in length

V.2 Sill:

- local deformation to the sill in excess of 60 mm
- cracks or tears in excess of 10 mm in length

V.2.1 Corner posts:

- local deformation to the post in excess of 30 mm

- cracks or tears in any length

V.2.2 Corner and intermediate fittings:

- missing corner fittings
- any through cracks or tears in the fitting
- any deformation of the fitting that precludes full engagement of the securing or lifting fittings
- any weld separation of adjoining components
- any reduction in the thickness of the plate containing the top aperture that makes it less than 26 mm thick

V.2.3 Understructure:

- one or more cross members are missing or detached.

V.2.4 Door:

- one or more locking rods are non-functional

Annex VI. Practical inclination test for determination of the efficiency of cargo securing arrangements

VI.1 The efficiency of a securing arrangement can be tested by a practical inclining test according to the following description.

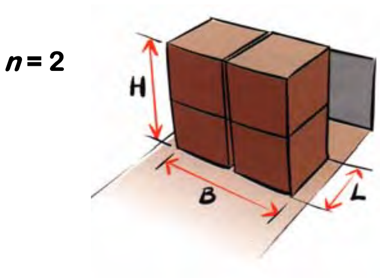
VI.2 The cargo (alternatively one section of the cargo) is placed on a lorry platform or similar and secured in the way intended to be tested.

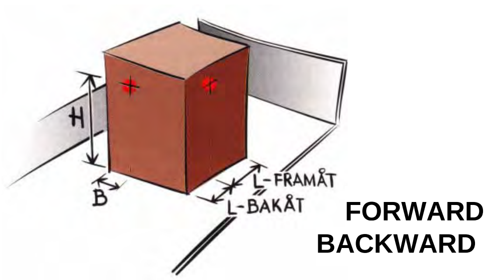
VI.3 To obtain the same loads in the securing arrangement in the inclining test as in calculations, the securing arrangement is to be tested by gradually increasing the inclination of the platform to an angle, α, according to the diagram below. The theories behind the calculation of the required inclination angle are shown in the enclosure to this annex.

VI.4 The inclination angle to be used in the test is a function of the following parameters:

- The horizontal acceleration a_h for the intended direction (forward, sideways or backward) and the vertical acceleration a_v.
- To test the efficiency of the securing arrangement in the lateral direction, the greatest of the following test angles should be used:
  - the angle determined by the friction coefficient μ (for the sliding effect), or
  - the angle determined by the ratio of $\frac{B}{n \cdot H}$ (for the tilting effect).
- To test the efficiency of the securing arrangement in the longitudinal direction, the greatest of following test angles should be used:
  - the angle determined by the friction coefficient μ (for the sliding effect)
  - the angle determined by the ratio of $\frac{L}{H}$ (for the tilting effect).

VI.5 The lowest coefficient of friction, between the cargo and the platform bed or between cargo units if over-stowed should be used. The definition of *H*, *B*, *L* and *n* is according to the sketches below.

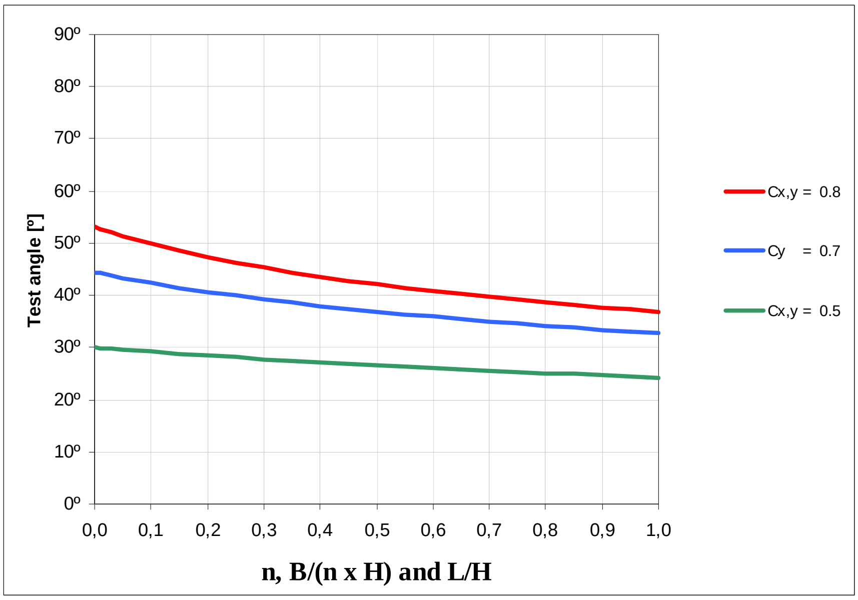




Cargo unit or section with the centre of gravity close to its geometrical centre (L/2, B/2, H/2).
The number of loaded rows, n, in above section is 2.
L is always the length of one section also when several sections are placed behind each other.

Cargo unit with the centre of gravity away from its geometrical centre.

The required test angle α as function of a_h (0,8 *g*, 0,7 *g* and 0,5g) as well as μ, $\frac{B}{n \cdot H}$ and $\frac{L}{H}$ when a_v is 1,0 g is taken from the diagram below.



Example: If μ and $\frac{B}{n \cdot H}$ is 0,3 at accelerations sideways at transport in sea area B (a_h = 0,7 *g*) the cargo securing arrangement shall manage to be inclined to approximately 39º, according to the diagram.

The securing arrangement is regarded as complying with the requirements if the cargo is kept in position with limited movements when inclined to the prescribed inclination α.

The test method will subject the securing arrangement to stresses and great care should be taken to prevent the cargo from falling off the platform during the test. If large weights are tested the entire platform should be prevented from tipping as well.

The cargo securing arrangement of a heat exchanger is here tested for acceleration forces forward and sideways.

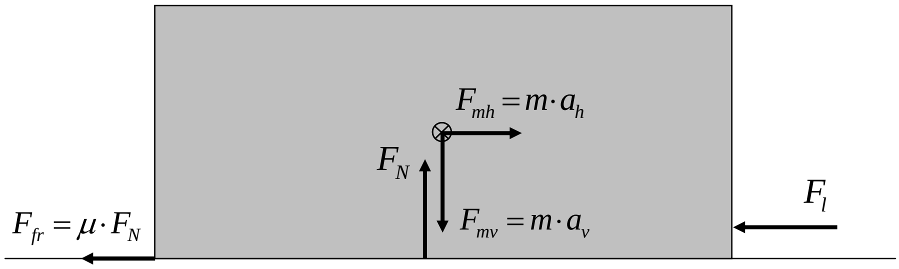
THE ENCLOSURE ACCORDING TO BELOW TO BE DELETED

Enclosure – Theoretical background

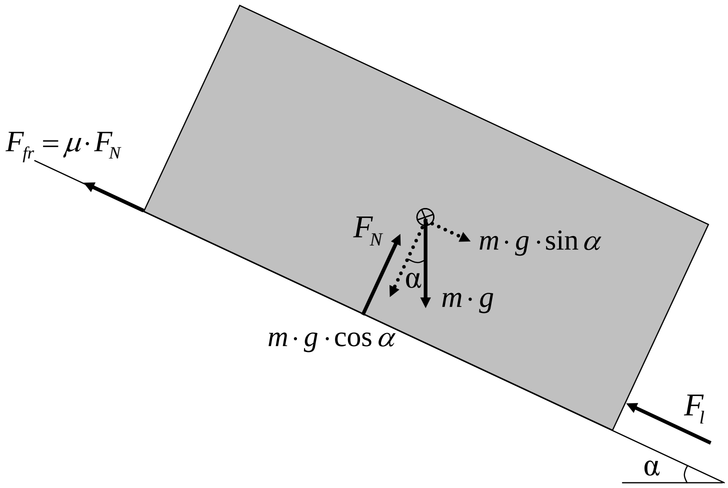
In this enclosure the equations are set up for the required static test angle to obtain the same forces in securing arrangements as in a real transport situation.

Case 1 – Horizontal lashing (type straight/cross lashing or blocking) – Sliding

Required static inclination angle as a function of μ, a_h and a_v to achieve the equivalent force F_l in a horizontal lashing as in a real transport situation.



$$\left.\begin{array}{l} \uparrow \; = \; \downarrow \quad F_N = m \cdot a_v \cdot g \\ \rightarrow \; = \; \leftarrow \quad m \cdot a_h \cdot g = F_l + \mu \cdot F_N \end{array}\right\} \quad F_l = m \cdot g \cdot (a_h - \mu \cdot a_v) \text{ (kN)} \qquad (1)$$



$$\left.\begin{array}{l} \uparrow \; = \; \downarrow \quad F_N = m \cdot g \cdot \cos\alpha \\ \rightarrow \; = \; \leftarrow \quad m \cdot g \cdot \sin\alpha = F_l + \mu \cdot F_N \end{array}\right\} \quad F_l = m \cdot g \cdot (\sin\alpha - \mu \cdot \cos\alpha) \text{ (kN)} \qquad (2)$$

(1) = (2) =>

$$m \cdot g \cdot (a_h - \mu \cdot a_v) = m \cdot g \cdot (\sin\alpha - \mu \cdot \cos\alpha) \quad \Leftrightarrow \quad m \cdot g \cdot (\sin\alpha - \mu \cdot \cos\alpha) = m \cdot g \cdot (a_h - \mu \cdot a_v)$$

The solution of this equation with tables and diagrams of required inclination angle is shown in the section solution of equations below.

Annex VII. Cargo securing with dunnage bags

VII.1 Introduction

VII.1.1 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.

VII.1.2 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:

$$F_{DUNNAGE\ BAG} \geq F_{CARGO}$$

VII.2 Force on dunnage bag from cargo (F_{CARGO})

VII.2.1 The maximum force, with which rigid cargo may impact a dunnage bag, depends on the cargo's mass, size and friction against the surface and the dimensioning accelerations according to the formulas below:

Sliding:

$$F_{CARGO} = m \cdot [a_h - \mu_{static} \cdot 0.7 \cdot a_v]$$

Tipping:

$$F_{CARGO} = m \cdot [a_h - b_p/h_p \cdot a_v]$$

F_{CARGO} = force in ton on the dunnage bag caused by the cargo

m = mass of cargo (t)

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 = Coefficient of friction for the contact area between the cargo and the surface or between different cargo units

b_p = Package width for tipping sideways, or alternatively the length of the cargo for tipping forward or backward

h_p = package height

VII.2.2 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 only the cargo mass that actually impacts the dunnage bag that shall to be used in the above formulas~~.

VII.2.3 It is only the cargo mass that actually impacts the dunnage bag that shall be used in the above formulas The movement forward, when breaking for example, the mass of the cargo behind the dunnage bag is to be used in the formulas.

VII.2.4 If the dunnage bag instead is used to prevent movement sideways, the largest total mass of the cargo that either is on the right or left side of the dunnage bag is to be used, that is, either the mass m_1 or m_2, see Figure VII.1.

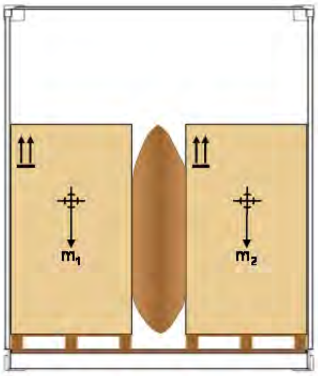


Figure VII.1 : Equal height packages

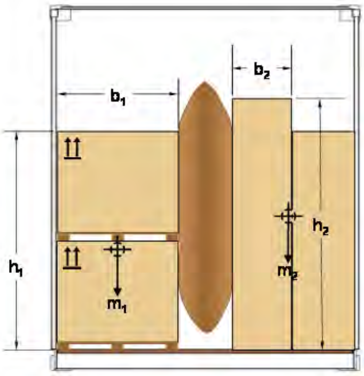


Figure VII.2 : Unequal height packages

VII.2.5 In order to have some safety margin in the calculations, the **lowest** friction coefficient should be used, either the one between the cargo in the bottom layer and the platform or between the layers of cargo.

VII.2.6 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_p~~b~~ / h_p ~~h~~ is chosen.

VII.2.7 However, in both cases the total mass of the cargo that is on the same side of the dunnage bag is to be used, that is, either the mass m_1 or m_2 (Figure VII.2).

VII.3 Permissible load on the dunnage bag (F_{DB})

VII.3.1 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:

$$F_{DB} = A \cdot 10 \cdot P_B \cdot SF$$

F_{DB} =	force that the dunnage bag is able to take up without exceeding the maximum allowable pressure (t)
P_B =	bursting pressure of the dunnage bag (bar)
A =	contact area between the dunnage bag and the cargo (m^2)
SF =	safety factor; 0.75 for single use dunnage bags 0.5 for re-usable dunnage bags

VII.4 Contact area (A)

VII.4.1 The contact area between the dunnage bag and the cargo depends on the size of the bag before it is filled with air and the gap that the bag is filling. This area may be approximated by the following formula:

$$\mathbf{A = (b_{DB} - \pi \cdot d/2) \cdot (h_{DB} - \pi \cdot d/2)}$$

b_{DB} =	width of dunnage bag (m)
h_{DB} =	height of dunnage bag (m)
A =	contact area between the dunnage bag and the cargo (m^2)
d =	gap between packages (m)
π =	3.14

VII.5 Pressure in the dunnage bag

VII.5.1 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.

VII.2 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~~according to above shall be used.

Annex VIII. Quick Lashing Guides

This Annex include Quick Lashing Guides for the three sea areas

CTU Code Draft QLG Sea Area A all
CTU Code Draft QLG Sea Area A road and sea To be deleted
CTU Code Draft QLG Sea Area B
CTU Code Draft QLG Sea Area C

THIS ANNEX SHOULD BE DELETED

Annex IX. Safe transport of containers at sea

Note: This annex is an extract of the International Chamber of Shipping (ICS) and World Shipping Council (WSC) publication Safe Transport of Containers at sea. Although many items are outside of the scope of the Code of practice, it provides those involved with the packing and handling of container CTUs with a better understanding of the requirements for safe transport of containers on maritime transport.

IX.1 Booking and assignment

IX.1.1 Overview

IX.1.1.1 This chapter highlights best practices with regard to the booking and assignment of containerised cargoes, particularly those concerning such critical matters as the accuracy of mass and measures, and declarations of Dangerous Goods, that can have serious implications for the safety of ships as well as the safety of personnel throughout the supply chain.

IX.1.1.2 The key concerns with regard to any cargo booking are as follows:

IX.1.1.3 Ensuring that the shipment and shipper are bona fide;

IX.1.1.4 The accuracy of mass and descriptions;

IX.1.1.5 The hazardous nature of the cargo;

IX.1.1.6 The correct handling instruction.

IX.1.2 Practical constraints

It should be observed that practical constraints may affect the accuracy and effectiveness of any cargo booking, and that this should be accounted for in operations relating to booking and assignment of container cargoes.

IX.1.2.1 Ensuring accuracy of the shipper's declaration

IX.1.2.1.1 Most major shipping lines have in place a standardised electronic booking system that precludes transaction discrepancies and errors between shippers, hauliers and carriers that might be caused, for example, by illegible handwriting or unintended repeat transmission of Shipping Instructions (SI).

IX.1.2.1.2 E-booking systems place the principal responsibility for ensuring bill of lading (B/L) accuracy on shippers from whom the cargo originates. In the interests of safety, security and the efficient movement of cargo, the use of such e-booking systems is strongly recommended. However, support of e-booking varies from region to region and country to country.

IX.1.2.1.3 It should be noted that government fines and penalties can be imposed on shippers if miss-declared, mismarked, improperly stowed or otherwise deficient loads are tendered for shipment.

IX.1.2.2 Undeclared dangerous goods

IX.1.2.2.1 Since virtually any shipper can approach a carrier's customer service staff to place a Dangerous Goods (DG) booking at any time, it is necessary that all relevant staff have received basic DG training so as to be able to process DG bookings in accordance with IMDG Code requirements. Whenever in doubt, staff should always seek professional assistance from the DG Controller in the shipping company's headquarters or regional offices.

IX.1.2.2.2 A minority of shippers, unintentionally or otherwise, may occasionally fail to declare the Dangerous Goods status of containerised cargo. It is therefore very important for carriers to establish the credibility of the shipper, and it is recommended that shipping lines carry out a step-by-step verification as described in 4.3.2.1 below.

IX.1.2.2.3 Shippers' personnel processing Dangerous Goods bookings should also receive DG training.

IX.1.2.3 Last Minute Changes to Outbound Lifting Figures

IX.2 Shipping line stowage co-ordination

IX.2.1 Overview

IX.2.1.1.1 This chapter addresses the principles of safe stowage of containerised cargoes. For the purposes of this Guide, the term "stowage co-ordinators" refers to all of a carrier's shoreside planning staff, and "terminal planners" refers to all terminal personnel involved in stowage planning. However, the following is also directly relevant to the crew of containerships involved in cargo operations (the responsibilities of the master and crew are addressed further in IX.4

IX.2.1.1.2 Stowage co-ordination is a vital part of a shipping line's logistics management process. As well as being central to operational efficiency, proper stowage management is essential for ensuring containership safety.

IX.2.1.1.3 Stowage pre-plans for each ship must take into account all booking information, the harbour situation at all ports of call, any restrictions of ship draft, ship stresses and stability, and restrictions on entering ports due to the carriage of Dangerous Goods, special cargo on board and seasonal weather conditions.

IX.2.1.1.4 The process of stowage co-ordination ordinarily involves the interaction of a number of shipping line personnel including ship managers, Dangerous Goods departments, agents and ships' masters, as well as communication with stevedores and other terminal representatives.

IX.2.1.1.5 In order to fulfil these functions in a professional, responsible and effective way, it must be ensured that all personnel involved in stowage co-ordination have appropriate experience and training and that the safety of ships and their crews is recognised as paramount above all other considerations.

IX.2.1.2 Operational space capacity and operational deadweight capacity

The volume of booked containers should comply with Operational Space Capacity (OSC) and Operational Deadweight Capacity (ODC) for the ship and service loop. ODC is determined by considering the ship's condition with respect to safety, restrictions at ports of call and during the passage, and the seasonal areas restricted by the International Convention on Load Lines, etc.

IX.2.1.3 Stowage co-ordination systems (SCS)

IX.2.1.3.1 Stowage co-ordinators use Stowage Co-ordination Systems (SCS) to assist stowage co-ordination and planning of the voyage of ships over multiple ports, to ensure that all booked cargo can actually be carried safely, and in order to minimise variable costs (e.g. re-stows of containers, lashing, and ballast related fuel consumption).

IX.2.1.3.2 The SCS works with both known data (where containers are already on board or have been received at the terminals) and projected data (where cargo is booked, but specific container numbers and cargo details may not be fully known).

IX.2.1.3.3 The SCS requires trim, stability, strength, visibility and hazardous segregation calculations to determine the practicality of the planned loading at each port and the ship's condition upon departure.

IX.2.1.3.4 More information on the SCS is included in 0~~IX.5.2~~.

IX.2.1.4 Rules of stowage planning

The stowage co-ordinator should follow the company's standing rules for stowage planning, and the ship's Document of Compliance for the Carriage of Dangerous Goods, while ensuring compliance with international regulations such as the IMDG Code, and other applicable local rules such as the US Department of Transport CFR 49. If the shipping line is part of a consortium, any agreed Joint Working Procedures (JWP) of the consortium are relevant when the company is in charge of technical judgements about the acceptance of cargo and the stowage planning of containers that may be loaded on board ship.

IX.2.3.2 On deck stowage of cargo and containers

When making judgements on the on deck stowage of cargo and containers, stowage co-ordinators should take into account:

- The maximum permissible hatch cover load distribution and maximum permissible container stack mass limit, using whichever is the lower as the safe working limit for stowing containers in a stack;
- The rotational and racking forces on container components and ship's lashing gear and stack stability are within safety limits.
- Whether containers comply with the standards of strength defined by ISO standards (see Annex A of this Guide);
- That transverse and vertical forces are divided equally between the two ends of the container, and longitudinal forces between the two sides;
- That two ends or sides of the container do not interact;
- The strength of securing equipment used to restrain the containers;
- Whether any DG cargo requires on deck stowage in accordance with the IMDG code and/or inner row storage, e.g. marine pollutants;
- That, where possible, containers carrying animal hides and other similar cargoes have been stowed on deck at first tier wings and away from accommodation and active reefer containers, to allow washing in case of leakage;
- Where the shipper has expressed a preference for it, the on deck stowage of containers;
- That IMO visibility requirements are complied with (see Annex D of this Guide);
- That port restrictions on the stacking height of on deck containers and/or the height of the gantry crane at each port have been taken into account;
- That when uncontainerised cargoes and cargoes stowed in flat racks, open tops or side open containers, which are not weathertight, are required to be loaded on deck, they are loaded in such a way that they are protected from shipping spray, e.g. in front of the bridge house, under an acceptance by the shipper;
- That where flat rack containers, open top containers or uncontainerised cargo are to be loaded on deck, they should preferably be loaded in front of the accommodation to avoid soot/fire damage, even if they are empty.

IX.2.3.3 Under deck stowage of cargoes and containers

When making judgements on the under deck stowage of cargo and containers, stowage co-ordinators should take into account:

- That uncontainerised cargoes and cargoes stowed in flat racks, open tops or side open containers which are not weathertight are in principle to be loaded below deck;
- That bulk containers containing bulk cargoes, such as malt, should be stowed as far as possible under deck in the inner rows;
- That under deck stowage is recommended for marine pollutant DG containers. Where it is unavoidable that marine pollutant DG containers are to be stowed on deck, inner row stowage is required to minimise pollution in case of accidental leakage;
- Which containers should preferably be stowed under deck according to the shipper;
- That containers requiring under deck stowage and cooling should be stowed away from bulkheads adjacent to machinery rooms and fuel oil tanks, in order to keep them as cool as reasonably practicable during transit;
- That in cases where 20' containers are loaded in 20'/40' convertible bays, the 40' containers should be loaded on the top of secure 20' containers, unless stacking

IX.3 Marine terminal operations (MTOs)

IX.3.1 Overview

IX.3.1.1 This chapter addresses actions that should be undertaken by marine terminal operators when accepting containers, and the correct procedures to be followed when loading and unloading containers on board ships. This guidance follows the sequence of actions normally expected of a container terminal during its operations, and takes into consideration existing practical constraints concerning terminal productivity and overall safety and security, as well as local methods and practices, which may vary from port to port and from terminal to terminal.

IX.3.1.2 It should be stressed that at all times and in all operations, the safety and security of the terminal, the shoreside and shipboard personnel, and ships calling at the port must always take precedence over terminal productivity.

IX.3.2 Shipper's booking

Prior to berth assignment and the development of a cargo loading plan, terminal operators should receive full container details from the shipper, including, but not limited to:

- Gross mass of laden container (gross cargo mass plus container tare mass);
- Full hazard details of DG;
- Exact dimensions, nature and extent of over size with respect to OOG cargo;
- Temperature setting in degrees centigrade (°C) or degrees Fahrenheit (°F) with respect to reefer containers;
- Any special requirements, e.g. under deck stow, deck stow, cool stow, away from sources of heat, import priority container etc., and any other parameter that will affect the stacking in the yard and planning on board the ship;
- Digital photographs of the cargo packing and securing arrangements.

Kommentar [B1]: Is this true? Is there any formal link between t MTO and shipper, or does it go through the carrier?

IX.3.3 Berth assignment

IX.3.3.1 Terminal operators should pre-assign berths on the basis of the following criteria:

- Proximity to the export yard and, to a lesser extent as appropriate, to the import yard as well. Berths should preferably be pre-assigned at least 3 days in advance of the ship's arrival;
- Number of gantry cranes available at the berth to match with what is needed for optimal crane deployment;
- Adequate outreach capacity of gantry cranes;
- Adequate water depth, for which early advice of the estimated arrival draft is important and which may present problems for ships with a short steaming time (e.g. less than 24 hours) from the previous port.

IX.3.3.2 The export yard should be pre-determined before commencement of receiving export containers, normally 3 days before the ship's arrival, although some containers may start arriving at the terminal as much as 7 days prior to the ship's arrival.

IX.3.4 Cargo cut off

Adequate cargo delivery cut-off is necessary to ensure proper segregation of containers at export container yards, in order to facilitate stowage planning and crane sequencing. Adequate time should also be provided to facilitate drafting of the stowage plan (see also Section 4.2.3).

IX.3.5 Safety and security checks prior to entry

IX.3.5.1 It is important for the terminal to ensure that containers accepted into the terminal are safe for operations and do not present a threat to the safety and security of the terminal, or ships and personnel within its environs. It is particularly important to ensure that "paperless" systems do not result in any dilution of the need to verify documentation.

IX.3.5.2 The terminal should undertake the following actions at the first entry gate of the export yard, or

Annex X. Access to tank and bulk tops, working at height

X.1 CTU ladders

X.1.1 CTUs for bulk transport will often require access to the roof, to gain access to the interior of the CTU, to open and close the loading hatch or to sample the cargo. All of these units will have a built in feature to permit access, but these are provided for emergency access rather than regular use as they can restricted and in some cases incomplete rungs / steps.

Figure X-1 : Full frame ladder

Figure X-2 : Partial frame ladder

Figure X-3 : Road tanker

X.1.2 Tank containers, swap tanks and road tankers will have a ladder built into the rear frame, some of which can be clearly discernible as a ladder, see Figure X-3~~Figure X-3~~, while others may appear as a climbing frame see Figure X-2~~Figure X-2~~.

X.1.3 Ideally, inbuilt ladders should be constructed with two styles and should have steps that are at least 300 mm with high friction surface and the steps uniformly spaced about 300 mm apart. The pictures above show good and less satisfactory versions.

Figure X-4 : Bulk container rungs

X.1.4 The design of tank containers, swap tanks and road tankers permits the user to place their feet easily, however access to bulk CTUs is far less satisfactory. Often access is provided by a number of shaped bars attached to the rear doors as Figure X-4. The example shows five shaped bars, the bottom and top steps quite narrow and the spacing varies from 480 mm to 640 mm. Operators attempting to climb onto and from the roof will find these steps difficult.

Where access is required to the top of the container, they will be marked with a warning decal as shown in Figure X-5. The decal indicates a warning from all overhead hazards and power cables in particular. Operators when deciding whether to access the top of the container should make themselves aware of all potential hazards directly overhead and immediately adjacent to the container. This warning is particularly important for operations in rail transfer depots but may affect other handling operations.

Figure X-5 : Overhead warning sign

X.1.5 Ladders built into the CTU should only be considered as a means of access to the top of the container in an emergency, as the process of climbing onto the top of the container entails a risk of slipping and falling. Operational access to tank container tops should be made using suitable mobile steps or from a gantry.

X.1.6 When a tank or dry bulk container is loaded onto a chassis the bottom of the ladder can be as much as 1,600 mm, and the top of the container as much as 4.3 m off the ground. Furthermore on some designs of chassis the container will be slightly inclined with the front end elevated which would mean that the ladder would be inclined backwards towards to the operator.

X.1.7 The steps / rungs are generally manufactured from steel or aluminium and can be slippery in the cold and wet. Operators can easily miss their step when climbing these ladders.

X.1.8 When transitioning from the ladder to the walkway on the container top, there are limited hand holds available for the operator to grip (see Figure X-6~~Figure X-6~~) making the manoeuvre hazardous. An operator climbing onto the top of the tank container shown in Figure X-7~~Figure X-7~~ will be presented with either the walkway securing bracket or the miss-stacking plate, neither of which are ideal handholds. Climbing off the top of the container can be more hazardous as the operator is attempting to locate rungs / steps which are not visible and in an awkward position.

Figure X-6 : Container handhold

Figure X-7 : Transitioning

X.2 Working at height safety

X.2.1 Typical health and safety regulations will state that every employer shall ensure that work is not carried out at height where it is reasonably practicable to carry out the work safely otherwise than at height. Where work is carried out at height, every employer shall take suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

X.2.2 The measures should include:

X.2.2.1 ensuring that the work is carried out:

- from an existing place of work; or
- (in the case of obtaining access or egress) using an existing means, which complies with guidelines with those regulations, where it is reasonably practicable to carry it out safely and under appropriate ergonomic conditions; and
- where it is not reasonably practicable for the work to be carried out in accordance with sub-paragraph X.2.2.1, his providing sufficient work equipment for preventing, so far as is reasonably practicable, a fall occurring.

X.2.2.2 Where the measures taken do not eliminate the risk of a fall occurring, every employer should:

- so far as is reasonably practicable, provide sufficient work equipment to minimise:
- the distance and consequences; or
- where it is not reasonably practicable to minimise the distance, the consequences, of a fall; and
- without prejudice to the generality of paragraph X.2.2~~IV.2.2~~, provide such additional training and instruction or take other additional suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

X.2.3 The regulations can generally be interpreted to mean that wherever possible working at height should be avoided, but where that is not possible, then make it as safe as possible by providing facilities and equipment to minimise the risk of injury.

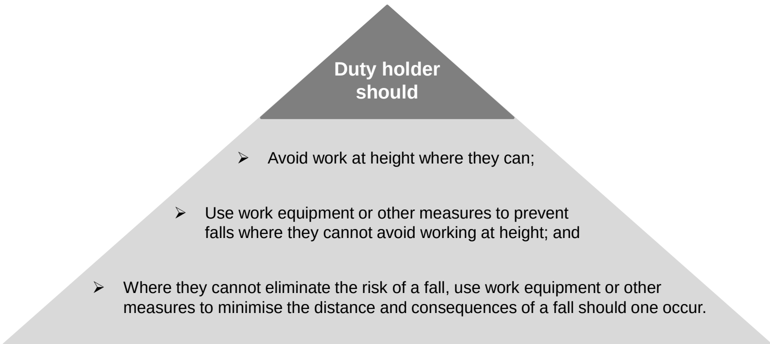


Figure X-8 : Regulations hierarchy

X.3 Access and safety equipment

X.3.1 Where regular access is required to the top of CTUs at a number of different facilities, alternative access solutions should be considered. Some operators have provided more substantial access ladders attached to the trailer as shown in Figure X-9~~Figure X-9~~. The ladder provided satisfies the step dimension recommendation and can be adjusted so that the lowest step is just off the ground. However there are no guard rails on the ladder or on the work platform so the operator will still be at risk of a fall. As an alternative mobile steps similar to those shown in Figure X-10~~Figure X-10~~ can be used which can be positions beside the CTU and from which the operator can safely step.

Figure X-9 : Trailer mounted access ladder

Figure X-10 : Mobile access ladder

X.2 At facilities where regular access is required the CTU should be positioned next to a fixed access gantry (see Figure X-11. Once the container is positioned next to the gantry the operator can lower the counterbalanced handrail / barrier to provide additional safety while working on the CTU top.

Figure X-11 : Access gantry

X.3 If the container is mounted on a chassis, the operator should not attempt to access the top of the container unless the tractor unit has been disconnected or immobilised to prevent accidental movement of the container.

X.4 Use a fall arrest system, by far the best item of personnel safety equipment that can be employed. Operators should wear an approved harness and attach themselves to the overhead cables. In Figure X-12 a number of “T” shaped stanchions are positioned about the area where an operator will work on the top of the container. The connecting overhead cables have counterbalanced arrest drums supported from them to which the operator will attach their harness.

Figure X-12 : Fall arrest stanchions

X.5 Do not overcrowd the top of the container. The walkways are limited in size and strength. Furthermore with too many people on the top of the container moving about can be hazardous.

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Annex XI. CTU Seals

XI.1 Introduction

XI.1.1 CTUs all have facilities for sealing them and packers and shippers may elect to seal them to protect the cargo against theft. That decision will depend on the mode of transport, the route that it follows and the cargo carried. Other agencies, such as the World Customs Organisation, may require CTUs on engaged in international transport to seal them against to improve security against the illegal movement of materials such as narcotics and weapons, and of persons.

XI.1.2 Within this annex the responsibilities of parties within in the supply chain[1] are discussed, the types of seal available and why each may be used and the method of fixing and removal of the seals.

XI.2 Responsibilities along the chain of custody

XI.2.1 Cross-cutting responsibilities

XI.2.1.1 There are responsibilities and principles that apply throughout the life cycle of a shipment of goods. The emphasis is on the relationships among parties upon changes in the custody or possession of the CTU. That emphasis does not reduce and should not obscure the fundamental responsibility of the shipper for the safe and secure stuffing and sealing of the container. Each party in possession of the CTU has security responsibilities while cargo is entrusted to them, whether at rest at a terminal or while moving between terminals.

XI.2.1.2 Those responsibilities include :

- Protecting the physical goods from tampering, theft, and damage.
- Providing appropriate information to government authorities in a timely and accurate manner for security screening purposes.[2]
- Protecting the information related to the goods from tampering and unauthorised access. This responsibility applies equally to times before, during and after having custody of the goods.

XI.2.1.3 Seals are an integral part of the chain of custody. The proper grade and application of the seal is addressed below. Where fitted, seals should be inspected by the receiving party at each change of custody for a packed CTU.

XI.2.1.4 Inspecting a seal requires visual check for signs of tampering, comparison of the seal's identification number with the cargo documentation, and noting the inspection in the appropriate documentation. If the seal is missing, or shows signs of tampering, or shows a different identification number than the cargo documentation, then a number of actions are necessary:

XI.2.1.4.1 The consignee should bring the discrepancy to the attention of the carrier and the shipper. The consignee should also note the discrepancy on the cargo documentation and notify Customs or law enforcement agencies, in accordance with national legislation. Where no such notification requirements exist, the consignee should refuse custody of the CTU pending communication with the carrier until such discrepancies can be resolved.

XI.2.1.4.2 Seals may be changed on a container for legitimate reasons. Examples include inspections by an exporting Customs administration to verify compliance with export regulations; by a carrier to ensure safe blocking and bracing of the shipment; by an importing Customs administration to confirm cargo declarations; and by law enforcement officials concerned with other regulatory or criminal issues.

XI.2.1.4.3 If public or private officials should remove a seal to inspect the shipment, they should install a replacement in a manner that meets the requirements specified below, and note the particulars of the action, including the new seal number, on the cargo documentation

XI.2.1.4.4 All facilities listed in the next section may not be used in the transport route for the CTU and

[1] As described in the WCO SAFE Framework of Standards, June 2011

[2] This responsibility only refers to CTUs engaged in international transport.

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Annex XII. Receiving CTUs

XII.1 Introduction

XII.1.1 This annex covers a number of actions, activities and safety advice for persons involved in the reception and unpacking of a CTU.

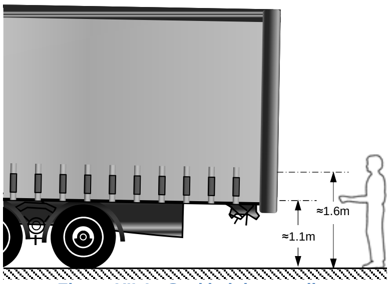

Figure XII-1 : Seal heights - trailer

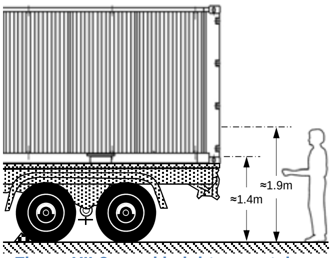

Figure XII-2 : seal heights - container

XII.2 Removing seals

XII.2.1 Stance

XII.2.1.1 The height of the door handle and the seal varies depending on the type of CTU and the design of the door. Rigid vehicles and trailers are generally lower within a range 1.1 and 1.6m from the ground. Containers carried on a trailer will have the security cam fitted seal approximately 1.4m from the ground, but the handles and any seals attached to them at a height of approximately 1.9m

XII.2.1.2 Seals attached to handles on containers doors (approximately 1.9m above the ground) will be about head height for the average person and attempting to cut through a bolt seal at that height is likely to result in a musculoskeletal injury.

XII.2.1.3 The best posture for cutting seals is for the operator to stand upright with the angle at the elbow between 90° and 120° and the elbow in line or slightly forward of the body.

XII.2.1.3.1 Avoid positions where the elbows are behind the body or above the shoulder.

XII.2.1.3.2 When gripping the cutting tool, the wrist should be kept as straight as possible.

XII.2.1.3.3 The best position of the cutting head will be approximately 0 to 15 cm above the height of the elbow. The height above ground level to the elbow for the average (western) man is 109 cm. This means that the best position for the seal will be between 109 and 124 cm (1.09 and 1.24m) above standing level.

XII.2.1.4 Figure XII-3 shows a typical example of how many seals are actually cut. The operator has his back bent, the seal is well below the height of the elbow, the arms are almost straight and the left wrist is cocked, while the right appears to be straight.


Figure XII-3 : Cutting a seal on the ground

XII.2.1.5 The length of the bolt cutter levers are very long compared to the movement of the cutting blades, therefore the hands have to "squeeze" in a considerable distance.

XII.2.1.6 Cutting resistance is high as the blades start to cut and reduces to grow again as the cut finishes. Therefore while the hands are wide apart the greatest inwards pressure is required.

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Annex XIV. In-service repair criteria

There are a number of inspection and repair criteria available and many owners operated their own version. However the Common Interchange Criteria (CIC) has been published by the Container Owners Association and represents an inspection criteria used by leasing companies (for interchange) and is almost identical to the International Chamber of Shipping's in-service Unified Container Inspection and Repair Criteria (UCIRC).

Kommentar [B1]: Lars K Please see comment 14.3.4.4

Kommentar [B2]: Al Le M Where ISO dimensional tolerances are referenced, the actual dimensions should be stated. If not the shipper or consignee will ignore it.

	Component	Damage	Action Required
Rail Inspection Criteria	All rails, including side rails, headers and sills	Holed, cut, torn or cracked; broken component and/or weld	REPAIR
		Missing or loose parts or fasteners	REPAIR
		Any deformation, such as bend, bow, dent, etc.	If exceeding ISO dimensional tolerances, see Table A
	Top and bottom rails	Bend or dent within 250 mm (10 in) of a corner fitting	The weld or other connection to the corner fitting must be carefully examined and repaired if it gives any evidence of a break, cut, tear, crack, hole or other damage
	Top side rails	Any deformation such as bend, bow, dent, etc. EXCEPT on a header extension plate or corner protection plate	If more than 30 mm (1-3/1 6 in) deep, REPAIR
	Front and rear headers	Any deformation such as bend, bow, dent, etc. EXCEPT on a header extension plate or corner protection plate	If more than 40 mm (1-9/1 6 in) deep, REPAIR
	Rain gutters	Any deformation such as bend, bow, dent, etc.	If door operation or securement is impaired, REPAIR
	Bottom side rails, front and door sills	Any deformation such as bend, bow, dent, etc. ON A WEB	If more than 50 mm (2 in) deep, REPAIR
		Any deformation, such as bend, bow, dent, etc. ON A FLANGE	If torn, cracked or cut, REPAIR
	Door headers and sills	Interference with door closure, securement and/or weather tightness weather tightness	REPAIR
Corner post inspection criteria	All corner posts, including J-bars	Holed, cut or torn; broken component and/or weld	REPAIR
		Missing or loose parts or fasteners	REPAIR
		Any deformation, such as bend, bow, dent, etc.	If exceeding ISO dimensional tolerances, see Table A
	All corner posts, front and rear	Any deformation, such as bend, bow, dent, etc.	If more than 20 mm (1 3/16 in), regardless of length or location, REPAIR
		Cracks	REPAIR
	Rear corner posts	Any deformation causing interference with door operation, securement or weather tightness	REPAIR
	J -bars	Any deformation such as bend, bow, dent, etc.	Door must be able to open fully (27O°). If door operation is impaired, REPAIR

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Annex XV. **CTU types**

XV.1 ISO Containers

XV.1.1 Containers – General

XV.1.1.1 A container[1] (freight container) is an article of transport equipment which is:

- of a permanent character and accordingly strong enough to be suitable for repeated use;
- specially designed to facilitate the carriage of goods by one or more modes of transport, without intermediate reloading;
- fitted with devices permitting its ready handling, particularly its transfer from one mode of transport to another;
- so designed as to be easy to pack and unpack;
- having an internal volume of at least 1 m^3 (35,3 ft^3)

XV.1.1.2 A container is further defined by the international convention for safe containers[2]:

- designed to be secured and / or readily handled, having corner fittings for these purposes
- of a size such that the area enclosed by the four outer bottom corners is either:
  - at least 14 m^2 (150 ft^2) or
  - at least 7 m^2 (75 ft^2) if it is fitted with top corner fittings.

XV.1.1.3 Container types

World container fleet at end 2011 by operating category and summarised type					
		Teu		Container	
		Number	Share (%)	Number	Share (%)
Maritime - 8' width					
	Dry freight standard	26,849,672	89.25	17,719,244	89.91
	Dry freight special	956,906	3.18	665,771	3.38
	Refrigerated	2,048,028	6.81	1,094,908	5.56
	Tank (liquid bulk)	229,517	0.76	227,517	1.15
	Subtotal	30,084,123		19,707,440	
Regional - 8' 6" width (North Americam domestic)					
	Dry freight standard	551,275	94.40	210,480	94.11
	Dry freight special	13,014	2.23	5,445	2.43
	Refrigerated	19,696	3.37	7,731	3.46
	Subtotal	583,985		223,656	
Regional - 2.5m width (non cellular pallet-wide, swapbody and swaptank)					
	Dry freight standard	423,310	72.73	286,270	70.79
	Dry freight special	109,956	18.89	81,156	20.07
	Refrigerated	12,237	2.10	6,355	1.57
	Swaptank	36,516	6.27	30,639	7.58
	Subtotal	582,019		404,420	
Grand total		31,250,127		20,335,516	

Figure XV.1 : World container fleet

A teu (twenty foot equivalent) refers to a standard unit based on an ISO container of 20 feet length (6.10 m), used as a statistical measure of traffic flows or capacities.
One standard 40' ISO Series I container equals 2 teu
A dry freight special generally refers to open top, open side and platform based containers.

[1] ISO 830:1999 Freight containers - vocabulary

[2] The international convention for safe containers (CSC), 1972 as amended, IMO.

THIS ANNEX SHOULD BE DELETED

Annex XVI. Unsafe Containers

XVI.1 Introduction

XVI.1.1 This section only refers to containers engaged in the carriage of international transport covered by the International Convention for Safe Containers. Regional and domestic containers may be covered by local regulations or legislation that requires the container to be maintained in line with the requirements of the CSC.

XVI.1.2 The International Convention for Safe Containers (CSC), 1972 includes information on unsafe containers and serious structurally sensitive components and the definition of serious structural deficiencies. While the recommendations are aimed at Control Officers, it is important that the responsible person at the packer's facility undertakes structural checks that include all of the structurally sensitive components.

XVI.1.3 Control officers who find a container that is in a condition that creates an obvious risk to safety should stop the container until it can be ensured that it is in a safe condition to continue in service.

XVI.1.4 All containers with serious structural deficiencies in structurally sensitive components (see section XVI.2) should be considered to be in a condition that creates an obvious risk to safety.

XVI.1.5 Control officers should notify the container owner whenever a container is placed under control.

XVI.1.6 Control officers may permit the onward movement of a container that has been stopped to its ultimate destination providing that it is not lifted from its current means of transport.

XVI.1.7 Empty containers with serious structural deficiencies to structurally sensitive components are also deemed to place a person in danger. Empty containers are typically repositioned for repair at an owner-selected depot provided they can be safely moved; this can involve either a domestic or an international move. Any damaged container being so repositioned should be handled and transported with due regard to its structural deficiency. Clear signage should be placed on all sides and the top of the damaged container to indicate it is being moved for repairs only.

XVI.1.8 Empty containers with severe damage that prevents safe lifting of the container, e.g., damaged, misplaced or missing corner fittings or a failure of the connection between side walls and bottom side rails, should only be moved when carried on a platform-based container, such as a flatrack.

XVI.1.9 Major damage may be the result of significant impact which could have been caused by improper handling of the container or other containers, or significant movement of the cargo within the container. Therefore, special attention should be given to signs of recent impact damage.

XVI.1.10 Damage to a container may appear serious without creating an obvious risk to safety. Some damage, such as holes, may infringe customs requirements but may not be structurally significant.

XVI.2 Structurally sensitive components (and definition of serious structural deficiencies for consideration by authorized control officers only)

XVI.2.1 The structurally sensitive components of a container that should be examined for serious deficiencies are the:

- top rail;
- bottom rail;
- header;
- sill;
- corner posts;
- corner and intermediate fittings;