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Item 2 of the provisional agenda
Consultations on updates to the Code of Practice for Packing of Cargo Transport Units

Proposed updates to the Code of Practice for Packing Cargo Transport Units

Note by the secretariat

Introduction

1. This document contains proposals for text modifications to the IMO/ILO/UNECE Code of Practice for Packing Cargo Transport Units.

2. These modification proposals have been elaborated during an informal pre-work of experts as mandated by the Working Party on Intermodal Transport and Logistics. Annex I presents modification proposals which experts have been able to reach agreement on during its 2021-2023 informal pre-work while Annex II shows changes on which discussion needs to continue.

3. The Special session, further to the mandate given by the Economic Commission's for Europe Inland Transport Committee is invited to review the changes and is requested to:

(a) for the text proposals in Annex I, to conclude if it recommends these proposals to be approved, and

(b) for the text proposals in Annex II, to propose a way forward for their finalisation.

Annex I

Text modification proposals elaborated in the informal pre-work

1. The following text modification proposals have been elaborated:

- A. Definitions – text modification to definitions in chapter 2, and corresponding amendments regarding the use of label, mark and sign in chapters 3, 4, 8, 11, 12, as well as annex 4, annex 5, annex 7 appendix 1 and annex 10.
- B. Chains of responsibilities and information – text modification to chapter 4, and related changes to chapter 12, and annex 1, annex 5.
- C. Blocking material and arrangements – editorial changes to preamble, chapter 6, chapter 7, annex 2, annex 4 and text modifications to annex 7, sections 2 and 4 as well as appendix 4 of annex 7, section 4.
- D. Bedding arrangements – text modifications to annex 7, section 3 and to annex 7, appendix 4, section 2.
- E. Load positioning – text modifications to annex 7, section 3.
- F. Transport Stability level – text modification to annex 7, new section 4.2 and changes to annex 7, appendix 5.
- G. Liquid in flexitank – text modifications to annex 7, clause 5.2.
- H. Solid bulk material – text modifications to annex 7, clause 5.3 and corresponding changes to chapter 11.
- I. Unit of measurements – editorial corrections in chapters 5, 6, and 7.
- J. Acceleration coefficient – text modification to chapter 5, clause 5.3, table on rail transport.
- H. Illegal wildlife trafficking – text modification to chapters 1 and 13 and annex 10.

2. Text modifications are depicted by bold text for text addition and by strikethrough for text deletion vis-à-vis the 2014 edition of the CTU Code.

3. The numbering of clauses and figures would need to be reviewed and adjusted as necessary once all the changes to the CTU Code are finalized.

4 The text contained in square brackets and referring to prevention of pest contamination requires further review pending a consolidated proposal on this issue.

A. Definitions and corresponding amendments regarding the use of label, mark and sign

A.1 Changes to definitions in chapter 2

BK1	**Sheeted bulk container. An open top bulk container with rigid bottom (including hopper-type bottom), side and end walls and a non-rigid covering,**
BK2	**Closed bulk container. A totally closed bulk container having a rigid roof, sidewalls, end walls and the - floor (including hopper-type bottoms). The term includes bulk containers with an opening roof, side or end wall that can be closed during transport. Closed bulk containers may be equipped with openings to allow for the exchange of vapour and gases with air and which prevent under normal conditions of transport the release of solid contents as well as the penetration of rain and splash water.**

BK3	**Flexible bulk container. A flexible container with a capacity not exceeding 15 m^3 and includes liners and attached handling devices and service equipment.**
Blocking	**Cargo securing method where the cargo is prevented from sliding and/or tipping by being stowed against sufficiently strong permanent structures or fixtures on the CTU. Wedges, dunnage, stanchions, inflatable dunnage bags, temporary wooden structures and other devices which are supported directly or indirectly by fixed blocking structures are also considered as blocking elements.**
Blocking capacity	**The maximum ability of a structural member, arrangement, element or material to take the force distributed over its full height and width during sustained use.**
Bulk container	**Container for the transport of dry bulk solids, capable of withstanding the loads resulting from packing, transport motions and discharging of non-packaged dry bulk solids, and having packing and unpacking apertures and fittings.** **There are two variants:** ● **non-pressurized dry bulk container - dry bulk container permitting packing and unpacking by gravity** ● **pressurized dry bulk container - dry bulk container which may be packed or unpacked by gravity or pressure discharge.**
Bulk materials	**Materials that can move freely in a CTU or that are not otherwise secured in their position and for the purpose of this document includes liquids.**
Cargo securing method	**Method for preventing cargo from sliding and/or tipping in forward, backward and sideways directions by blocking, lashing, locking or a combination of these basic methods, respectively providing a pushing force, pulling force or both.**
Carrier haulage	**The main haulage carrier arranges the preceding and/or subsequent transport of a CTU.**
[Clean CTU	A CTU free from: • Any previous cargo residues; • Any securing materials used from previous cargos; • Any **labels,** marks **or**, placards~~ or signs~~ associated with previous cargoes; • Any detritus (waste) that may have accumulated in the CTU; ~~• Visible pests and other living or dead organisms, including any part, gametes, seeds, eggs or propagules of such species that may survive and subsequently reproduce; soil; organic matter;~~ • ~~All other items covered by contamination, infestation and invasive alien species that can be discovered upon visible inspection.~~ • **Any pest contamination.** **If used for international transport where required, the CTU has further been inspected to the exterior and interior and, for reefer containers, ventilation inlet grilles and floor drain holes, and found to have no pest contamination as defined below.]**
Consignee	The party to whom a cargo is consigned under a contract of carriage or a transport document or electronic record. ~~Also known as the receiver.~~

Consignor	The party who prepares a ~~consignment~~ **cargo** for transport. ~~If the consignor contracts the transport operation with the carrier, the consignor will undertake the function of the shipper and may also be known as:~~ ~~• The shipper (maritime);~~ ~~• The sender (road transport)~~
[Contamination	*Deleted]*
EDI	**Electronic data interchange - the concept of businesses electronically communicating data and information that was traditionally communicated on paper.**
EDP	**Electronic data processing - the use of automated methods to process commercial data.**
Flexitank	Bladder **with a loading/discharging valve which is installed inside a general purpose CTU and is** used for the transport and/or storage of a non-regulated liquid~~ inside a CTU~~.
[Freight Forwarder	~~The party who organizes shipments for individuals or other companies and may also act as a carrier. When the freight forwarder is not acting as a carrier, it acts only as an agent, in other words as a third-party logistics provider who dispatches shipments via carriers and that books or otherwise arranges space for these shipments.]~~ **The party that provides services relating to the carriage, consolidation, storage, handling, packing or distribution of goods, as well as ancillary and advisory services in connection therewith including customs clearance. Freight forwarding services may also include logistics services in connection with the carriage, handling or storage of the goods**
[Infestation	*Deleted]*
Illegal Wildlife Trafficking	**Illegal transport or trafficking of wildlife.**
Inspectors/surveyors	**Parties employed by governments or commercial entities to perform inspection/surveying functions to ensure the safe transport of CTUs**
Insurers	**Entities/parties that provide insurances which variously cover loss or damage to cargo, CTUs, ships and other means of conveyance.** **Some insurances, such as Cargo or Hull, provide cover based on the value of the item insured. Others, such as Protection & Indemnity or Carrier's Liability, cover the liability under law or contract in relation to the goods being transported and other parties who may be impacted.**
[Invasive alien species	*Deleted]*
Label	**a) A decal or panel applied to packages and/or cargo items that indicates a hazard or danger to persons or to the environment.** **b) A piece of material or plastic attached to, but not printed on, lashing equipment to provide information about its strength and other characteristics.**
Lashing	**Cargo securing method where the cargo is prevented from sliding and/or tipping by the use of bendable devices, e.g., web- or chain lashings, steel straps, wire or ropes. Lashings can be attached by different techniques such as top-over-, half loop-, straight- or spring lashings.**

Lashing capacity	**Maximum force for use in straight pull that a lashing is designed to sustain in use. See also the definition for Maximum securing load.**
Locking	**Cargo securing method where the cargo is prevented from sliding and tipping in all directions by mechanical devices, e.g. twist-locks, bolts or welds.**
Mark	**An applied decal, ~~or~~ panel, or imprint that provides information concerning the cargo packed, dunnage blocking capacity or other packing equipment information.**
Maximum securing load	**A term used to define the allowable load capacity (expressed as a force) for a device used to secure cargo. Safe working load (SWL) or lashing capacity (LC) may be substituted for MSL for securing purposes, provided this is equal to or exceeds the strength defined by MSL.**
Merchant haulage	**Merchant haulage is when the merchant, which may be the cargo owner, consignor, shipper or consignee arranges the CTU transport through their appointed service providers.**
[Pest	*Deleted]*
[Pest Contamination	Visible forms of animals, insects or other invertebrates (alive or dead, in any lifecycle stage, including egg casings or rafts), or any organic material of animal origin (including blood, bones, hair, flesh, secretions, excretions); viable or non-viable plants or plant products (including fruit, seeds, leaves, twigs, roots, bark); or other organic material, including fungi; or soil, or water; where such products are not the manifested cargo within the CTU.]
Placards	**Placards are a larger version of labels as defined under label in (a).**
[Quarantine Pest	*Deleted]*
[Recontamination	*Deleted]*
Shipper	The party ~~named on the bill of lading or waybill as shipper and/or~~ **who** concludes a contract of carriage (or in whose name or on whose behalf a contract of carriage has been concluded) with a carrier. ~~Also known as the sender.~~
Shoring slot	A permanent fixture into which cargo securing bars or boards can be inserted and which will prevent cargo from placing loads in excess of the container doors' design load on the doors during sudden motion.
Shoring slot system	**Is designed to restrain the cargo from forcing the door open during sudden stops or tilting of the container during transportation. It also serves to restrain dislocated cargo to prevent it from spilling out of the container when the container's doors are opened. Shoring slot systems consist of shoring slots and one or more cargo securing bars.**
Siftproof	**Means impermeable to dry contents including fine solid materials produced during transport.**
Sign (distinguishing sign)	**Distinguishing sign of the state of registration used on motor vehicles and trailers in international road traffic in accordance with the 1949 Geneva Convention on Road Traffic or in the 1968 Vienna Convention on Road Traffic.**

Temperature sensitive cargo	Cargo that should be packed, stored or transported within a defined temperature range with an upper and / or lower temperature value, and outside of which may cause: • **the cargo to be damaged** • **the state of the cargo to change** • **the cargo to auto ignite** • **decomposition or polymerization** **Temperature sensitive cargos may also need to arrive within a strict time frame or be subjected to maximum dwell times during transport.**
Transport documentation	**Documents required for the movement of cargo related to the origin, destination, nature and character of the goods transported. Electronic records are considered equivalent to paper documents when permitted by the regulations.**
Unpacker	**The party that unloads, removes or empties the cargo from the CTU.**
[Visual examination	**The physical examination of CTUs for Pest Contamination using the unaided eye or lens, to detect contaminants without testing or processing]**
Wildlife	**All species of wild animals and plants, whether alive or dead, and parts and derivatives of those species, whose international trade is regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora, as well as those protected under international law, and those whose exports are restricted under national legislation implementing of the same.**

A.2 Corresponding amendments regarding the use of label, mark and sign

Relevant to Chapter 3. Key Requirements:

3.4 Packing of dangerous goods

• Do check that all packages are properly marked and labelled.

• Do pack dangerous goods according to applicable dangerous goods regulations.

• Do pack dangerous goods near the door of the CTU where possible.

• Do affix required **labels, marks and** placards~~, marks and signs~~ on the exterior of the CTU.

• Do not pack incompatible goods which should be segregated.

• Do not pack damaged packages.

3.7 Unpacking

• Do check that the identification number on the CTU and, when the CTU should be sealed, the seal serial number, are as shown on the transport documentation.

• Do check the exterior of the CTU for signs of leakage or infestation.

• Do use proper equipment to cut the seal if affixed.

• Do ensure the CTU is safe to enter. Be aware that the atmosphere in the CTU may be dangerous – ventilate before entering.

• Do open the CTU with caution as cargo might fall out.

• Do record every package as it is removed noting any markings and damages.

• Do remove all securing and protection material for reuse, recycling or disposal.

- Do clean the interior of the CTU to remove all traces of the cargo, especially loose powders, grains and noxious materials and fumigants, unless otherwise agreed with the CTU operator.
- Do remove all **labels,** marks **and**~~,~~ placards ~~and signs~~ regarding the previous consignment from the exterior of the CTU once it has been cleaned.

Relevant to Chapter 8. Arrival, checking and positioning of CTUs:

8.2 CTU checks

8.2.2 Exterior checks

8.2.2.1 The structural framework, the walls and roof of a CTU should be in good condition, and not significantly distorted, cracked or bent. The CTU operator is responsible for delivering a CTU that complies with international structural integrity requirements and international or national safety regulations. If the structural integrity is in doubt, advice should be sought from supervisory personnel or the CTU operator.

8.2.2.2 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.

8.2.2.3 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.

8.2.2.4 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.

8.2.2.5 Removable or swinging headers of open top CTUs 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.

8.2.2.6 Road vehicles that are likely to be carried on rail wagons or on ro-ro ships 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.

8.2.2.7 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, should be in good condition. All lashing strap ratchet tighteners should be able to be engaged and operate correctly.

8.2.2.8 Labels, placards~~, marks or signs~~ **or marks** regarding previous usages of the CTU should be removed. Permanently affixed signs and marks may never be removed.

8.2.2.9 When undertaking the exterior checks, the CTU should be checked for any signs of recontamination particularly:

- Along bottom rails;
- Within forklift pockets;
- In and around the twist lock fittings;
- Underside and cross members;
- On tops where necessary.

Relevant to Chapter 11. On completion of packing:

11.2 Marking and placarding

11.2.1 The applicable dangerous goods regulations may require that placards (enlarged labels), marks and other **labels** ~~signs~~ be affixed to the surfaces of a CTU. The specifications of these placards, marks and **labels** ~~signs~~ and the locations where they should be affixed are described in detail in the applicable dangerous goods regulations **and Chapter 11 of this Code**.

11.2.2 The applicable dangerous goods regulations may require other **labels** warning ~~signs~~ ~~for~~ **of** specific risks, e.g. a **label** ~~sign~~ warning of the possibility of an asphyxiating atmosphere when solid carbon dioxide (CO2 – dry ice) or other expendable refrigerant has been used for cooling purposes or a **label** ~~sign~~ warning of a potentially explosive atmosphere when vehicles or lighters have been packed into the CTU.

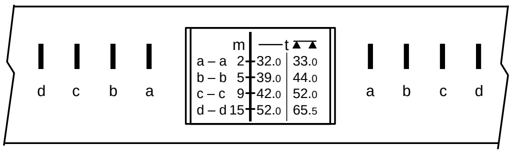
11.2.3 The applicable dangerous goods regulations may require specific **marks** ~~warning signs~~ for CTUs under fumigation even though the cargo is not classified as dangerous. The details of marking and further instructions for the handling of such CTUs are set forth in the applicable dangerous goods regulations (see annex 9).

Relevant to Annex 4. Approval plates:

5.1.6 Concentrated loads

Shown in the centre of each solebar*

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 (see figure 4.13).



Column	Symbol	Description
1		~~Signs~~ **Marks** showing the length of the supporting surfaces of concentrated loads, or the distance between supports
2	m	Distance in metre between the ~~signs~~ **marks** showing the length
3	—	Maximum tonnage of concentrated loads
4	▲▲	Maximum tonnage of loads resting on two supports

Figure 4.13 Reduction in payload due to concentrated load and bedding distance

Relevant to Annex 7, Appendix 1. Packing and securing cargo into CTUs

Packaging marks

2 Symbols

2.1 Display of symbols

2.1.1 Symbols should preferably be stencilled directly on the package or may appear on a **decal** ~~label~~. It is recommended that the symbols be painted, printed or otherwise reproduced as specified in this ISO standard. They need not be framed by border lines.

2.1.2 The graphical design of each symbol should have only one meaning; symbols are purposely designed so that they can also be stencilled without changing the graphics.

To note: Corresponding amendments regarding the use of label, mark and sign in chapters 4 and 12 and annex 5 are provided in section B and for annex 10 in section H.

B. Chains of responsibilities and information

B.1 Changes to chapter 4

4.1 Chain of responsibility

4.1.1 In general, transport operations using CTUs in particular, involve various parties each of whom have a responsibility to ensure that the cargo is transported through the supply chain without incident. Notwithstanding any national legislation or contracts between the involved parties the chain of responsibility discussed below identifies functional responsibilities of the parties involved.

4.1.2 Although the carrier generally, in a contract of carriage is responsible under that contract to deliver the cargo in the same condition as received, it is the shipper who should deliver a cargo which is safe and suitable for transport. Thus, the shipper remains responsible for any deficiency of the CTU that is a result of poor packing and securing. However, when the shipper is neither the packer nor the consignor, the packer and the consignor should fulfil their obligation to the shipper ensuring that the CTU is safe for transport. If not the shipper may hold those parties responsible for any faults or deficiencies that can be attributed to poor packing, securing, handling or reporting procedures.

4.1.3 Within this chain of responsibilities, each party in the chain should comply with their individual responsibilities and in doing so increase safety and reduce the risk of injury to persons involved in the supply chain.

[4.1.4 All persons involved in the movement of CTUs also have a duty to ensure, in accordance with their roles and responsibilities in the supply chain, that the CTU **is free from pest contamination** ~~is not infested with plants, plant products, insects or other animals, or~~ **and** that the CTU is not carrying illegal goods or immigrants, contraband or undeclared or misdeclared cargoes **including wildlife**.]

4.1.5 The supply chain is a complex operation and individual modes of transport may have defined terms for parties within the supply chain which are not consistent with other modes of transport.

4.1.6 A single entity may undertake one or more of the functions listed below. **For example, the role of shipper may be performed by the consignor, the freight forwarder or the consignee, depending on the terms of the trade.** The flow of information between the functions is discussed further in annex 1.

4.2 Functions within the supply chain

Between the different functions involved in an intermodal transport chain, the tasks are assigned as follows:

[4.2.1 The CTU operator is responsible for providing CTUs that:

- Are fit for purpose;
- Comply with international structural integrity requirements;
- Comply with international or national safety regulations;
- Are clean, free of cargo residues, noxious materials, plants, plant products and visible pests.]

4.2.2 The consignor is responsible for:

- Correctly describing the goods including the mass of the total payload;
- Notifying the packer/shipper of any unusual transport parameters of individual packages, for example, the offset of the centre of gravity or transport temperatures which should not be exceeded or undercut;
- Ensuring that packages and unit loads are suitable to withstand the stresses which are to be expected under normal transport conditions;
- Providing all the information that is required for proper packing;
- Ensuring that goods in packages and unit loads are adequately secured to prevent damage during transport;
- Ensuring that goods are ventilated so that any noxious or harmful gases are permitted to vent off before packing;
- Ensuring that dangerous goods are correctly classified, packed**, marked** and labelled;
- Ensuring the dangerous goods transport document is completed, signed and transmitted to the packer, forwarder, shipper (if not the consignor) and carrier as applicable.

4.2.3 The packer is responsible for:

- Ensuring that the CTU is checked before packing and that the condition of the CTU is suitable for the cargo to be transported;
- Ensuring that the floor of the CTU is not overstressed during packing operations;
- **Ensuring that transport documentation is available for all dangerous goods to be packed;**
- **Ensuring that no incompatible or damaged dangerous goods are packed. Account should be taken of all applicable dangerous goods legislations during the entire journey of the CTU from original point of dispatch to final destination;**
- **Ensuring that the cargo is correctly packed in the CTU.**
- **Ensuring that the cargo is secured in the CTU;**
- Ensuring that the cargo is correctly distributed in the CTU and properly supported where necessary;
- **[Ensuring that measures are put in place to prevent pest contamination. Such measures involve use of lights that minimize the attraction of insects during active packing and closing doors and tarpaulins once active packing is interrupted but not fully finished;]**
- ~~Ensuring that the CTU is not overloaded;~~
- ~~Ensuring that the cargo is sufficiently secured in the CTU;~~
- ~~Ensuring that measures are put in place to prevent the movement of plants, plant products and visible pests, such as closing doors and tarpaulins once packing has started but not taking place and lights that minimize the attraction of insects;~~
- Properly closing the CTU and sealing it, when required, and reporting seal details to the shipper **with a view to sharing those details with the container operator and, where different, the carrier**. CTUs used for international transport should be sealed;
- Fitting marks and placards to the CTU as required by dangerous goods regulations;
- Fitting the fumigation mark if any fumigant has been used as part of the packing process;
- **Fitting other marks and / or labels applicable to the cargo being carried, e.g., flexitank labels;**
- Accurately determining the gross mass* of the CTU** and **transmitting** it to the shipper;

- **Ensuring that the CTU is not overloaded and complies with the maximum operating gross mass indicated on the approval plate (see annex 3)**

- ~~Ensuring that no incompatible dangerous goods are packed. Account should be taken of all dangerous goods legislations during the complete transport chain;~~

- Providing the container/vehicle packing certificate*** (new document or signed statement in the dangerous goods transport documentation as appropriate) and forwarding any documentation to the shipper **with a view to sharing that information with the container operator and, where different, the carrier**.

To assist with the stowing of freight containers on board ships, and as the only party who may physically see the container, t~~T~~he packer should also pass on **to the shipper** information relating to any freight container with a reduced stacking capacity (less than 192,000 kg marked on the CSC safety approval plate)****~~, to the shipper~~. **This information is critically important for the proper stowage of the CTU aboard ship; it should therefore be shared also with the container operator and, where different, the carrier.**

* The gross mass of the CTU needs to be verified before any transport operation commences. Incorrect gross masses are a hazard for any mode of transport. Therefore, the gross mass verification should be carried out before the unit leaves the premises of the packer~~. If a certain transport mode deems it necessary that a reverification has to take place when the CTU is transferred from one mode to another, this is beyond the scope of this Code and may be regulated in the regulations of that mode~~. Where a cargo is to be transported by road **vehicle,** or rail **wagon**~~ only~~, **and where the tare of the CTU is not known,** the packer need**s** only provide the mass of the cargo and any packing and securing material to the **shipper.** ~~carrier when the tare of the transport vehicle is not known.~~

~~**~~ **Where the CTU is a freight container in sea transport, the Packers should provide a gross mass as required by the International Convention for the Safety of Life at Sea (SOLAS) Chapter VI, Regulation 2 which shall be verified by the Shipper and transmitted to the Container Operator, and where different, the Carrier.**

***** To include electronic documentation in accordance with 11.3.1 and 11.3**

***** As of January 1st 2012, all freight 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.

4.2.4 The consolidator is responsible for:

- **Fulfilling the responsibility of the packer as shown in 4.2.3**

- **Confirming to each and every shipper / consignor using a consolidated CTU that their cargo will be packed and secured in accordance with the requirements of the shipper / consignor to ensure the safe transport of their cargo**

~~4.2.4~~**4.2.5** The shipper is responsible for ensuring that:

- The work distribution concerning packing and securing is clearly agreed and communicated to the consignor and carrier/carriers;

- A suitable CTU is used for the intended cargo for the intended transport;

[• A CTU is requested which is safe for transport and is clean, free of cargo residues, noxious materials, plants, plant products and visible pests before being 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;

- The gross mass of the CTU is accurately determined;

- The accurate description of the cargo* is communicated to the carrier as early as required by the carrier;
- The verified 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;
- In the case of temperature controlled goods, the correct temperature set point is entered into the control unit and onto the transport/shipping documents;
- Ensuring that a seal, where required, is affixed immediately upon completion of the packing of the CTU;
- The seal number, where required, 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;
- Shipping instructions are despatched to the carrier on time and that the CTU meets the outbound delivery window;
- The CTU arrives at the terminal before the stated cargo cut off time;
- The information concerning the consignment, description of packages and, in the case of freight containers, the verified gross mass is transmitted to the consignee.

* A description of the cargo should include a description of the goods and the packaging, for example wine in a flexitank, hard frozen hanging beef sides or the number and type of packages. However, national and/or regional regulations may impose additional requirements for the scope and level of detail of cargo descriptions, including usage of Harmonized System (HS) codes.

4.2.6 The freight forwarder may perform any of the following functional roles:

- **Consignor**
- **Packer**
- **Consolidator**
- **Shipper**
- **Carrier**
- **Unpacker**
- **Consignee**

and should undertake the responsibilities of the roles as required by the contractual agreements between the parties concerned.

~~4.2.5~~**4.2.7** The road haulier is responsible for:

- Confirming that the gross mass, length, width and height of the vehicle are within the national road/highway regulations limits;
- **Ensuring that the driver is qualified and / or experienced in driving the vehicle with the CTU / Cargo combination, for example: road tankers and tank container;**
- **Ensuring that the driver is aware of any cargoes that may influence the performance of the vehicle, for example bulk liquids on the CTU or hanging foodstuffs;**
- **Ensuring that the driver:**
  - **secures the CTU properly on the trailer or chassis (except where the CTU is a trailer);**

[• visually examines the exterior of the CTU to confirm that it is safe to move and that it is pest-free;]

- **confirms that there are no loose components or coverings that may become detached or damage the CTU and / or cargo during transport;**

[• is aware of their responsibilities in conformance with the underlying contract between the haulier and shipper (merchant haulage) or carrier (carrier haulage) with regard to securing of the cargo and determining the status of the CTU and that the CTU is pest-free;]

- **Moves the CTU in such a manner that there are no exceptional stresses placed on the CTU or the cargo;**
- **is in possession of all documents required by the dangerous goods regulations.**

~~• Ensuring that the driver is able to get sufficient rest and does not drive when fatigued;~~

~~• Except when the CTU is a trailer, securing the CTU properly on the trailer or chassis;~~

~~• Moving the CTU in such a manner that there are no exceptional stresses placed on the CTU or the cargo.~~

~~4.2.6~~**4.2.8** The rail haulier is responsible for:

• Handling the CTU in a manner that would not cause damage to the cargo;

• Except when the CTU is a rail wagon, securing the CTU properly on the rail wagon.

~~4.2.7~~**4.2.9** The intermodal operator is responsible for:

[• Ensuring that appropriate pest prevention methods are in place, which may include removal of muds and soils from the CTU;]

• Complying with annex 2.

~~4.2.8~~**4.2.10** The carrier is responsible for:

• Monitoring agreed temperatures in the CTUs where applicable and reacting to changes as appropriate;

• Securing the CTU on the means of transport;

• Transporting the CTU 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, uncontainerized).

~~4.2.9~~**4.2.11** The **unpacker** ~~consignee/receiver~~ of CTUs is responsible for:

• **Checking the seal prior to its removal on whether it conforms with information on the transport documentation**

• Correctly ventilating the CTU before entering;

• Confirming that the atmosphere within the CTU is not hazardous before permitting persons to enter it;

• Not overstressing the floor of the CTU during unpacking operations;

• **Removing all cargo, securing material and other debris from the CTU;**

• [Applying suitable measures and steps for detection of pest contamination and, where found, to dispose of them in accordance with applicable rules and requirements promulgated by the local office of the National Plant Protection Organization (NPPO) or, if contamination is of animal origin, the local Animal Quarantine Office];

~~• Returning the CTU to the CTU operator completely empty and clean, unless otherwise agreed;~~

• Removing all **labels,** marks **or**~~,~~ placards ~~or signs~~ regarding the previous consignments.

• Detecting any damage to the CTU and to notify the carrier.

~~4.2.10~~**4.2.12 The consignee of CTUs is responsible for:** ~~Shippers of empty CTUs and operators of empty CTUs are encouraged to have practices and arrangements in place to ensure that they are empty.~~

• Receiving the CTU from the designated transport provider and ensuring that the information supplied by the shipper concerning the consignment matches those of the CTUs received;

• Returning the CTU to the CTU operator completely empty and clean, unless otherwise agreed.

~~4.2.11~~**4.2.13 The inspectors/surveyors are responsible for:**

● Informing the principal of compliance and/or non-compliance of applicable codes and standards for further action where appropriate.

[● Visually examining the CTU to ensure that it is free from pest contamination.]

4.2.14 Insurers are responsible for:

● Raising awareness of the CTU Code and best practice among customers.

● Assisting in the development of additional advice for specific cargo types as appropriate.

4.2.15 Customs is responsible for:

● Ensuring the compliance with applicable laws and regulations by inspecting the CTU and its cargo at any stage in the transport chain.

● Replacing seals removed with one that is at least to the same standard and complies with ISO 17712.

● Ensuring that, the documentation is amended to include the inspection and its results as well as any seal removal and the affixing of new seals.

4.2.16~~.(4.2.10)~~ Shippers of empty CTUs and operators of empty CTUs are encouraged to have practices and arrangements in place to ensure that they are empty.

[4.2.17 All parties identified within section 4.2 should minimize the risk of ~~re~~contamination of CTUs when in their custody. This may include the following:

• Implementation of appropriate pest management programs;

• Removal of any plants, plant products or visible pests taking into account the roles and responsibilities of each party within the supply chain and, further, the impossibility of inspecting the interior of closed and sealed CTUs for recontamination.

For more information see annex 6.]

4.2.~~12~~**18** All parties should ensure that the flow of information is transmitted to parties identified in the transport contract along the supply chain. The information should include:

• The identification, in accordance with a risk assessment6, of risks to the integrity of the CTU that may be present for all or some part of the journey;

• CTU identification;

• Seal number (where required);

• Verified gross mass of the CTU;

• Accurate description of the cargo carried in the CTU;

• The correct description of dangerous goods;

• Correct and appropriate transport documentation;

• Any information required for safety, security, phytosanitary, veterinary, Customs or other regulatory purposes.

4.2.19 All parties should check the integrity of the CTU and its seal when in their custody in order to detect possible intrusions into the CTU.

4.2.20 All parties should set up a procedure to report all suspicious cases or incidents of misdeclared or undeclared wildlife shipments with customs and law-enforcement authorities. It is important that any incidents with shippers and/or consignors misdeclaring or trying to conceal wildlife shipments be identified and reported on arrival.

B.2 Corresponding changes in other chapters or annexes

Relevant to Chapter 12. Advice on receipt and unpacking of CTUs:

12.1 General Precautions

12.1.1 **The unpacker of a CTU should:** ~~When applicable the consignee or the receiver of a CTU should check whether the unit is externally in good condition, and not significantly distorted, cracked or bent. If such damage is found, the receiver should document and notify it to the CTU operator. Specific attention should be paid to damage that may have influenced the condition of the cargo within the unit.~~

12.1.1.1 [Visually examine the CTU on arrival to ensure that it is pest free and continue to check that there are no signs of Pest contamination],

12.1.1.2 Check whether the unit is externally in good condition, and not significantly distorted, cracked or bent. If such damage is found, the receiver should document and notify it to the CTU operator. Specific attention should be paid to damage that may have influenced the condition of the cargo within the unit.

12.1.2 Where a seal number is stated on the transport documentation, the seal should be checked. If the reference number on the seal differs from the documentation or if the seal appears to be damaged or is missing, this could indicate that the CTU has been opened during transport. In such case the CTU operator should be contacted.

12.1.3 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.

12.1.4 Persons opening a CTU should be aware of the risk of cargo falling out (for details see annex 5, section 6).

12.1.5 CTUs with substances used for cooling or conditioning purposes present a particular risk of a toxic or asphyxiant atmosphere (see paragraphs 11.2.2 and 11.2.3). Before opening the doors, it should be ascertained by measurement that no harmful atmosphere is present in the CTU.

12.1.6 Some cargoes may emit 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 emit harmful substances to an extent making the atmosphere in the CTU dangerous. Care should be taken not to come into contact with the internal atmosphere when opening the doors. Therefore, any CTU should be ventilated before allowing personnel to enter, preferably by mechanically forced ventilation. If this is not available, the doors should be opened for a period of time – enough to allow the internal atmosphere to regularize with the ambient.

12.1.7 CTUs that are fumigated should be properly **labelled** ~~marked~~. On occasion, **the labels** ~~marks~~ may become obliterated or lost during transport. As CTUs may then not be appropriately **labelled** ~~marked~~, the doors and vents should be checked. Tape applied to door gaskets or to the vents may indicate the risk of fumigant presence.

12.1.8 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 safety data sheet (SDS) should be required from the consignor, to determine appropriate measures and necessary personal protection equipment.

Relevant to Annex 1. Information flow:

1 To ensure that the cargo is transported from sender to destination safely and securely, it is essential that those involved in CTU movements fully comply with the proper flow of information.

2 This includes the responsibility of the packer to identify all packages packed into a CTU and to include them in all appropriate documentation.

3 Additionally, it will include a responsibility of the packer to determine the actual gross mass of the CTU and to declare any hazards that may be present for all or part of the journey.

4 Parties involved with transport are responsible for ensuring that documentation and information is provided in adequate time and using terms that are internationally accepted.

5 The functions of the supply chain are discussed in chapter 4 of this Code and can be summarized in the graphical representation shown in figure 1.1.

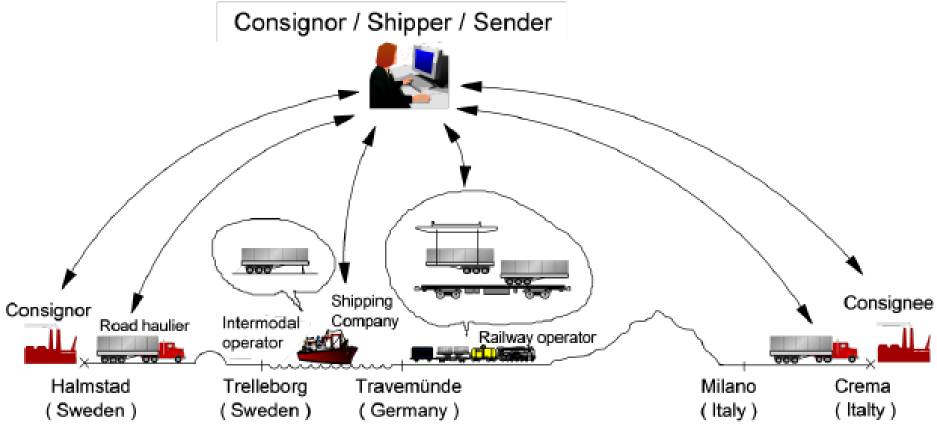


Figure 1.1 Typical flow of information

6 Within the terms of this Code the principal contracts are between the shipper and the carrier. Others parties such as the terminal or haulier, though actively involved, are responsible to one of these parties.

~~7 Figure 1.2 shows the relationship of functions at the start of the supply chain. A sender and consignor may be considered as the same function and under certain circumstances may be also referred to as the shipper. However the shipper may act as the processor of information receiving information about the cargo and the packing details from the consignor / sender and packer / consolidator respectively.~~

~~Figure 1.2 Relationship of functions~~

[figure deleted]

~~7.1 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.~~

~~7.2 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.~~

~~7.3 There is a final combination, where the shipper combines the consignor, the packer and the carrier.~~

~~8~~**7** The shipper will arrange the transport of the goods and may arrange the cargo insurance cover. In some contracts there is an agreed location, terminal or destination where the responsibility of the shipper ends. Thereafter responsibility is transferred to the consignee or another party who may undertake the function of a shipper.

~~8.1~~**7.1** Figure 1.3 shows a typical INCOTERM published by the International Chamber of Commerce. Under this contract the shipper is responsible for all aspects of transport up until the CTU is unloaded at the port of import.

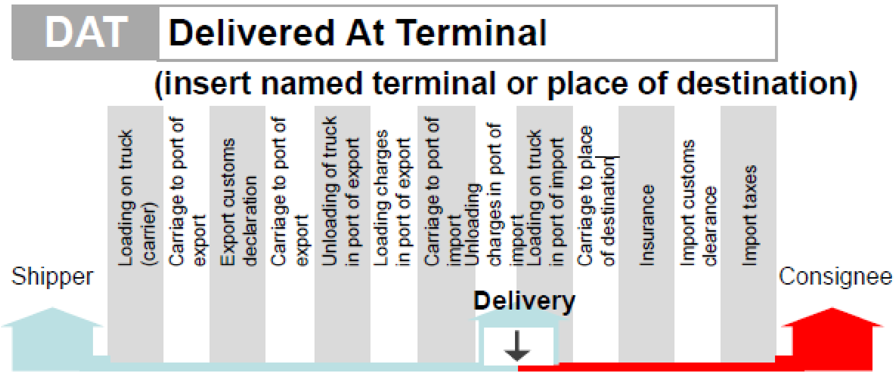


Figure ~~1.3~~1.2 Typical sales contract term

~~8.2~~**7.2** Thereafter the consignee, or their agent who will undertake the function of a shipper, will arrange onward transport of the CTU and continue the chain of information for the shipment

Relevant to Annex 5. Receiving CTUs:

1 Introduction

1.1 This annex covers a number of actions and activities and provides safety advice for persons involved in the reception and unpacking of CTUs.

1.2 When receiving a CTU, the ~~receiver or consignee~~ **unpacker** should:

1.2.1 Confirm that the unit is as specified on the transport documentation, checking the CTU identification reference as shown in figure 5.1. If the identification reference shown on the documentation is not the same as that on the CTU, it should not be accepted until clarification is received from the shipper.

Figure 5.1 Three examples of CTU identification references

1.2.2 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:

1.2.3 ~~The receiver or consignee should bring the discrepancy to the attention of the carrier and the shipper.~~ **The unpacker should bring the discrepancy to the attention of the consignee who in turn should notify the CTU operator or, where different, 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.

4 Preparing to open the doors

4.1 External checks

4.1.1 Once the seal has been removed the CTU doors may be opened, however before doing so, a few more checks should be made.

4.1.1.1 Check the exterior for **placards, marks or label** ~~signs, marks or other labels~~ that may indicate that the cargo may put those involved in unpacking the CTU at risk.

Figure 5.17 Flexitank label

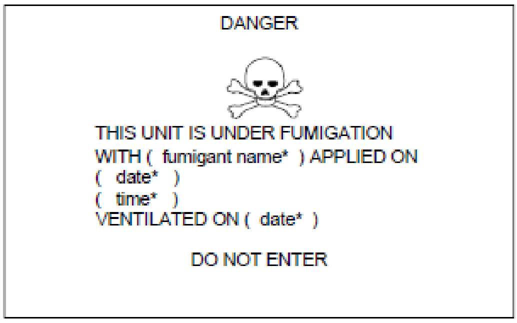


Figure 5.18 Fumigation label

Figure 5.19 Dangerous atmosphere label

4.1.1.2 The labels shown above indicate that opening the doors should follow a particular process. Only the right hand door on a CTU carrying a flexitank should be opened (see figure 5.17). CTUs that have been fumigated (see figure 5.18) or where there is a coolant or conditioner (see figure 5.19) should be opened and ventilated before entering the CTU.

4.1.2 Dangerous atmospheres

4.1.2.1 CTUs carrying dangerous goods also should be opened with care as there is a risk that the carrying packages have been damaged and the goods spilled.

4.1.2.2 Fumigants are highly toxic. Cargoes most likely to have been fumigated include foodstuffs, leather goods, handicrafts, textiles, timber or cane furniture, luxury vehicles and cargo in timber cases or on timber pallets.

4.1.2.3 CTUs transported under fumigation are required to be marked and declared in accordance with the applicable dangerous goods regulations. However, absence of marking cannot be taken to mean fumigants are not present. CTUs marked as having been ventilated after fumigation may also contain fumigant that was absorbed by the cargo and released during transit (see annex 9).

4.1.2.4 CTUs that are fumigated should be properly ~~marked~~ **labelled**. On occasion, ~~marks~~ **the labels** may become obliterated or lost during transport. As CTUs may then not be appropriately **labelled** ~~marked~~, the doors and vents should be checked. Tape applied to door gaskets or to the vents may indicate the risk of fumigant presence (see figure 5.20).

4.1.2.5 In addition to the presence of fumigants, toxic gases associated with the cargo's manufacturing process have been found in dangerous levels, for example shoes may have high levels of toluene, benzene and 1,2-dichloroethane.

4.1.2.6 In the short term, vapours irritate the eyes, the skin and respiratory tract. Inhalation of vapours can cause pulmonary oedema. The substance can have an effect on the central nervous system, the kidneys and the liver, causing functional deficiency.

4.1.3 If there are concerns that there are ~~signs~~ **labels or other indications** of a dangerous atmosphere, a safety data sheet (SDS) should be requested from the consignor or from the shipper, as appropriate and sampling the air inside the CTU before opening could be considered.

8 Returning the CTU

8.1 General

8.1.1 The internal and external cleanliness of CTUs is very important if unnecessary restrictions to their use and movement are to be avoided.

8.1.2 The ~~receiver or~~ consignee should return the CTU in the same state that it was delivered. This means that the CTU should be:

[• Completely empty and clean. A clean CTU should be free of all cargo residues, plants, plant products, visible ~~signs~~ **indications** of pests, packing, lashing and securing materials**, labels,** marks, ~~signs~~ and placards associated with packing the CTU or the cargo, and any other debris removed. This includes fumigant materials or other noxious substances (see definitions in chapter 2 of this Code). Personal protective equipment should be provided for such work;]

• Returned in a timely manner as agreed with the CTU operator. CTUs in the supply chain and associated road vehicles, if separate, are often scheduled for immediate reuse or positioning. CTU operators may charge demurrage if the CTU is not returned as soon as practically possible after unpacking.

8.2 Cleanliness

8.2.1 If additional cleaning beyond a thorough sweep of the CTU is required the **unpacker and/or** consignees should consider the following techniques:

• Washing – wash the interior of the CTU using a low pressure hose and a scrubbing brush (if required). To remove contamination a suitable additive or detergent can be used;

• Power washing – internal faces using a medium pressure washing device;

• Scraping – areas of contamination can be removed by light scrapping. Care should be taken not to damage the paint work, or flooring.

8.2.2 After a CTU with dangerous cargoes, including fumigated cargoes, 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 substance has occurred or is suspected. When the CTU offers no further hazard, ~~the dangerous goods placards, placards and any other marks or signs~~ **labels, marks or placards** regarding the cargoes should be removed. A CTU that retains ~~these exterior signs and marks~~ **any label, mark or placard related to a dangerous goods** should continue to be handled as though it still carried the **indicated** dangerous goods.

8.2.3 Contamination of the CTU can be found in many different guises:

• Damage to the interior paint work where the surface finish becomes cracked, flaky or softened by contact with a substance;

• Stains and wet patches to any part of the CTU, especially the flooring, which can be transferred to a cloth by light wiping. Small dry stains that do not transfer to the cloth are considered as non-transferrable and may not be considered as contamination;

[• Visible forms of animals, insects or other invertebrates (alive or dead, in any lifecycle stage, including egg casings or rafts), or any organic material of animal origin (including blood, bones, hair, flesh, secretions, excretions); viable or non-viable plants or plant products (including fruit, seeds, leaves, twigs, roots, bark); or other organic material, including fungi; or soil, or water; where such products are not the manifested cargo within the CTU.]

8.2.4 Dunnage, blocks, bags, braces, lashing materials, nails into the floor and tape used to cover vents and gaskets should all be removed.

8.3 Disposal

8.3.1 Local environmental regulations and legislation should be considered when disposing of waste removed from the CTU.

8.3.2 Cargo residues should be removed and disposed of in line with the **unpacker's and/or** consignee's procedures **and any applicable local or national requirements**.

8.3.3 Wherever possible or practicable, dunnage bags and other materials should be recycled*.

8.3.4 Timber dunnage, blocks and braces should be checked for the appropriate IPPC mark (see annex 7, section 1.14). Other timber should be disposed of by incineration.

8.3.5 Liner bags and flexitanks are often removed by the supplier; however all will be contaminated and should be disposed of at an appropriate facility.

* Do not reuse inflatable dunnage bags if they cannot be safely reinflated.

C. Blocking material and arrangements

C.1 Editorial changes to preamble, chapter 6, chapter 7, annex 2 and annex 4

Preamble

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 personal injury when they are handled or transported. In addition, serious and costly damage may occur to the cargo or to the equipment.

Chapter 6

6.2.11 Flatracks and platforms have a bottom structure consisting of at least two strong longitudinal H-beam girders, connected by transverse stiffeners and lined by solid wooden boards. For securing of cargo units, strong **anchor points**~~lashing brackets~~ are welded to the outer sides of the longitudinal bottom girders with an MSL of at least 30 kN according to the standard. In many cases the **anchor points**~~lashing points~~ have an MSL of 50 kN. Cargo may also be secured in longitudinal direction by **blocking against**~~shoring to~~ the end walls of flatracks. These end walls may be additionally equipped with lashing points of at least 10 kN MSL.

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

Chapter 7

7.2.5 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~~**Blocking** against the frame **of** the CTU and/or lashing to the securing points is necessary (see annex 7, ~~section~~ **clause** 4.~~3~~**4**). As the lashing capacity of the securing points in general purpose freight containers is limited, such standard containers might not be appropriate for certain large and heavy cargo items. Instead, platforms or flatracks could be used.

Annex 2

3.3.5 ~~A b~~**Bottom** sling**s are**~~is~~ used in connection with a cross beam spreader bar. The freight container ~~is~~**may be** lifted from the side apertures of the four bottom corner fittings by means of ~~slings which are connected to the corner fittings~~**lifting devices bearing on the bottom corner fittings only.** ~~by means of locking devices.~~ Hooks are not suitable for this connection. This method can be used for all freight container sizes in an empty or packed state. Packed freight containers the angle between the sling and the horizontal should not be less than 30° for 40 ft freight containers, 45° for 20 ft freight containers and 60° for 10 ft freight containers.

Annex 4

2.4 (table) Ts = Mass of the ~~securing and bracing~~ **cargo securing** materials

C.2 Changes to annex 7, sections 2 and 4

Annex 7

2.1.2 Timber planks or ~~scantlings~~**battens** may also be used for creating gaps between parcels of cargo in order to facilitate natural ventilation, particularly in ventilated container is. Moreover, the use of such dunnage is indispensable, when packing reefer containers. clause

2.3 Blocking ~~and bracing~~ material and arrangements

2.3.1 Blocking~~, bracing or shoring~~ is a securing method, where **either the cargo is stowed directly against strong structural elements of the CTU or additional materials**, e.g., timber beams and frames, empty pallets or dunnage bags **are used to** fill~~ed in the~~ gaps between the cargo and solid boundaries of the CTU or ~~into~~ gaps between different packages (see figure 7.3). 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 designed.~~ In CTUs with strong sides, **and where** ~~if~~possible, packages 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~~ **blocking** arrangement, because lateral g-forces from only one side will need to be transferred at a time.

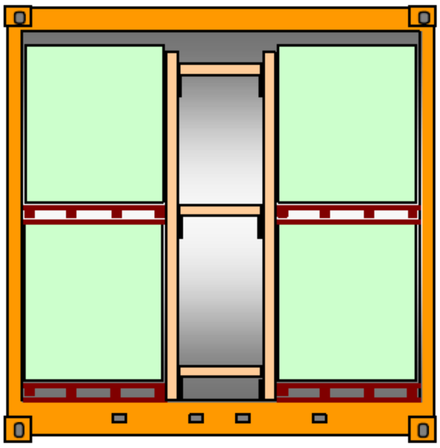


Figure 7.3 Centre gap with transverse ~~bracing~~ blocking

2.3.2~~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 **clauses** ~~sections~~ 1.13 and 1.14 of this annex).

2.3.3 **Temporary wooden structures used for blocking should be so designed that they primarily transfer the forces from the cargo to the boundaries of the CTU by means of compressions of the timber and not rely on their bending strength or the strength of the joints of the different components. Those forces** ~~Forces being transferred by bracing or shoring~~ needs to be dispersed at the points of contact by suitable ~~cross-beams,~~ **spreader beam** unless a point of contact represents a strong structural member of the cargo or the CTU. Softwood timber ~~cross-~~spreader beams should be given sufficient overlaps at the shor**eing beam** contact points. For the assessment of bedding and blocking arrangements the nominal strength of timber should be taken from the following table **7.1**:

	Compressive strength normal to the grain	**Compressive strength parallel to the grain**	**Bending strength**
Low quality	0.3 kN/cm²	2.0 kN/cm²	2.4 kN/cm²
Medium quality	0.5 kN/cm²	2.0 kN/cm²	3.0 kN/cm²

Table 7.1

2.3.4 A ~~bracing or shoring arrangement~~ **temporary wooden structure** 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~~ **supports** or benches supporting the actual ~~shores~~**blocking elements**, a proper joining of the elements by nails or clamps and the stabilising of the arrangement by diagonal braces as appropriate (see figure~~s~~ 7.4~~ and 7.5~~). **Inclined blocking arrangements bear the risk of bursting open under load and should therefore be properly designed.**

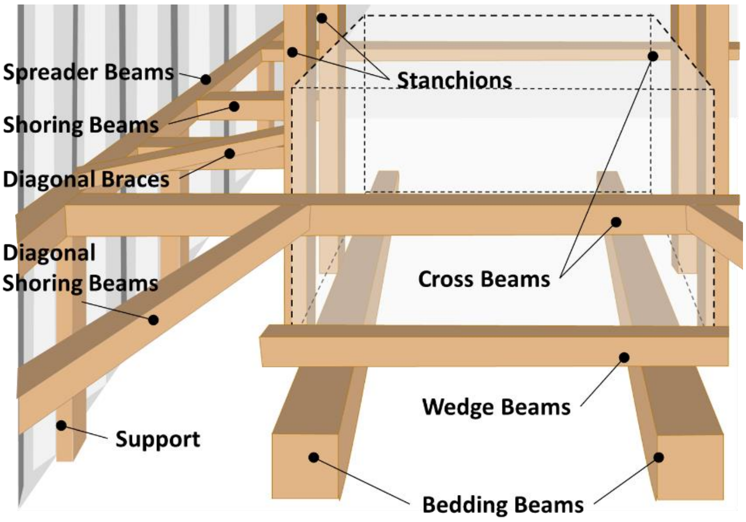


Figure 7.4 Components of a temporary wooden blocking arrangement

Guide to components:
Shoring beams are generally under compression
Spreader and bedding beams run longitudinally
Stanchions stand vertically
Cross beams and door shoring bars run transversally

~~2.3.4 Transverse battens in a CTU, intended to restrain a block of packages 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 (see figure 7.6). 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 appendix 4 to this annex.~~

~~Figure 7.6 General layout of fence battens for door protection in a CTU~~

2.3.5 Blocking ~~by nailed-on scantlings~~ **that is secured using mechanical fastenings on bedding or spreader beams** should be used for minor securing demands only. **The different types of fixing will provide a range of shear strength,** depending on the **type, configuration and** size of the nails~~ **fastener**~~ used. **For example,** ~~the shear strength of such a blocking arrangement secured using nails may be estimated to take up a blocking force between 1 and 4 kN per nail. Nailed~~**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 timber beams or wedges should only be nailed to bedding beams or timbers placed under the cargo **(see figure 7.5)**. Wooden floors of closed CTUs are generally not suitable for nailing. Nailing to the softwood flooring of flatracks or platforms and open CTUs may be acceptable with the consent of the CTU operator ~~(see figure 7.7)~~.

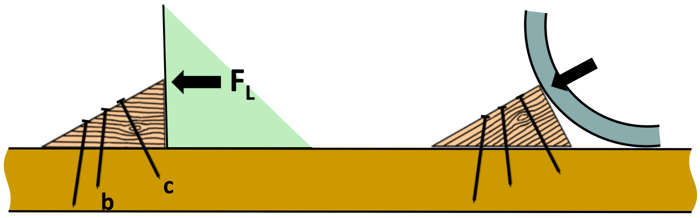


Figure 7.~~7~~**5** Properly cut and nailed wedges

2.3.6 **Joints in blocking arrangements fail when the lateral load exceeds the strength of the mechanical fastener, often resulting in the blocking beam or wedge rotating and levering the fastening out. To prevent this, the correct type of mechanical fastenings must be selected and correctly inserted. The most common fastening used in fabrication packing framework is the nail due to its ease of availability and use. Nailed joints rely on three basic elements:**

- **The size and shape of the nail**
- **The penetration of the nail**
- **The timber used for blocking**

2.3.6.1 The size of the nail is measured by its diameter and length. The most commonly used nail has a smooth shank and round in cross section. Other shapes and designs are available and may improve the effectiveness of the joint. When deciding on the size of the nail and its effectiveness the loads that the joint is subjected to and the effectiveness of the two timber elements need to be considered:

1. Nails in use are subjected either to withdrawal loads or lateral loads (as shown in figures 7.6 and 7.7), or a combination of the two. Both withdrawal load and lateral load are affected by the wood, the nail, and the condition of use.

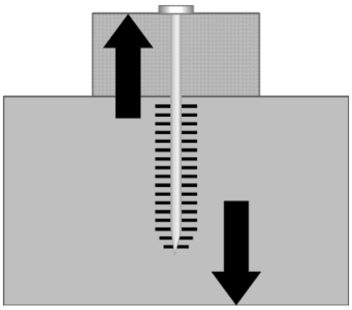


Figure 7.6 Withdrawal loads

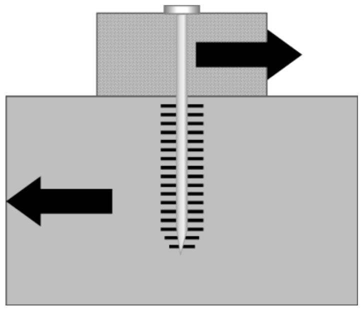
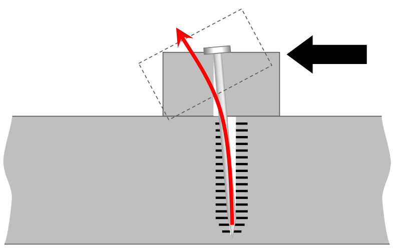


Figure 7.7 Lateral loads

2. Any lateral load on a blocking element that is affixed using nails will result in the hole formed in the timber as the nail in driven in will distort and the blocking element rotates, thus levering out the nail (see figure 7.8). As shown in Figure 7.9, the force required to extract the nail diminishes significant already at relatively small displacements, but the effect is less prominent for ringed or spiral nails.



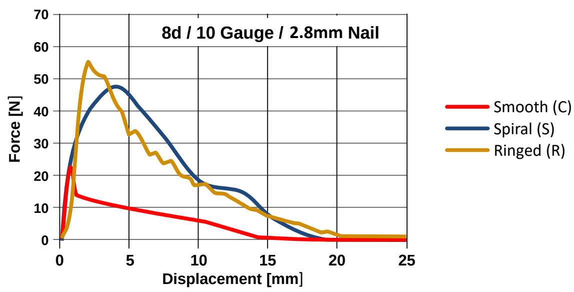


Figure 7.8 Lateral displacement and effect on nail

Figure 7.9 Extraction force vs displacement

3. Blocking arrangements that rely on nailed joints should primarily be used for taking up lateral loads on the nails and be sufficiently strong to not allow any significant displacement of the wooden components. Table 7.2 gives the approximate blocking capacity for nails of various sizes with sufficient penetration.

Nail diameter [mm]	Approximate blocking capacity per nail [daN]
3	90
4	120
5	150

Table 7.2 Approximate lateral blocking capacity of nails with various diameters and sufficient penetration

2.3.6.2 Depth of penetration

1. The lateral nail load is also related to the depth of penetration of the nail in the foundation member or member receiving the point. There are two general rules for the depth of penetration:

(a) The depth of penetration generally recommended for plain-shank nails to develop full load varies but is about 14 times the nail diameter for the softer woods[1].

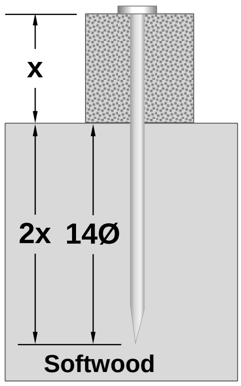


Figure 7.10 Depth of penetration

(b) The depth of penetration can also be calculated so that the shank penetrates to a depth of twice the thickness of the affixed member. Thus, the length of the nail should, if possible, be three times the thickness of the blocking element to be attached and that the nail is fully driven in.

2.3.6.3 Finally the effectiveness of the nail will depend on the timber used and it should be properly seasoned:

- **It should be clean, dry, and free from dry rot, knotholes, infestation, and splits which will affect its strength or interfere with proper nailing.**
- **Dry timber (at approximate moisture content 15 to 25 percent) is an excellent securing material. It is much lighter than wet or green timber. This is very important when weight limitations are to be considered.**
- **The use of green or wet timber should always be avoided.**
    - **Such timber quickly loses most of its strength and can contain 30 to 50 percent moisture depending upon the species.**

[1] The most common used timbers for blocking arrangements are softwoods such as Douglas Fir, Larch, Scots Pine and Spruce.

- **Green and wet timber will emit a heavy concentration of moisture which may cause water or sweat damage, moulding, or cargo staining**
- **Shrinkage of green timber in drying loosens the nails, and the movement of the container during transportation often causes nails to work out. This results in a reduction of cargo security in the container and eventual breakdown of the holding system.**

2.3.6.4 As it has been shown the use of nails to provide resistance to lateral forces within a blocking arrangement is very limited and it is therefore recommended that nails are used to secure blocking elements in place, but where they are required to provide the lateral resistance the largest diameter of nail available should be used.

~~2.3.6~~**2.3.7** ~~In the case of form locking~~**When cargo units are blocked against each other**, void spaces should be filled and may be favourably stuffed by empty pallets inserted vertically and tightened by additional timber battens as necessary. Materials 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 be filled. The sum of the void spaces in any horizontal direction should not exceed 15 cm. However, between dense and rigid cargo items, such as steel concrete or stone, void spaces should be further minimised, as far as possible.

~~2.3.7~~**2.3.8** 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 (see figure 7.~~8~~**11**). Securing of cargo to pallets by **lashing,** shrink foil **or winding-foil** wrapping is only sufficient if the **transport stability of such unit loads has been determined by a practical test which should be documented by marking the unit with its corresponding Transport Stability Level (TSL) as provided in section 4.2 of Annex 7** ~~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 7.~~8~~**11** Cargo firmly secured to pallets by textile lashings

~~2.3.8~~**2.3.9** If dunnage bags are used for filling gaps[2], the manufacturer's instructions on filling pressure and the maximum gap 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 should be taken for smoothing the surfaces appropriately (see figures 7.~~9~~**12** and 7.~~10~~**13**). 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 reusable dunnage bags (see appendix 4 to this annex).

[2] Dunnage bags (inflated by air) should not be used for dangerous goods on US railways.

Figure 7.~~9~~**12** Gap filled with central dunnage bag

Figure 7.~~9~~**13** Irregular shaped packages **without sharp edges** blocked with dunnage bags

2.3.10 Road vehicles may be prepared to accept different types of demountable blocking devices, such as stanchions or blocking cross beams. Such devices may be marked with their Blocking Capacity (BC), indicating the maximum ability to take loading distributed over the device's full height and width during sustained use. Stanchions are exerted to a bending moment which depends on the height of the load. Blocking beams are typically restricted by the strength of the fittings on each side the CTU (see figures 7.14, 7.15 and 7.16)

Figure 7.14 Floor mounted stanchions

Figure 7.15 Blocking cross beams with limited strength due to physical connection

Figure 7.16 Blocking cross beams with greater strength due to physical connection

4. Securing of cargo in CTUs

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 **(see 4.1.7)**. 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 pretension 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 should always be combined with measures of direct securing or friction securing.

4.1.4 Lashings used for direct securing will inevitably elongate under external forces, thus permitting the package a degree of movement. To minimize this movement, (horizontal or lateral sliding, tipping or racking) it should be ensured that the:

- Lashing material has appropriate load-deformation characteristics (see **clause** ~~section~~ 2.4 of this annex)
- Length of the lashing is kept as short as practicable; and
- Direction of the lashing is as close as possible to the direction of the intended restraining effect.

A good pre-tension in lashing 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~~ **shoring beams** or stanchions) or by locking devices (locking cones or twist-locks) will not allow significant cargo motion and should therefore be preferred method of direct securing.

4.1.7 Any cargo securing measures should be applied in a manner that does not affect, deform or impair the package or the CTU. Permanent securing equipment incorporated into a CTU should be used whenever possible or necessary. **Where this is not possible the following should apply:**

4.1.7.1 Blocking should be braced against structurally significant components of the CTU, which may be corner posts and bottom rails.

4.1.7.2 Additional shoring may be made against the boundary side and front walls so long as the forces are distributed by spreader beams as shown in Figure 7.40.

[figure deleted]

~~**Figure 7.40 Boundary blocking arrangement**~~

Figure 7.40 Boundary blocking arrangement

4.1.7.3 The CTU doors may be tested to withstand a force equivalent to a percentage of the CTU's payload, however, for cargoes that are liable to collapse, such as ~~bulk~~

~~materials (solids and liquids),~~ small hand-packed packaged and pallets with low integral stability, the doors should not be used as the only mean to constrain the cargo as there is a risk of the cargo falling onto those who open the CTU for inspection or unpacking. ~~In such cases the cargo should in addition be restrained~~ A possible falling out of cargo can be prevented by spring lashing (see Figure 7.~~58~~59), a modular lashing system (see Figure 7.26), a tarpaulin (see Figure 7.27) or nets or net-curtains (see Figure 7.28).~~using shoring bars / rear false bulkhead (see clause 5.3.3.4)~~.

4.1.7.4 Cargo should never be secured by blocking or lashing against the CTU roof except for designs that permit this method of securing.

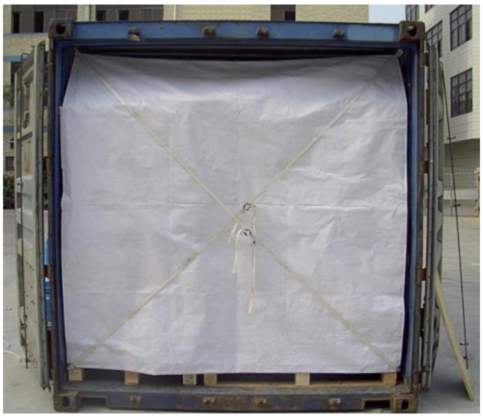


Figure 7.27 Tarpaulin used solely to prevent small and light packages from falling out when stowed close to the door.

[figure to be added]

Figure 7.28 - Net-curtain used to prevent small and light packages from falling out when stowed close to the door.

4.~~2~~**3** Tightly arranged cargoes

4.~~2~~**3**.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 utilize the cargo space, to prevent cargo items from tumbling around and to enable measures of common securing against transverse and longitudinal movement during transport.

4.~~2~~**3**.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 **clause** ~~section~~ 3.~~2~~**4** of this annex. 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 **clause** ~~subsections~~ 2.3.~~6~~**7** to 2.3.~~8~~**10** of this annex). Direct contact of cargo items with CTU boundaries may require an interlayer of protecting material (see **clause** ~~section~~ 2.1 of this annex).

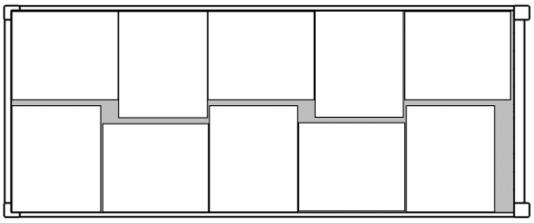


Figure 7.~~29~~**42** Packing 1,000 x 1,200 mm unit loads into a 20-foot container

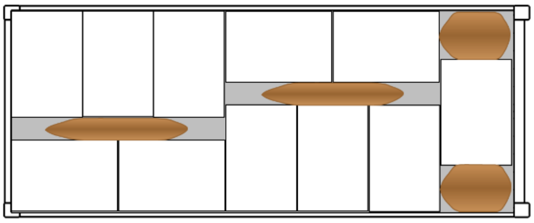


Figure 7.~~30~~**43** Packing 800 x 1,200 mm unit loads into a 20-foot container

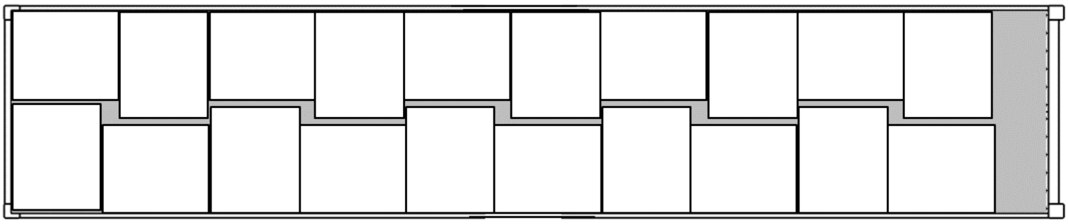


Figure 7.~~31~~**44** Packing 1,000 x 1,200 mm unit loads into a 40-foot container

Note: The void areas (grey shaded) shown in figures 7.~~29~~**42** to 7.~~31~~**44** should be filled when necessary (see **clause**~~subsection~~ 2.3.~~6~~**7** of this annex).

4.~~2~~**3**.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:

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

$c_{x,y}$ = horizontal acceleration coefficient in the relevant mode of transport (see chapter 5 of this Code)

m = mass of cargo packed [t**onnes**]

g = gravity acceleration 9.81 m/s^2

$r_{x,y}$ = CTU wall resistance coefficient (see chapter 6 of this Code)

P = maximum payload of CTU (t**onnes**)

μ = applicable friction factor between cargo and stowage ground (see appendix 2 to this annex)

c_z = vertical acceleration coefficient in the relevant mode of transport (see chapter 5 of this Code)

4.~~2~~**3**.4 Critical situations may arise, e.g., with a fully packed freight container in road transport, where longitudinal securing should be able to withstand an acceleration of 0.8 g. The longitudinal wall resistance factor of 0.4 should be combined with a friction factor of at least 0.4 for satisfying the securing balance. If a balance cannot be satisfied, the mass of cargo should be reduced, or the longitudinal forces transferred to the main structure of the container. The latter can be achieved by intermediate transverse ~~fences of~~**false bulkheads of** ~~timber battens~~**cross beams** (see **clause**~~subsection~~ ~~2.3.4~~**X** of this annex) or by other suitable means~~,~~ ~~(see figure 7.32)~~. ~~Another option is the use of friction increasing material.~~ **When bracing against the rear corner frames, vertical timber battens (VB) should be inserted into the shoring slots between the slot bars and the bracing battens (BB) fitted against this. Where required nails or other fixings can be used to stabilise the bracing battens.**

4.~~2~~**3**.5 When the door end of a CTU is designed to provide a defined wall resistance (e.g. the doors of a general purpose freight container (see chapter 6 of this Code), the doors may be considered as a strong cargo space boundary, provided the cargo is stowed to avoid impact loads to the door end and to prevent the cargo from falling out when the doors are opened.

4.~~2~~**3**.6 Where there is the need to stack packages in an incomplete second layer at the centre of the CTU, additional longitudinal blocking can be adopted (see figures 7.~~33~~**45** to 7.~~36~~**48**).

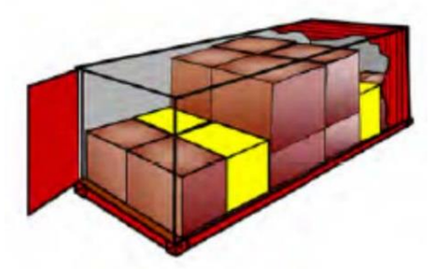


Figure 7.~~33~~**45** Threshold by height

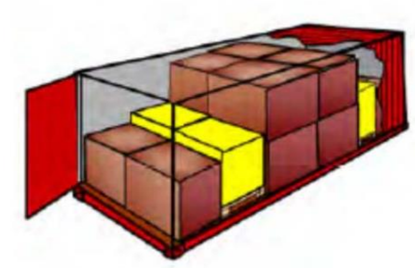


Figure 7.~~34~~**46** Threshold by elevation

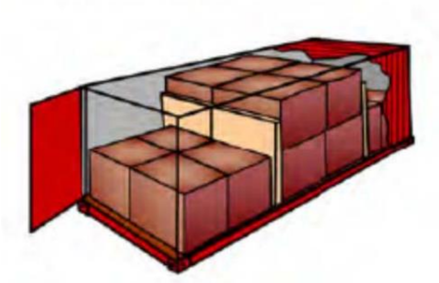


Figure 7.~~35~~**47** Threshold by board

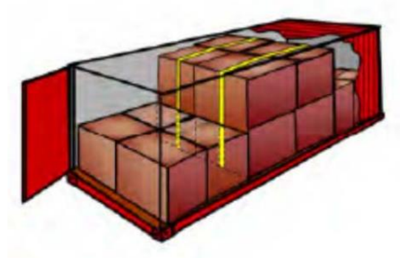


Figure 7.~~36~~**48** Round turn lashing

4.3.7 Transverse cross beams in a CTU, intended to restrain a block of packages in front of the door (see figure 7.49) 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. Such members 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 section 1 of appendix 4 to this annex. Wherever possible such battens should be braced against the solid frame structure, such as bottom or top rails or corner posts. While it is recognised that this type of blocking is not possible on all types of CTUs, any that has a shoring slot built into the rear frame can accommodate this blocking technique. Alternative blocking can be achieved by forcing the battens into the solid corrugations of the side walls of the CTU (see figure 7.50). However, since these methods have limited strength, they should be used in combination with friction increasing material and/or limited cargo weight. The blocking capacity, BC, of a 75 x 100 mm beam inserted into the corrugation of a container is 500 daN if it is placed at half the height of the container and 750 daN if it is placed at the floor.

Figure 7.49 Shoring bars inserted in the shoring slots and supported by uprights placed against the doors

Figure 7.50 Cross beams inserted in the corrugations supported by shoring beams against the doors at the hinges

4.3.8 When a temporary wooden structure is used to block the cargo against the end walls of platform and flatrack type CTUs, this should be supported against the corner posts and the shoring beams should be placed as far out towards the sides as the cargo permits (see figure 7.51). Stanchions, produced from wooden beams with a cross section of 75x75 mm, may often be inserted into pockets along the sides of the platforms to prevent the cargo from sliding sideways (see figure 7.52).

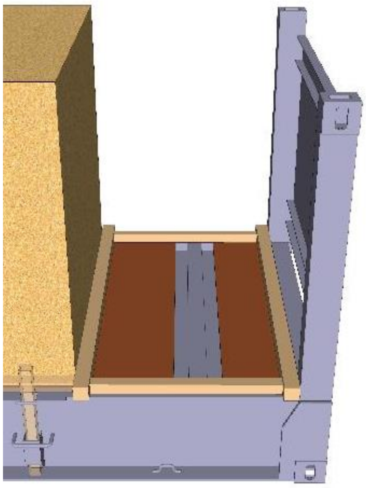


Figure 7.51 Wooden structure for blocking against the end wall of flat rack

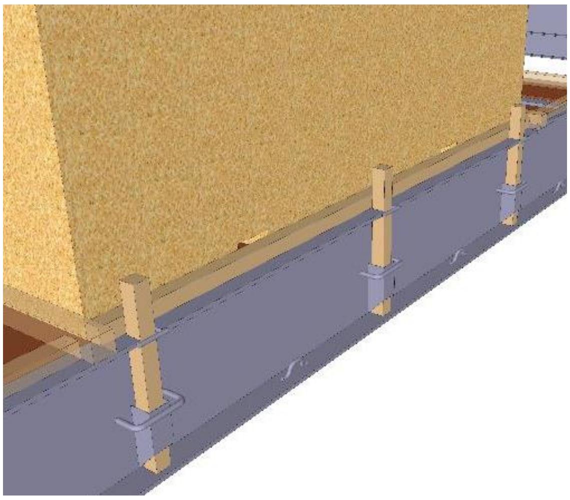


Figure 7.52 Stanchions preventing sideways sliding on platform CTUs [image to be replaced with a better one]

4.~~2~~**3**.~~7~~**9** 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 factor 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:

$$c_{xy} \cdot m \cdot g \leq r_{xp} \cdot P \cdot g + \mu \cdot c_z \cdot m \cdot g + F_{sec}\ kN$$

Where:

F_{sec} = additional securing force

If a wall resistant coefficient is not specified in the distinguished CTU, it should be set to zero. The additional securing (F_{sec}) 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. Alternatively, the addition securing force may be obtained by direct securing methods or top-over lashings. F_{sec} per top-over lashing is: $F_v \cdot \mu$, where F_v ~~the~~ is the total vertical force from the pretension. The vertical lashings F_v is 1.8 times the pretension of the lashing. The direct lashing arrangements μ should be set to 75% of the friction factor.

4.~~2~~**3**.~~8~~**10** On CTUs without boundaries the entire securing effect should 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:

$c_{xy} \cdot m \cdot g \leq \mu \cdot c_z \cdot m \cdot g + F_{sec}\ kN$

Where:

F_{sec} = additonal securing force

For Fsec, see **clause**~~subsection~~ 4.2.~~7~~**9**. It should be noted that even in case of a friction factor 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.

4.~~3~~**4** Individually secured packages and large unpackaged articles

4.~~3~~**4**.1 Packages and articles of greater size, mass or shape or units with sensitive exterior facing, which does not allow direct contact to other units or CTU boundaries, should be individually secured. The securing arrangement should 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 (see also figure 7.~~37~~**53**):

$$c_{x,y} \cdot d \geq c_z \cdot b$$

$c_{x,y}$ = horizontal acceleration coefficient in the relevant modes of transport (see chapter 5 of this Code)

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 5 of this Code)

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

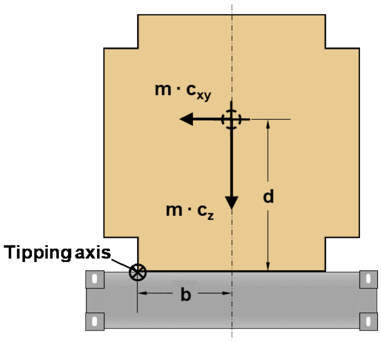


Figure 7.~~37~~**53** Tipping criterion

4.~~3~~**4**.2 Individually secured packages and articles should preferably be secured by a direct securing method, i.e. by direct transfer of securing forces from the package to the CTU by means of lashings **and/**~~, shores~~or blocking.

4.~~3~~**4**.2.1A direct lashing will be between fixed fastening points on the package/article 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.

4.~~3~~**4**.2.2For sliding prevention by lashings the vertical lashing angle should preferably be in the range of 30° to 60° (see figure 7.~~38~~**54**). For tipping prevention the lashings should be positioned in a way that provides effective levers related to the applicable tipping axis (see figure 7.~~39~~**55**).

4.~~3~~**4**.3 Packages and articles without securing points should be either secured by ~~shoring or~~ blocking against solid structures of the CTU or by top-over, half-loop or spring lashings (see figures 7.~~40~~**56** to 7.~~43~~**59**)

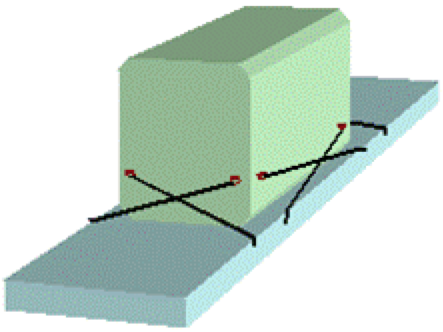


Figure 7.~~38~~**54** Direct lashing against sliding

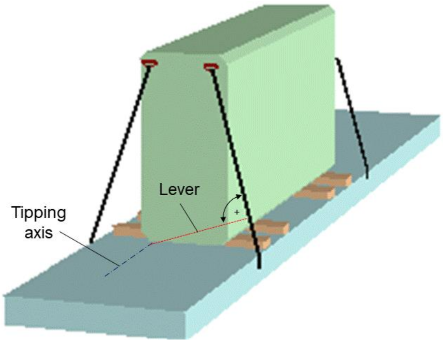


Figure 7.~~39~~**55** Direct lashing against tipping

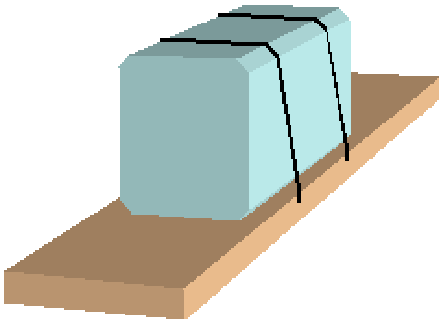


Figure 7.~~40~~**56** Top over lashing

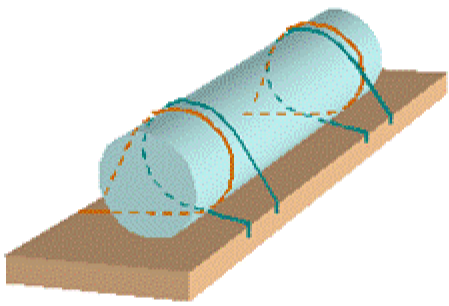


Figure 7.~~41~~**57** Vertical half-loop lashing

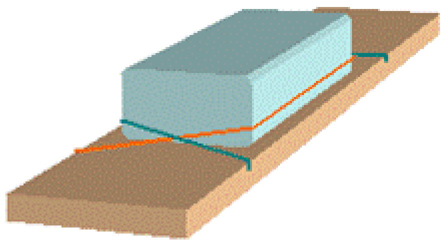


Figure 7.~~42~~**58** Horizontal half-loop lashing

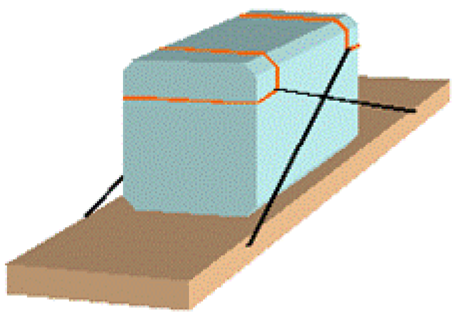


Figure 7.~~43~~**59** Spring lashing

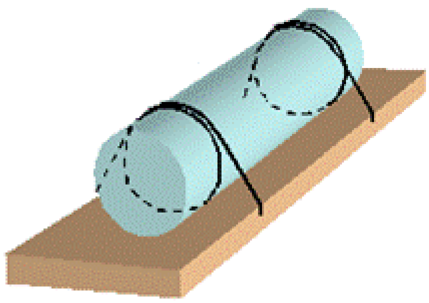


Figure 7.~~44~~**60** Silly-loop lashing

4.~~3~~**4**.3.1Loop lashings with their ends fastened to either side (see figure 7.~~44~~**60**), also called "silly-loops", do not provide any direct securing effect and may permit the package/article to roll and therefore are not recommended.

4.~~3~~**4**.3.2Lashing corner fittings are available to provide alternative lashing to the spring lashing (see figure 7.~~43~~**59**).

4.~~3~~**4**.3.3Any 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 **clause**~~subsection~~ 4.1.4 of this annex should be followed.

4.~~3~~**4**.4 CTUs with strong cargo space boundaries favour the method of blocking ~~or shoring~~ for securing a particular package or article. 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 ~~a load~~ spreader~~ing~~ ~~cross~~ beams (see **clauses**~~subsections~~ 2.3.1 to 2.3.3 of this annex). Very heavy packages or articles, 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 **clause**~~subsection~~ 4.1.6 of this annex (see figure 7.~~45~~**61**). Articles with sensitive surfaces may rule out the blocking method and be should be secured by lashings only.

Figure 7.~~45~~**61** Transverse blocking of steel slab

4.~~3~~**4**.5 Individual securing of packages or articles 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 set out in **clause**~~subsection~~ 4.1.6 of this annex should be observed. Although the provision of good friction in the bedding of a package or article is recommended in any case, the use of top-over lashings for sliding prevention is discouraged unless the cargo has limited mass. Top-over lashings may be suitable for tipping prevention. In particular over width packages or articles, often shipped of flatbed CTUs, should not be secured solely by top-over lashings (see figure 7.~~46~~**62**). The use of half loops and/or spring lashings is strongly recommended (see figures 7.~~47~~**63** and 7.~~48~~**64**).

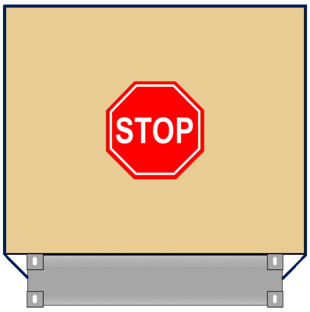


Figure 7.~~46~~**62** Top-over lashing

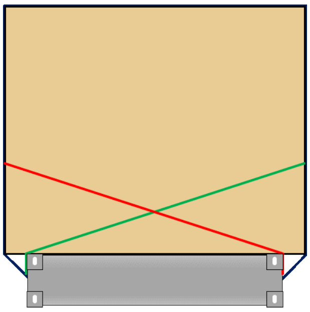


Figure 7.~~47~~**63** Top-over and horizontal half-loop

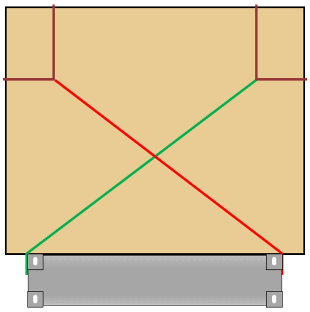


Figure 7.~~48~~**64** Transverse spring lashing

4.~~3~~**4**.6 Where horizontal half loops are used, a means should be provided to prevent the loops from sliding down the package/article.

4.~~3~~**4**.7 Alternatively an over-width package or article can be secured by half-loops over the corners as shown in figure 7.~~49~~**65**

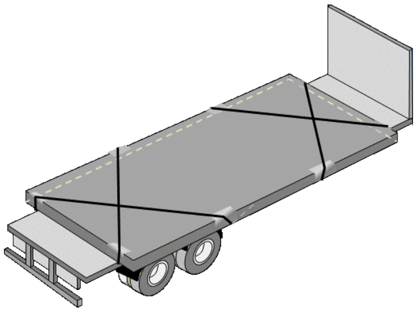


Figure 7.~~49~~**65** Over-width package secured by half-loops

4.~~4~~**5** Evaluation of securing arrangements

(Renumbering of clauses)

4.~~4~~**5**.2 The assessment of the securing potential includes the assumption of a friction factor, based on a combination of materials (see appendix 2 to this annex) and the character of the securing arrangement (~~subsection~~**clause** 2.2.2 of this annex), and, if applicable, the determination of the inherent tilting stability of the cargo (~~subsection~~**clause** 4.~~3~~**4**.1 of this annex). 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. These figures are required for evaluating the securing arrangement.

(Renumbering of clauses)

C.3 Changes to Appendix 4, section 4

4 Cargo securing with dunnage bags

4.1 Introduction

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

4.1.2 The size and strength of the dunnage bag are to be adjusted to the cargo weight so that the permissible ~~lashing~~ **Blocking C**apacity **(BC)** of the dunnage bag, without risk of breaking it, is larger than the force the cargo needs to be supported with:

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

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

4.2.1 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:	Tipping:
$F_{CARGO} = m \cdot g \cdot (c_{x,y} - \mu \cdot 0.75 \cdot c_z)$ [kN]	$F_{CARGO} = m \cdot g \cdot (c_{x,y} - b_p/h_p \cdot c_z)$ [kN]

where:
F_{CARGO} = force on the dunnage bag caused by the cargo ~~[t]~~ **[kN]**
m = mass of cargo [t**onnes**]
$c_{x,y}$ = Horizontal acceleration, expressed in *g*, that acts on the cargo ~~sideways~~ **in longitudinal or transverse**~~or in forward or backward~~ directions
c_z = Vertical acceleration that acts on the cargo, expressed in *g*
μ = Friction factor for the contact **surface** ~~area~~ between the cargo and the ~~surface~~ **cargo deck** or between different packages
b_p = Package width for tipping sideways, or alternatively the length of the cargo for tipping forward or backward
h_p = package height [m]

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

4.2.3 Only the cargo mass that actually ~~impacts~~**acts on** the dunnage bag that should be used in the above formulas. If the dunnage bag is used to prevent movement forwards, when breaking for example, the mass of the cargo behind the dunnage bag should be used in the formulas.

4.2.4 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 should be used, that is, either the mass m_1 or m_2 (see figure 7.~~59~~**94**).

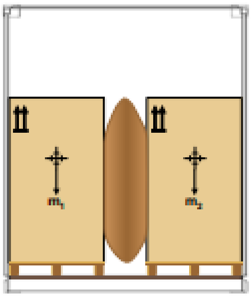


Figure 7.~~59~~**94** Equal height packages

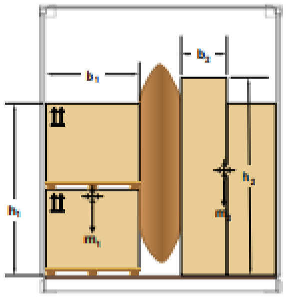


Figure 7.~~60~~**95** Unequal height packages

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

4.2.6 If the package 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 has the smallest value of b_p / h_p is chosen.

4.2.7 However, in both cases the total mass of the cargo that is on the same side of the dunnage bag should be used, that is, either the mass m_1 or m_2 in figure 7.~~60~~**95**.

4.3 ~~Permissible load on~~**Blocking Capacity of** the dunnage bag (**BC**~~F_{DB}~~)

4.3.1 The force that the dunnage bag is able to ~~take up~~ withstand**, i.e. its Blocking Capacity**, 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:

$$\mathbf{BC}\cancel{F_{DB}} = A \cdot 10 \cdot g \cdot P_B \cdot SF \text{ [kN]}$$

where:

BC~~F_{DB}~~ = force that the dunnage bag is able to take up without exceeding the maximum allowable pressure**, i.e its Blocking Capacity** (kN)

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 reusable dunnage bags

4.4 Contact area (A)

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

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

where:

b_{DB} = width of dunnage bag [m]

h_{DB} = height of dunnage bag [m]

A = contact area between the dunnage bag and the cargo [m2]

d = gap between packages [m]

$\pi = 3.14$

4.4.2. In order to provide a sufficient contact area, neither the width nor the height of the dunnage bag should be less than 2.5 times the size of the filled gap.

4.4.3 When a dunnage bag is used to secure a load, its working height must not exceed the height of the cargo or the boundary wall of an open vehicle. The maximum permissible height of a dunnage bag can be determined depending on the height of the cargo by using the following formula:

$$\mathbf{h_{DB} = h + (\pi - 1) \cdot d / 2}$$

where:

h_{DB} = height of dunnage bag [m]
h = height of cargo [m]
d = gap between packages [m]
$\pi = 3.14$

4.5 Pressure in the dunnage bag

4.5.1 **To be fully effective the dunnage bag must be inflated to its operating pressure, taking into account the climatic conditions along the route of the CTU and in accordance with the manufacturer's recommendations.** ~~Upon application~~ ~~**of**~~**This may require that** the dunnage bag ~~it~~ is filled to a slight overpressure **so that if the ambient pressure rises or the air temperature falls there is no risk that the dunnage bag may become loose**. ~~If this pressure is too low there is a risk that the dunnage bag may come loose if the ambient pressure is rising or if the air temperature drops.~~ Conversely, if the filling pressure is too high there is a risk of the dunnage bag bursting or damaging the cargo if the ambient pressure decreases, or if the air temperature rises.

4.5.2 The bursting pressure (PB) of a dunnage bag depends on the quality and size of the bag and the gap that it is filling. The pressure exerted on a dunnage **bag** by the cargo forces should never be allowed to approach bursting pressure of the bag because of the risk of failure. A safety factor should, therefore, be incorporated and, if necessary, a dunnage bag with a higher bursting pressure selected.

4.5.3 Whenever d~~D~~unnage bags mark with Level 1 to 5 according to the Association of American Railroads criteria, these have the following minimum bursting pressure:

Level 1 - 0.55 bar

Level 2 - 1.2 bar

Level 3 - 1.7 bar

Level 4 - 2.1 bar

Level 5 - 1.5 bar

Level 1 to 4 dunnage bags are tested at a gap of 30 cm while Level 5 dunnage bags are tested at a gap of 46 cm.

4.6 Recommended marking for dunnage bags

Blocking capacity in tonnes of various size dunnage bags ~~marked Level 3 and~~ having a bursting pressure of 1.7 bar at a gap of 30 cm.

Fillable gap size	Bursting pressure	Dunnage bag dimension (cm)				
		60 x 100	100 x 120	100 x 150	120 x 200	120 x 250
10 cm	2.3 bar	4.2	10	13	22	28

20 cm	**2.0 bar**	**1.9**	**6.0**	**8.1**	**15**	**19**
30 cm	**1.7 bar**	**n/a**	**3.3**	**4.6**	**9.5**	**13**
45 cm	**1.3 bar**	**n/a**	**n/a**	**n/a**	**4.1**	**5.6**

Table 7.14 Blocking capacity example

D. Bedding arrangements

D.1 Changes to annex 7, section 3

3. Principles of packing

3.1 ~~Load distribution~~**Bedding arrangements in freight containers**

3.1.1 Freight containers~~, flatracks and platforms~~ are designed according to ISO standards, amongst 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 should be considered. It may be necessary to transfer the weight to the corner posts by supporting the cargo on strong timber or steel beams as appropriate (see figure 7.2~~1~~**6**).

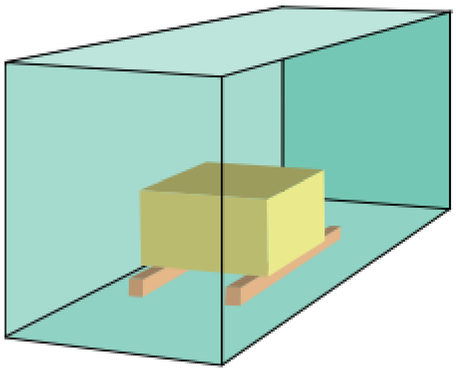


Figure 7.2~~1~~**6** Load transfer beams

3.1.2 ~~The bending strength of the beams should 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 should be designed in consultation with the CTU operator.~~**The necessary length (L_R) of these beams depends on the cargo weight mass and their mutual distance (B). It is important to make the distance B of the longitudinal beams as large as possible in order to minimise the stress onto the cross-members of the container floor. The beams must have sufficient strength for effectively spreading the load. Their necessary dimensions should be determined by the cargo mass and the intended spreading effect, expressed by their “free length”. This simple arrangement complies with the principles of structural engineering. There is no benefit of flooring the area under the cargo item with beams of lesser strength.**

3.1.2.1 Step 1 - Minimum length

1. **The bedding beams must be long enough to cover the distance of the container's floor so that load from the cargo will not overstress the floor.**

2. **The minimum length depends on the following factors (see figure 7.27):**
   - **The cargo mass (in tonnes)**
   - **The spacing of the beams, B (in meters)**

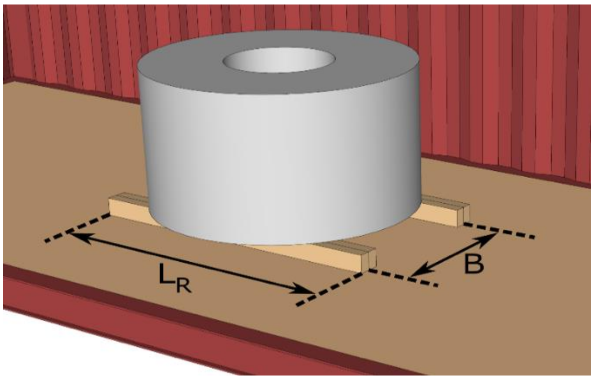


Figure 7.27 Minimum length

3. **The table 7.5 below gives the minimum required length, L_R, of longitudinal bedding beams based on these two factors.**

Minimum required length of longitudinal bedding beams, L_R, [m]							
Spacing between beams, B [m]	**Cargo mass [tonne]**						
	4	**8**	**12**	**16**	**20**	**24**	**28**
0.50	1.2	2.4	3.6	4.8	6.0	-	-
0.75	1.0	2.1	3.1	4.1	5.1	6.2	-
1.00	0.9	1.7	2.6	3.4	4.3	5.2	6.0
1.25	0.7	1.4	2.1	2.8	3.5	4.2	4.9
1.50	-	1.1	1.6	2.1	2.6	3.2	3.7
1.75	-	0.7	1.1	1.5	1.8	2.2	3.0
2.00	-	-	0.6	0.8	1.3	2.1	3.0

Table 7.5

3.1.2.2 Step 2 - Minimum dimensions

1. **The proper size of the bedding beams depends on the bending resistance (section modulus) that is required of the beams for them to successfully transfer the load from the cargo over the required floor length. The required section modulus depends on the following factors (see figure 7.28):**
   - **The cargo mass (in tonnes)**
   - **The minimum length of the beams, L_R (in meters), as given by table below**
   - **The length of the footprint of the cargo on the beams, L_C (in meters)**
   - **The strength of the material of the bending beams**

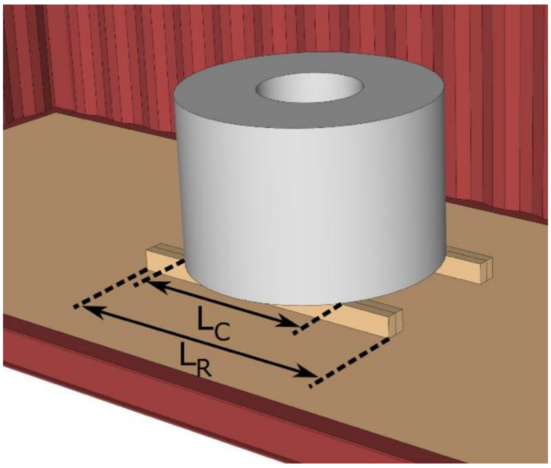


Figure 7.28 Minimum dimensions

2. **When wooden beams are used, the section modulus is calculated by the cross section. It is recommended that square sections are used to ensure the beams stability with a height and width of "a" measured in mm (see figure 7.29).**

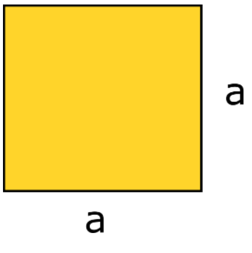


Figure 7.29 Definition of height and width, "a" for wooden beams with a square cross section

3. **The table 7.6 below shows the minimum value of "a" based on the cargo mass and the free length of the beams.**

4. **Free length is defined as:**

$$\frac{L_R - L_C}{2}$$

Minimum height and width, "a" ~~a × a~~, of a pair of square wooden beams with σ_p = 1.5 kN/cm^2 [mm]							
Free length ($L_R - L_C$) / 2 [m]	**Cargo mass [tonnes]**						
	4	**8**	**12**	**16**	**20**	**24**	**28**
0.25	79	99	114	125	135	143	151
0.50	99	125	143	158	170	181	190
0.75	114	143	164	181	194	207	218
1.00	125	158	181	199	214	227	239
1.25	135	170	194	214	231	245	258
1.50	143	181	207	227	245	260	274
1.75	151	190	218	239	258	274	289
2.00	158	199	227	250	270	287	302

Table 7.6

5. **When steel beams are used, the section modulus depends on which type of profile is used. The table 7.7 below gives the minimum size (in mm) to use for standard HEB profiles based on the cargo mass and the free length of the beams (see figure 7.30).**

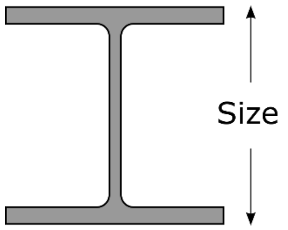


Figure 7.30 Definition of size for HEB steel profiles

Minimum size of a pair of HEB steel beams with σ_p = 15 kN/cm^2 [mm]							
Free length (L_R - L_C) / 2 [m]	**Cargo mass [tonnes]**						
	4	**8**	**12**	**16**	**20**	**24**	**28**
0.25	100	100	100	100	100	100	100
0.50	100	100	100	100	100	120	120
0.75	100	100	100	120	120	140	140
1.00	100	100	120	120	140	140	160
1.25	100	100	120	140	140	160	160
1.50	100	120	140	140	160	160	180
1.75	100	120	140	160	160	180	180
2.00	100	120	140	160	180	180	200

Table 7.7

6. **If multiple pairs of beams or beams with a different cross section are used, they shall have the same combined section modulus as the beams represented in the tables above. Furthermore, the required section modulus is proportional to the bending strengths, σ_p, given in each of the tables above.**

3.2 Bedding arrangements on flatracks and platform containers and in road vehicles

3.2.1 CTUs with longitudinal structural beams do not require the bedding arrangements described in 3.1 but still do require beams to be placed under heavy cargo items to ensure that there are no areas where forces are concentrated and to ensure that the forces are transmitted to the longitudinal structural beams.

3.2.2 The bedding arrangement for these types of CTU should be placed transversally so that they land on the longitudinal structural beams.

3.2.3 The bedding arrangement should also support the cargo item so that no part of the cargo items is landed on the cargo deck. This is particularly true when transporting coiled materials and the bedding arrangement can incorporate wedge beams to prevent the coil (eye to the side) from rolling.

3.2.4~~3.1.3~~ **If bedding beams cannot be used for concentrated loads on flatracks or platform containers and road trailers, the load may have to be reduced against the maximum payload.** ~~Concentrated loads on platforms or flatracks should be similarly expanded by bedding on longitudinal beams or the load should be reduced against the maximum payload.~~ The permissible load should be designed in consultation with the CTU operator.

(*Subsequent clauses need to be renumbered)*

D.2 Changes to annex 7, appendix 4, section 2

2. Bedding a concentrated load in a general purpose freight container ~~or on a flatrack~~

2.1 Introduction

2.1.1 Bedding arrangements for concentrated loads in general purpose freight containers ~~and on flatracks~~ should be designed in consultation with the CTU operator.

2.1.2 The minimum length and bending resistance (section modulus) of bedding beams should be taken from the tables in Section 3.1 of this annex or by the formulas presented below.

2.2 Minimum length

2.2.1 The minimum length of bedding beams, L_R, can be calculated by following formula:

$$\boldsymbol{L_R = 0.165 \cdot m \cdot (2.3 - B)}$$

Where:
L_R = Minimum length of bedding beams (m)
m = mass of cargo (t)
B = Spacing of bedding beams (m)

2.2.2 In addition, where the cargo mass is greater than 50% of the Payload, the length of bedding beams, L_R, should also not be less than:

$$\boldsymbol{L_R = \left(\frac{m}{P} - 0.5\right) \cdot L_{CTU}}$$

Where:
L_R = Minimum length of bedding beams (m)
m = mass of cargo (t)
P = Payload of CTU (t)
L_{CTU} = Length of CTU (m)

2.3 Minimum section modulus

2.3.1 The minimum section modulus, W, for bedding beams can be calculated by the following formula:

$$\boldsymbol{W = \frac{125 \cdot m \cdot g \cdot (L_R - L_C)}{n \cdot \sigma_p}}$$

Where:

W	***= Minimum section modulus of bedding beams (cm^3)***
m	***= mass of cargo (t)***
L_R	***= Minimum length of bedding beams as given in section 2.2 (m)***
L_C	***= Length of cargo footprint on bedding beams (m)***
n	***= number of bedding beams***
σ_p	***= Permissible bending stress of material in beams (N/mm^2)***

E. Load positioning – changes to annex 7, section 3.

3.3 Load distribution

3.3.1 In order to enable safe handling and transport of CTUs, all relevant limitations that restricts the allowable eccentricity of the centre of gravity for combined mass of the cargo, securing equipment and bedding arrangement must be considered. The allowable mass of cargo and securing materials based on the position of the centre of gravity may be visualized through a Load Distribution Diagram, in which a limiting curve is plotted based on all applicable restrictions (see figures 7.31 and 7.33 below). ~~(3.1.4)~~The precise longitudinal position of the centre of gravity of the cargo may be determined by calculation (see appendix 4 to this annex).

3.3.2~~3.1.4~~ Where freight containers, including flatracks or platforms, will be lifted and handled in a level state during transport, the cargo should be so arranged and secured in the freight container that its joint centre of gravity is close to the mid-length and mid-width of the freight container. The eccentricity of the centre of gravity of the ~~cargo~~ **container's gross** ~~weight~~ **mass** should not exceed ±5% in general. As a rule of thumb this can be taken as 60% of the cargo's total mass in 50% of the freight container's length. ~~Under particular circumstances an eccentricity of up to ±10% could be accepted, as advanced spreaders for handling freight containers are capable of adjusting for such eccentricity. The precise longitudinal position of the centre of gravity of the cargo may be determined by calculation (see appendix 4 to this annex).~~

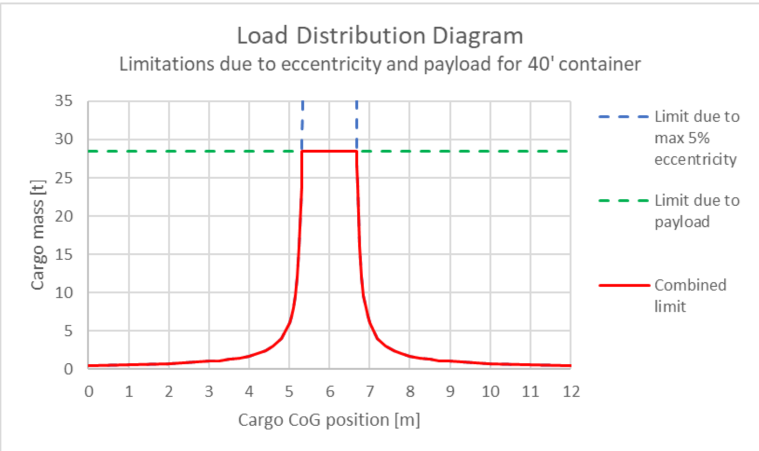


Figure 7.31 An example of a load distribution diagram for the safe loading and handling of a 40-foot container, based on the following parameters:

- **Tare mass of container: 4000 kg**
- **Max payload: 28 500 kg**
- **Maximum eccentricity: ±5% of the container's length**

3.3.3~~3.1.5~~ Roll trailers have structural properties similar to platforms, but are less sensitive to 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 also not as critical **but may further be restricted by the allowable deck and ramp capacities of the vessel**.

3.3.4~~3.1.6~~ Swap bodies have structural properties similar to freight containers, but in most cases ~~less tare weight~~**have a smaller tare mass** and less overall strength. They are normally not stackable. The loading instructions given under subsection 3.1.2 and ~~3.1.5~~**3.3.3** should be applied to swap bodies as appropriate.

3.3.5~~3.1.7~~ Road trucks and road trailers are in particular sensitive regarding the position of the centre of gravity of the cargo packed in them, due to **the manufacturer's** specified axle loads for maintaining steering and braking ability **as well as the infrastructure's restrictions for vehicle gross mass as well as axle and bogie loads. In case of semi-trailers, the maximum king pin load, resulting from the towing trucks restrictions, must also be considered.** ~~Such~~ **Individual** vehicles may be equipped with specific load distribution diagrams~~, which show the permissible cargo mass as a function of the longitudinal position of its centre of gravity~~. Generally, the maximum ~~cargo mass~~**payload** may be ~~used~~ **utilized** only when the centre of gravity (CoG) is positioned within narrow boundaries about half the length of the loading space (see figure~~s 7.22 and~~ 7.**3**2~~3~~).

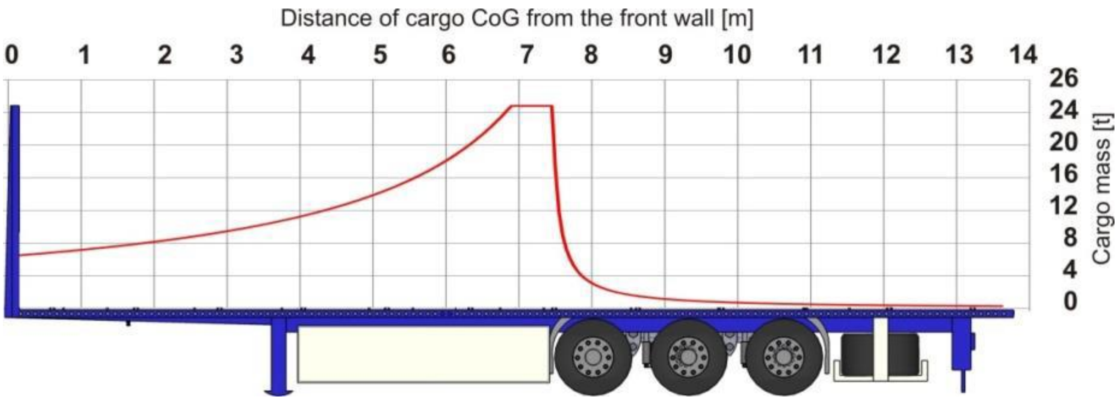


Figure 7.**3**2~~37~~ An example of a load distribution diagram for a semi-trailer

3.3.6~~3.1.8~~ Railway routes are generally classified into line categories, by which permissible **gross masses for wagons**, axle loads and loads per metre length of cargo space are allocated to each railway wagon. The applicable figures should be observed in view of 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~~**eccentricity** of cargo centre of gravity from wagon ~~centre lines~~ **centrelines** 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.

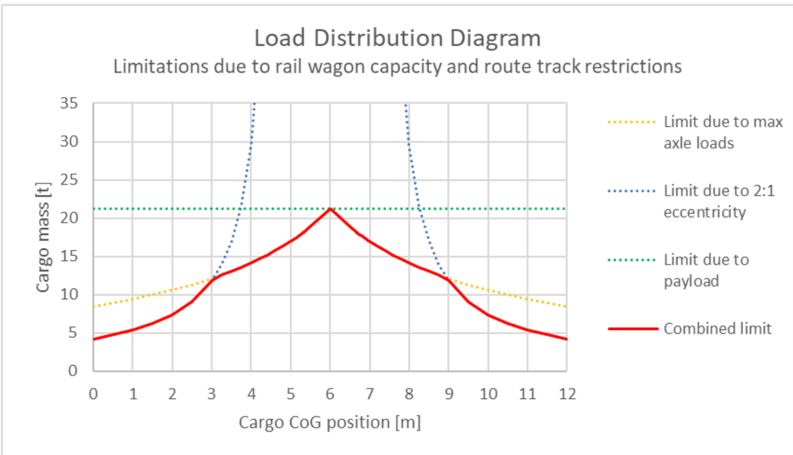


Figure 7.33 An example of a load distribution diagram for a 40-foot container on a two-axle rail wagon, based on the following parameters:

- **Maximum gross mass for wagon: 36 000 kg**
- **Tare mass of wagon: 10 800 kg**
- **Tare mass of container: 4000 kg**
- **Max cargo mass (payload): 21 200 kg**
- **Maximum axle load: 18 000 kg**
- **Distance between axles: 8 m**

- **Maximum difference between weight on axles: 2:1 (i.e. no axle may carry more than twice the weight of the other).**

3.3.7 Load Distribution Diagrams for different modes of transport may be superimposed to show the combined limiting curve for the whole intended voyage, as illustrated in the example in figure 7.34.

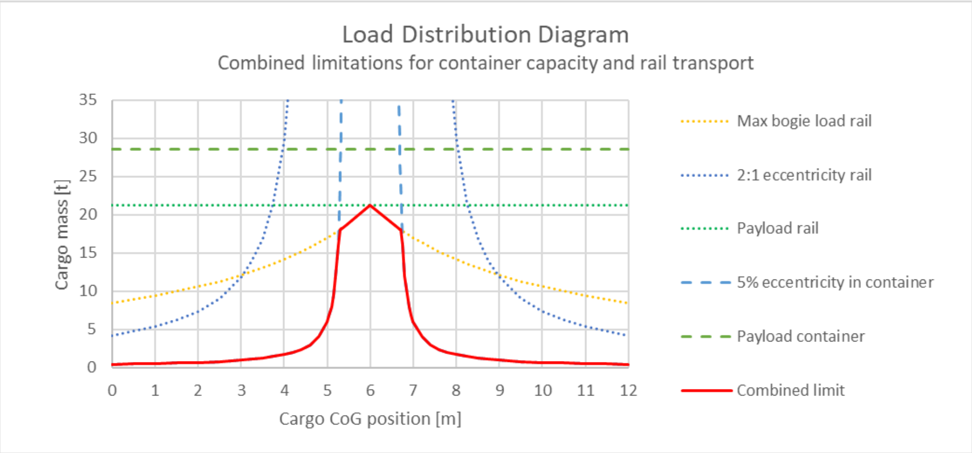


Figure 7.34 An example of a combined load distribution diagram for the handling and capacity of a 40-foot container as well as transport on a two-axle rail wagon

3.4~~3.2~~ General stowage/packing techniques **(**Subsequent clauses need to be renumbered)

- **F. Transport Stability level**

F.1 New section 4.2 in annex 7

4.2 ~~Tightly arranged cargoes~~ **Transport Stability Level, TSL**

4.2.1 Importance of package stability

~~**The term "package" is used to refer to any goods that are enclosed within one or more layers of packaging or secured on, or to, a packaging accessory.**~~

Consignors should ensure that formed packages are capable of withstanding the hazards of environmental exposure, storage, handling and transport. Overpacks ~~**Packages in the form of overpacks**~~ **should retain their integrity during transport, failure to do so increases the risk of the cargo being damaged or the CTU stability being adversely affected.**

To assist Packers in their role, the transport stability of the packages may be determined by practical tests, in which the packages capability of withstanding horizontal forces without substantial deformation is verified. Upon completion of such tests, the package may be marked with its corresponding Transport Stability Level (TSL), as given in table 7.8.

• Transport Stability Level • TSL	• Horizontal acceleration • a
• TSL 1	• $a \geq 1{,}0\ g^{a}$
• TSL 2	• $0{,}8\ g \leq a < 1{,}0\ g$
• TSL 3	• $0{,}5\ g \leq a < 0{,}8\ g$

• **TSL 4**	• ***0,35 g ≤ a < 0,5 g***
• **TSL 5**	• ***0,18 g ≤ a < 0,35 g***
• **[a]*g* = gravity acceleration 9,81 m/s²** • **Note: Below 0.18 g no TSL marking allowed**	

• **Table 7.8 – Transport Stability Level**

The TSL when associated with the CTUs boundary strength can indicate the need for additional securing of the cargo and should be determined in each specific case.

4.2.2 Determine the TSL

The TSL of a package can be determined through practical tests by exposing the package to the horizontal acceleration corresponding to the sought TSL level according to table 1, for example by inclination tests as described in ~~A~~appendix 5, with the addition that the maximum inclination angle shall be retained for at least 5 seconds and that the required inclination angle, to simulate the desired horizontal acceleration, shall be determined based on the internal friction of the goods in the package.

During the tests, the package should be prevented from sliding on the test platform by a measure that does not influence the package stability.

The package shall be tested 3 times in the lengthwise as well as in the sideways direction respectively. Asymmetrical cargo shall be tested in the most unstable directions. A separate test sample may be used in each test direction. No correction of the test samples may be done during the test.

After the test sequence, the permanent deformation of any part of the test sample from the primary location shall not exceed 60 mm in any direction. The maximum deformation may be measured on the front or back side of the test sample based on the primary vertical projection.

Furthermore, the test sample may not tip up or fall over during the tests.

No signs of visible leakage from the test sample are allowed after the test.

4.2.3 Marking of TSL

All packages which have a tested TSL should be marked with this, either on a separate label or incorporated with other markings on the units.

The TSL marking should:

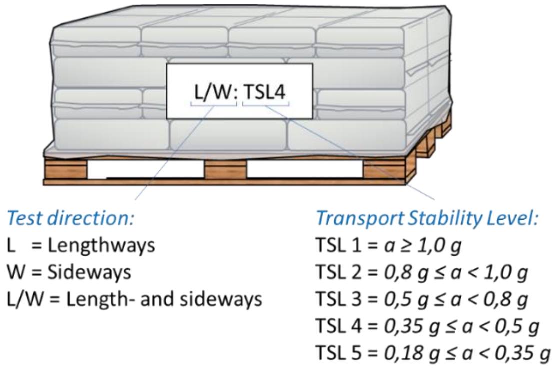
a) be marked on at least one side of each package,

b) use letters or numbers of at least 12 mm height,

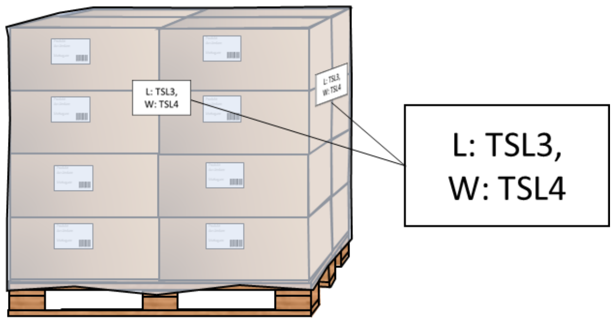
c) be visible and readable,

d) be displayed on a background of contrasting colour on the external surface of the package,

It is possible that test results for TSL differ in different directions depending on the shape of the package and therefore the lowest value for length and width directions should be displayed as per examples below (see figures 7.35 and 7.36).



- **Figure 7.35: Marking of Transport Stability Level 4 in both length (L) and width (W) directions.**



- **Figure 7.36: Marking of Transport Stability Level 3 in length (L) and 4 in width (W) directions**

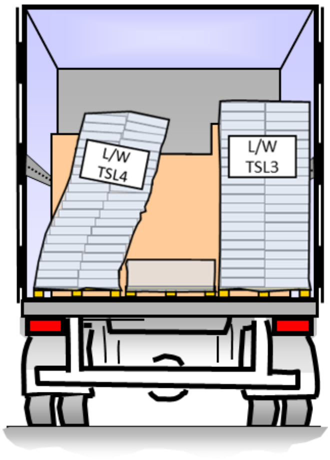
4.2.4 Practical applications for packages with known TSL

4.2.4.1 Bottom blocking

If the value of the directional TSL for a package (see table 7.8) is equal to or exceeds the directional acceleration coefficients (see chapter 5) for the intended transport mode, bottom blocking should be sufficient to prevent the cargo from sliding. When using bottom blocking only, table 7.9 below indicates the lowest required TSL to secure cargo in different directions and different modes of transport (see figure 7.37).

The lowest required TSL for securing the cargo using bottom blocking only			
Mode of transport	**Sideways**	**Forward**	**Backward**
Road	TSL3	TSL2	TSL3
Rail	TSL3	TSL3	TSL3
Sea Area A	TSL3	TSL3	TSL3
Sea Area B	TSL2	TSL2	TSL2
Sea Area C	TSL2	TSL2	TSL2
The TSL values for the sea areas in longitudinal direction apply to internal friction μ <0.5			

Table 7.9 –Required TSL for bottom blocking as the sole cargo securing method



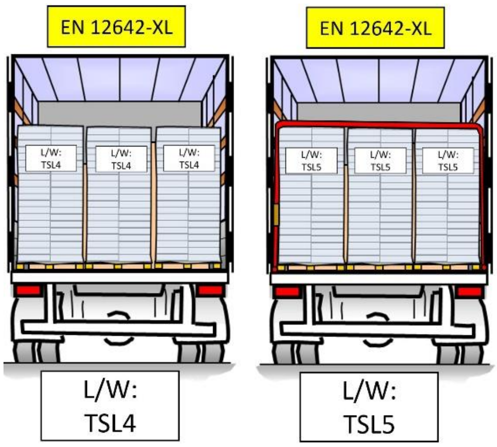
•

Figure 7.37: A package marked with TSL 3 or better may be bottom blocked sideways during road transport, while a package marked with TSL 4 risk collapsing in this situation.

4.2.4.2 Blocking against the side of the CTU

The TSL of the package indicates if the strength of the boundaries of the CTU is sufficient for blocking the packages or if additional securing methods are required by other means, e.g. lashings, in order not to overstress the CTU's boundary walls (see table 7.10 and figure 7.38).The lowest required TSL to block the cargo against the boundary walls of the CTU (evenly distributed cargo)						
Standard	**EN 12642:2016**				**EN 283**	**ISO 1496**
CTU	**L-vehicle**			**XL-vehicle**	**Swap-body**	**Container**
Mode of transport	**Box**	**Drop-sides**	**Curtain-sider**	**Box/Dropside/ Curtainsider**		
Road	TSL5	TSL5	TSL4	TSL5	TSL5	TSL5
Rail	TSL5	TSL5	TSL4	TSL5	TSL5	TSL5
Sea Area A	TSL5	TSL5	TSL4	TSL5	TSL5	TSL5
Sea Area B	TSL3	TSL3	TSL3	TSL4	TSL3	TSL5
Sea Area C	TSL3	TSL3	TSL2	TSL3	TSL3	TSL5

• **Table 7.10 – Required TSL for blocking only against the sides of CTUs**



•

• **Figure 7.38: During transport in sea area B in a ~~road~~ vehicle complying with standard EN 12642-XL, packages marked with TSL 4 or better may be secured by blocking against the CTU's sides only, whilst packages marked with TSL 5 needs additional securing measures, e.g. top-over lashings.**

~~4.2.4.3 TSL in combination with the Quick Lashing Guides~~

~~The lashing tables in the Quick Lashing Guides (QLG) in Informative material IM5 are based on rigid packages and the assumption that sliding occurs between the bottom of~~

~~**the package or package accessory and the CTU floor. However, this is not the case for packages with low transport stability, which may tip earlier than indicated by their shape and structure indicates due to substantial deformation or sliding may occur within the package.**~~

~~**When using the Quick Lashing Guide (QLG) to identify the number of lashings required to prevent a package, with a given cargo mass, from sliding the maximum friction factor for a declared TSL can be identified in table 7.11 below.**~~

~~• **Transport Stability Level**~~ ~~• **TSL**~~	~~• **Maximum friction factor for deciding**~~ ~~• **μ**~~
~~• TSL 1~~	~~• *1.0*~~
~~• TSL 2~~	~~• *0.80*~~
~~• TSL 3~~	~~• *0.50*~~
~~• TSL 4~~	~~• *0.35*~~
~~• TSL 5~~	~~• *0.15*~~

~~**Table 7.11 – Maximum friction factors to use in the QLG for different TSLs**~~

4.2.4.3 Selecting packaging to minimize breakage

If frequent breakage occurs during transport, the packaging may need improving. In such case, testing of TSL may be used as a tool for investigating the cause of the breakage, deciding on additional measures or new methods for packaging and verifying that these new measures provide a better transport stability.

Furthermore, a consignor or consignee may implement requirements of a minimum TSL for their packages, for themselves or for contracted partners, to minimize the risk of breakage and to make the cargo securing more efficient and safer.

~~4.2~~**4.3 Tightly arranged cargoes (**Subsequent clauses need to be renumbered)

F.2 Changes to Annex 7, Appendix 5

Practical inclination test for determination of the efficiency of cargo securing arrangements

1 The efficiency of a securing arrangement **or the transport stability level (TSL) of a package** can be tested by a practical inclining test in accordance with the following description.

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

3 To obtain the same loads in the securing arrangement **or package** in the inclining test as in calculations, the securing arrangement **or package** should be tested by gradually increasing the inclination of the platform to an angle, α, in accordance with the diagram**s** below.

4 The inclination angle that should be used in the test is a function of the horizontal acceleration $c_{x,y}$ for the intended direction (forward, sideways or backward) and the vertical acceleration c_z.

(a) 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 factor μ (for the sliding effect), or

- The angle determined by the ratio of $\frac{B}{n \cdot H}$ (for the tilting effect).

(b) To test the efficiency of the securing arrangement in the longitudinal direction, the greatest of following test angles should be used:

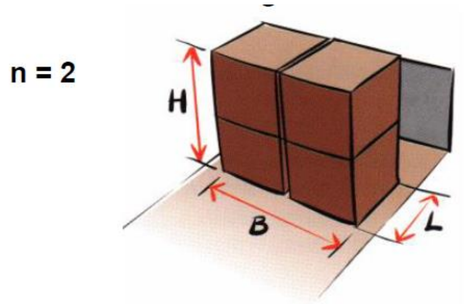
- The angle determined by the friction factor μ (for the sliding effect), or
- The angle determined by the ratio of $\frac{L}{H}$ (for the tilting effect).

(c) To test the TSL of a package in any direction the following test angles should be used:

- The angle determined by the internal friction factor μ on package without any package accessory.

5. Test of cargo securing arrangements

5.**1** The lowest friction factor, between the cargo and the platform bed or between packages if over-stowed should be used. The definition of *H*, *B*, *L* and *n* is according to the sketches in figures 7.~~61~~**96** and 7.~~62~~**97**.

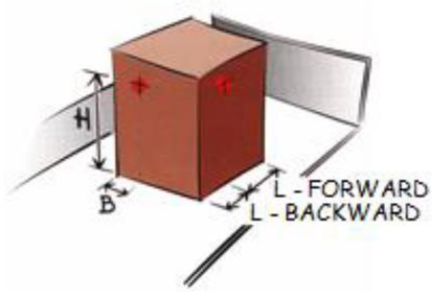


- Figure 7.~~61~~**96**

Package 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.



- Figure 7.~~62~~**97**

Package with the centre of gravity away from its geometrical centre.

The required test angle α as function of $c_{x,y}$ (0.8 g, 0.7 g and 0.5 g) as well as μ, $\frac{B}{n \cdot H}$ and $\frac{L}{H}$ when c_z is 1.0 g is taken from the diagram shown in figure 7.~~63~~**98** or from the table **7.15** below.

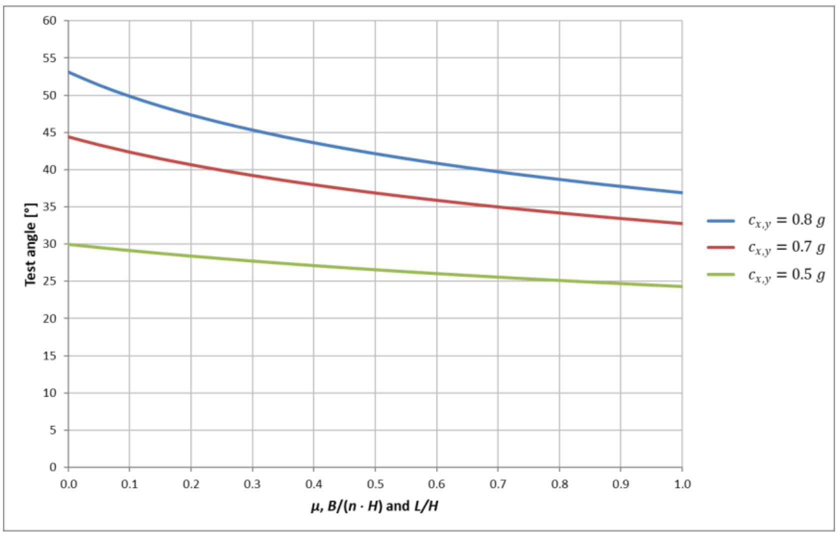


Figure 7.~~63~~**98**

Example:

If μ and $\frac{B}{n-H}$ is 0.3 ~~at~~ **for sideways** accelerations ~~sideways at~~**in** transport in sea area B (c_y = 0.7g) the cargo securing arrangement should be able to be inclined to approximately 39°, according to ~~the diagram~~**figure 7.98 and table 7.15**

In the table **7.15** below the inclination α is calculated for different γ factors at the horizontal accelerations ($c_{x,y} = 0.8$ g, *0.7* g and *0.5* g and $c_z = 1.0$ g).

The γ factor is defined as follows:

μ, B/(n · H) and *L/H*, as required in section 4 of this appendix.

$c_{x,y}$ / Υ factor	0.8g	0.7g	0.5g
	Required test angle α in degrees		
0.00	53.1	44.4	30.0
0.05	51.4	43.3	29.6
0.10	49.9	42.4	29.2
0.15	48.5	41.5	28.8
0.20	47.3	40.7	28.4
0.25	46.3	39.9	28.1
0.30	45.3	39.2	27.7
0.35	44.4	38.6	27.4
0.40	43.6	38.0	27.1
0.45	42.8	37.4	26.8
0.50	42.1	36.9	26.6
0.55	41.5	36.4	26.3
0.60	40.8	35.9	26.0
0.65	40.2	35.4	25.8
0.70	39.7	35.0	25.6
0.75	39.2	34.6	25.3
0.80	38.7	34.2	25.1
0.85	38.2	33.8	24.9
0.90	37.7	33.4	24.7
0.95	37.3	33.1	24.5
1.00	36.9	32.8	24.3

Table 7.15

When testing in longitudinal direction for sea transport, the corresponding test angle obtained by Figure 7.98 for the transverse direction may be used, or the required inclination angle, α, can be calculated by the following formula:

$$\boldsymbol{\alpha = \arcsin\left(\frac{r+\gamma\cdot\sqrt{1+\gamma^2-r^2}}{1+\gamma^2}\right), \text{where } r = c_{x,y} - \gamma \cdot c_z}$$

~~6~~**5.2** 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.

~~7~~**5.3** 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 masses are to be tested the entire platform should be prevented from tipping as well.

~~8~~**5.4** Figure 7.~~64~~**99** and figure 7.~~65~~**100** show tests to confirm the securing arrangements of a large package for acceleration forces in longitudinal and transverse directions.

- 

- Figure 7.~~64~~**99**

- 

- Figure 7.~~65~~**100**

6 Test of Transport Stability Level (TSL)

6.1 The required test angle α as a function of chosen TSL (1 – 5) is taken from the diagram shown in figure 7.101 or from the table 7.16 below.

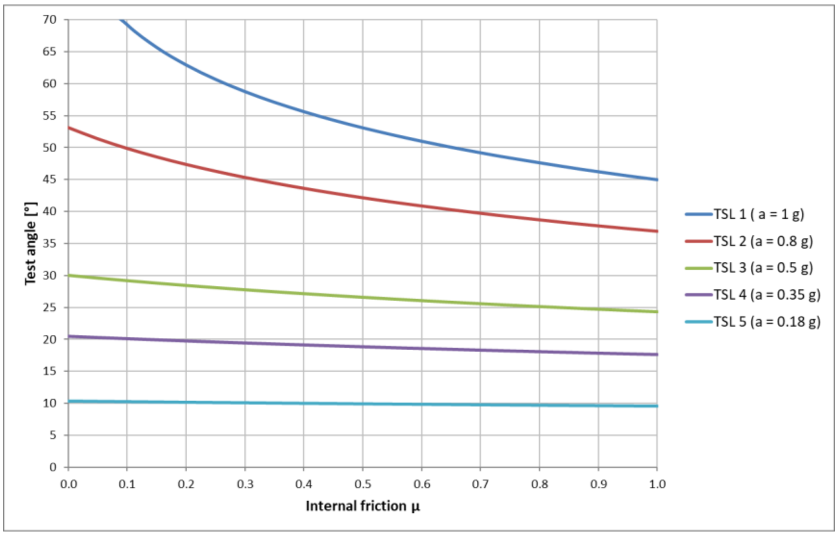


Figure 7.101

Example:

If the internal friction of a package is determined to µ = 0.40 and transport stability level chosen to be tested is TSL 3 the package should be able to be inclined to approximately 27°, according to the diagram

In table 7.16 the inclination *α* is calculated for different internal friction of a package at different TSL (1-5).

	TSL 1	TSL2	TSL3	TSL4	TSL5
Internal friction µ	Required test angle in degrees				
0.00	90.0	53.1	30.0	20.5	10.4
0.05	74.5	51.4	29.6	20.3	10.3
0.10	69.3	49.9	29.2	20.1	10.3
0.15	65.7	48.5	28.8	19.9	10.2
0.20	63.0	47.3	28.4	19.8	10.2
0.25	60.7	46.3	28.1	19.6	10.1
0.30	58.8	45.3	27.7	19.4	10.1
0.35	57.1	44.4	27.4	19.3	10.1
0.40	55.6	43.6	27.1	19.1	10.0
0.45	54.3	42.8	26.8	19.0	10.0
0.50	53.1	42.1	26.6	18.9	9.9
0.55	52.0	41.5	26.3	18.7	9.9
0.60	51.0	40.8	26.0	18.6	9.9
0.65	50.1	40.2	25.8	18.5	9.8
0.70	49.2	39.7	25.6	18.3	9.8

0.75	48.4	39.2	25.3	18.2	9.7
0.80	47.6	38.7	25.1	18.1	9.7
0.85	46.9	38.2	24.9	18.0	9.7
0.90	46.2	37.7	24.7	17.9	9.6
0.95	45.6	37.3	24.5	17.7	9.6
1.00	45.0	36.9	24.3	17.6	9.6

Table 7.16

6.2 Figure 7.102 shows inclining tests to confirm the TSL of a packages and figure 7.103 shows measuring of the permanent deflection after three tests with the same specimen in one direction.

- 

- **Figure 7.102**

- 

- **Figure 7.103**

- G. Liquids in flexitanks – changes to clause 5.2

5.2 Liquids in flexitanks

5.2.1 **The term flexitank has been used to describe the bag in which the cargo is carried, but for the safe transport of bulk liquids in CTU the whole system needs to be considered. A new term, a flexitank system has been developed specifically for freight containers and is defined as a "system used for the transport of a liquid commodity which comprises a flexitank, a restraining system, a constraining system and a general purpose freight container". Packers of all CTU types carrying bulk liquids in flexitanks should be aware that proper securing of the flexitank is essential for safe transport and should follow the installation advice provided by the flexitank supplier.**

5.2.2~~(5.2.1)~~ Flexitanks used for the transport of bulk liquids by road, rail or sea should carry a label that confirms the type approval by a recognized consultative body. The flexitank manufacturer's fitting instructions should always be followed, and the cargo intended to be carried should be checked for compatibility with the material of the flexitank. The transport of dangerous goods in flexitanks is prohibited.

5.2.3~~(5.2.2)~~ During transport the contents of a flexitank 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.

5.2.4~~(5.2.3)~~ Therefore the payload of a CTU should be appropriately reduced, when it is used for carrying a ~~loaded~~ **filled** flexitank. The reduction depends on the type of CTU and on the mode of transport. When a flexitank is ~~loaded into~~ **used in** a general purpose CTU, the mass of the liquid in the flexitank should not exceed a value agreed with the CTU operator, to prevent the CTU from suffering bulging damages (see figure 7.~~50~~**66**).

Figure 7.~~50~~**66** Damaged CTU side wall

5.2.5(5.2.4) Road vehicles intended to carry packed flexitanks 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 lashings every two metres is recommended for stabilizing the position and the strength of the flexitank.

~~Before being fitted with a flexitank, 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-foot 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 flexitank 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 flexitank should be unfolded and laid out accurately to facilitate a smooth filling process.~~

5.2.6 During intermodal transport the forces experienced by the CTU will be magnified by the potential sloshing of the liquid in the flexitank. Therefore, the correct handling of the CTU during transfers and on the various modal vehicles is essential. Improper handling or storage can cause a failure of the flexitanks and the partial or total loss of the cargo. Therefore, specific requirements for each transport mode are discussed in clause 5.2.8

5.2.7 Flexitank operation

5.2.7.1 Commodity considerations

1 General:

- **Flexitanks shall only be offered to transport non-regulated (non-dangerous) substances when the flexitank is suitable and the materials of construction are resistant and compatible with the substance temperatures likely to be encountered at the time of filling and during transport.**
- **All parties are required to undertake an appropriate risk assessment before accepting any cargo for transport in a flexitank container system.**
- **All parties are required to exercise responsible care and ensure safe and reliable flexitank systems conforming to all relevant regulations.**

2 Dangerous Goods:

- **Cargoes regulated as Dangerous Goods shall not be transported in flexitanks, therefore cargo included in IMDG Code (International Maritime Dangerous Goods Code) Dangerous Goods List, ~~C~~chapter 3.2 which provides the UN Number, Proper Shipping Name and Class of Dangerous Goods together with**

provisions for transport of substances classified as Dangerous Goods is not allowed to be transported in a flexitank.

- **~~Regional and National Regulations may also apply when the CTU passes through the state or region. Substances (cargo) classified as Dangerous Goods by Regional or National Regulations and statutory legislation,~~ Liquids meeting the classification requirements of the applicable dangerous goods regulations for relevant mode of transport are dangerous goods and are not ~~permitted~~ allowed to be transported in flexitanks.**

3 Non-regulated goods:

- **Non-regulated cargo is allowed for carriage in flexitanks, provided it is suitable for flexitank transport and the flexitank materials of construction are resistant and compatible with temperatures likely to be encountered during transport.**
- **The carriage needs to comply with the maritime and national legislation for governing maximum gross mass of the flexitank system.**
- **The carriage needs to comply with national, or modal transport legislation or directives, and an authorisation for the transport of flexitanks may be required.**

Note: Although the cargo might be classified as non-regulated by the criteria of the regulatory process, the cargo might contain hazards and risk. Therefore the Safety Data Sheet (SDS) should be referred to and the required safety provisions should be implemented.

5.2.7.2 Flexitank application

Shipper must be aware of their responsibilities and liabilities when transporting bulk liquids in flexitanks. In addition to the chemical compatibility of the flexitank with the cargo, shippers should be aware of any potential changes that may occur during transport or the potential effect of a catastrophic failure, such as:

- **Certain cargoes, such as wine, may be subject to fermentation during transport and the selection of the flexitank must be appropriate for the cargo carried. Improper selection may result in the flexitank expanding and damaging the container structure.**
- **Many of the cargoes carried in flexitanks (such as foodstuffs, wines and spirits) present little risk to the infrastructure should there be a serious leak, while others (such as oils and latex) may severely impact the operation of a facility (ship, terminal, roadway etc.) should a similar leak occur.**
- **Environmental controls may require that a leak of some easily disposed cargoes, such as wine, beer and fruit juices, require containment, dilution or cleaning before it enters the wastewater system.**

5.2.7.3 Flexitank selection

When selecting a flexitank shipper and / or packers should:

- **carry out appropriate risk assessments of the flexitank system and the cargo to ensure safe and reliable processes.**
- **select a flexitank manufacturer who has had their flexitank tested, certified and listed in the Container Owners Association (COA) Flexitank Quality Management List (FQML) with the status COA Member Certificate of Compliance[3].**

5.2.7.4 CTU checks

[3] Using a flexitank that has not been certified and listed in the COA FQML does not mean that it is not suitable for the cargo, however, the risk of an incident or damage to the CTU may be increased.

On arrival the CTU should be checked in accordance with ~~C~~chapter 8, clauses 8.1 and 8.2 and annex 4 of this Code. Deficiencies should be notified to the CTU operator and returned for replacement.

CTUs supplied for transporting a flexitank should be checked to ensure that there are no deficiencies that may puncture the flexitank such as:

- **nails and screws**
- **splinters and broken flooring**
- **gouges in the flooring**
- **miss-aligned flooring or walls**
- **sharp edges at welds and repairs**

Where such deficiencies are found the CTU operator should be notified and a replacement CTU be provided or temporary repair be done and agreed with the CTU operator, such as covering the with a suitable protective lining.

5.2.7.5 Fitting, filling & securing

Note: Always operate the flexitank system in accordance with the manufacturer's instructions and best practice to ensure safe and reliable outcome.

1 Fitting:

- **The CTU should be prepared and the flexitank should be installed according to the manufacturer's installation instructions using trained personnel.**
- **If the cargo has a thick consistency and requires heating to improve unpacking then the heating pads (water or electric) should be installed underneath or to the sides of the flexitank**

Before filling starts, the installation should be checked to ensure the system has been fitted in accordance with the manufacturer's instructions and that there are no signs of damage to any constituent part of the flexitank system.

2 Filling:

• ~~(5.2.6)~~ For filling an empty flexitank the left-hand door of the CTU should be firmly closed so that the inserted barrier is appropriately supported (see figure 7.~~51~~**67**). The flexitank 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 (see figure 7.52).~~

Figure 7.~~51~~**67** Container fitted with flexitank

~~Figure 7.52 Flexitank warning label~~

• **Overfilling a flexitank can result in damage to the CTU and loss of cargo. Stop filling:**

- **once the target volume has been reached,**
- **if the flexitank or any constituent parts becomes trapped,**
- **if there are signs of the flexitank or the valve leaking.**

Do not restart filling until the deficiency has been rectified.

3 Closing:

On completion of filling the flexitank:

• **the CTU should be closed ensuring that the valve does not obstruct the door operation or be forced out of position when closing the door,**

•~~(5.2.6)~~ No part of the flexitank, ~~or retaining battens~~ **shoring bars** or bulkhead should touch either door when fully ~~loaded~~**filled**.

• **Where required the Shipper should also provide a VGM for the CTU (container). Under the current terms of SOLAS, bulk liquid cargoes can only have a VGM produced by method 1, therefore, on completion of packing and after the container has been sealed, the packer should weigh the packed and sealed container on a calibrated weighing device.**

5.2.7.6 Container CTU Markings

After filling and sealing the flexitank, the door of the CTU should be closed and a marking(s) applied to indicate that the CTU is carrying a flexitank.

~~**5.2.8 Transport of Flexitanks**~~

~~**5.2.8.1 Road transport**~~

~~**The driver should be made aware that the container is carrying a filled flexitank as the handling characteristics for the container may be different.**~~

~~**Caution! – Wherever possible the driver should avoid sudden alteration of direction or breaking as the contents of the flexitank are unhampered, and the flexitank material is flexible. Therefore, the load moves heavily and unpredictably.**~~

~~**The driver should inspect the container for signs of leakage prior to starting and periodically during the journey to the destination. If there are signs of leakage, then the driver should ensure that the vehicle is parked in a position that will not cause a hazard or undue traffic congestion and away from any drains, rivers or waterways and does not require returning to the public highways and notify the shipper / consignee.**~~

~~**Uneven surfaces and twisting roads can cause the cargo to move within the flexitank. Abrupt movements could cause an internal wave that could result in the end, or side walls being damaged (see figure 7.68). If the driver notices such damage, it should be reported when the load is delivered to its destination.**~~

~~**Figure 7.68 - Damaged side wall following road transport**~~

~~**5.2.8.2 Rail transport**~~

~~**Flexitanks should only be transported on block trains while shunting wagons with CTUs carrying loaded flexitanks should be avoided.**~~

~~**5.2.8.3 Terminal handling**~~

~~**Any CTU packed with a flexitank should not be lifted using a forklift truck and should be only lifted from all four top corner fittings or using a balanced lifting apparatus.**~~

~~**When handling a CTU carrying a flexitank:**~~

- ~~**the CTU doors should be closed, and the lock rod handles secured in their retainers.**~~
- ~~**Lifting and lowering it should be done with recognition that the liquid within the CTU will continue to move even though the CTU has stopped.**~~
- ~~**Lifting and lowering speeds should be restricted so that the static / accelerated liquid can make a smooth transition without damaging the CTU or the lifting equipment.**~~
- ~~**When swinging or moving a CTU carrying a flexitank transversely, care should be taken when attempting to position the unit within a slot or on a chassis / trailer as the free surface effect of the liquid may affect the CTU's placement.**~~

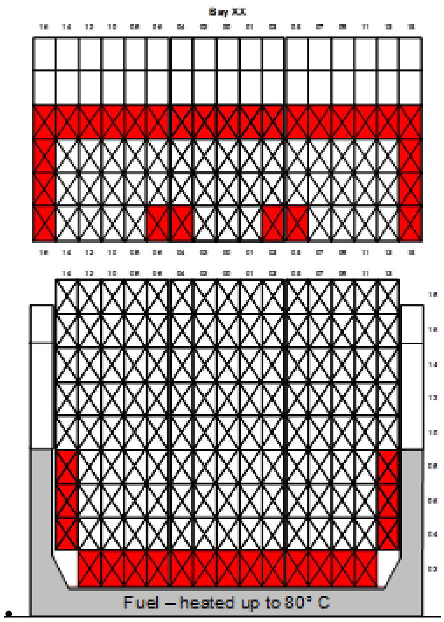
~~**5.2.8.4 Marine transport**~~

~~**CTUs (containers) packed with a flexitank can be loaded on ships and ship planners should consider the following when positioning these CTUs:**~~

- ~~**Temperature sensitive cargoes**~~[4] ~~**should not be placed on or near heated bunker tanks, the elevated temperature required to keep the fuel viscosity low may heat or otherwise damage the cargo (red slots below deck in figure 7.69).**~~

~~**Note: the height up the side will depend on the ship's design and may be higher or lower than shown in the figure. CTUs (containers) carrying flexitanks should not be stowed adjacent to the engine room bulkhead.**~~

- ~~**Above deck, CTUs (containers) with flexitanks should not be stowed in the outer and upper most slots as or at the edges of deck covers (red slots above deck in figure 7.54 as:**~~
  - ~~**CTUs (containers) in the top slot can be subjected to high temperatures from the sun's radiation.**~~
  - ~~**CTUs (containers) in the outer slots can be subjected to high acceleration loads.**~~
  - ~~**CTUs (containers) placed at the edge of the deck covers may have slightly wider separation and there is an increase in the risk of the side walls being bowed outwards.**~~



~~**Figure 7.69 - Positioning flexitanks**~~

[4] It is the responsibility of the shipper to inform the carrier of any temperature constraints or limits before the CTU is loaded.

~~**When planning the location of the CTU (containers) on board a ship, planners should consider the consequences of a leak from the CTU especially for:**~~

- ~~**Flexitanks carrying products that are viscous or that solidify, or which become more viscous when released from the containment of the flexitank, or**~~
- ~~**Water polluting and oily products.**~~

5.2.9 Discharging cargo

~~(5.2.7)~~**Only** the right-hand door of the CTU should be opened **until the majority of the cargo has been emptied from the flexitank.** ~~carefully for getting access to the top or bottom connection tube of the flexitank. The left hand door should be kept closed until the flexitank is substantially empty. The use of spill protection devices like collecting bag or drip tray is recommended. The empty flexitank should be disposed according to applicable regulations.~~

If heating pads have been requested and fitted, then these should be activated before the emptying process starts and only trained and competent personnel should conduct the heating,

The internal pressure of the flexitank will force the majority of the cargo out of the flexitank, but additional procedures may be required to fully empty the flexitank.

5.2.10 Environment: disposal and recycling

After discharge of the flexitank cargo, the flexitank, linings and all equipment should be completely removed from the CTU and safely disposed of or recycled for other use as agreed between the Shipper and the Consignee.

It is probable that a small amount of ullage will remain in the flexitank once the emptying process has been completed. This may affect the recycling of the flexitank after use.

The CTU should be cleaned, and any marks fitted to the exterior removed. The empty CTU should then be returned to the CTU Operator notifying them of any deficiencies or damage that occurred during the flexitank transport process.

- H. Solid bulk cargo

H.1 Changes to clause 5.3

5.3 ~~Non-regulated s~~**S**olid **dry** bulk cargoes

5.3.1 **General**

5.3.1.1~~(5.3.1)~~ **Regulated and** non-regulated solid bulk cargoes may be packed into ~~CTUs~~ **a CTU** provided the boundaries of the cargo space~~s~~ are ~~able~~ **capable** to withstand the static and dynamic forces of the bulk material under the foreseeable transport conditions (see ~~C~~chapter 5 of this Code).

5.3.1.2 Wherever possible, bulk solids should be packed into bulk CTUs and evenly distributed in a manner that minimises movements that could result in damage to the CTU or leakage of the cargo. However, general purpose CTUs are also permitted for use to carry bulk solids (see 5.3.4.1).

5.3.1.3 The density of bulk solids often means that smaller cargo spaces are normally required, such as the 20ft general purpose dry freight container or 30ft bulk container. However, the design requirements of the 20ft freight containers are not always fully suitable for such cargoes, especially free flowing powders and granules. For instance, extremely free flowing materials can damage the side (see figure 7.70) and end walls due to stresses induced during intermodal transport where there is high sideway acceleration, such as turning a sharp corner on a road vehicle.

Figure 7.70 Bulging wall

5.3.1.4 Additionally, freight containers, like many other types of CTU, are normally fitted with full width, full height rear doors which is the only means by which the cargo can be packed and unpacked. When transporting free flowing materials, opening the rear doors may result in the cargo falling from the container with the associated injury to cargo handlers and loss of cargo. Therefore, in order to transport powders and granules in general purpose containers, false walls, known as bulkheads, should be erected at the rear end to retain the cargo when one or both doors are opened.

5.3.1.5 Freight containers are not designed or tested for packing with the container positioned at an angle greater than [45] degrees and under no circumstances should it be stood on its endwall. When unpacking by tipping the container the unpacker must satisfy themselves that the operation is safe, and that the container is not damaged during the operation.

5.3.1.5 Substances which may become liquid at temperatures likely to be encountered during transport are not permitted in either bulk or general purpose CTUs.

5.3.2 ~~**Regulated solid dry bulk cargoes**~~ **Substances which meet the criteria for inclusion in a hazard class of the applicable dangerous goods regulations for relevant modes of transport are dangerous goods. Such goods are permitted for transport unpacked in a bulk CTU only if this is individually permitted by the applicable dangerous goods regulations for relevant modes of transport and when all their provisions are complied with. Only substances exhibiting a very low degree of hazard are permitted in bulk. They can be identified by an entry in column 13 of the Dangerous Goods List (IMDG Code). For dangerous goods, the mandatory provisions of the IMDG Code shall be observed in addition to following recommendations of this Code, which apply to all solid bulk cargoes.**

~~**5.3.2.1 Dangerous goods regulations include general provisions for the use of containers for the transport of solid substances in bulk. Substances shall be transported in bulk containers to the applicable bulk container instruction identified by the letters "BK" in column 13 of the Dangerous Goods List, with the following meaning:**~~

~~**1. BK1: the transport in sheeted bulk containers is permitted;**~~

~~**2. BK2: the transport in closed bulk containers is permitted;**~~

~~**3. BK3: the transport in flexible bulk containers is permitted.**~~

~~**5.3.2.2 Bulk containers shall be siftproof and shall be so closed that none of the contents shall escape under normal conditions of transport, including the effect of vibration, or changes of temperature, humidity or pressure. If the design of the container or any CTU is such that it cannot be made siftproof then it should be fitted with a liner to achieve this.**~~

~~**5.3.2.3 Before being filled and offered for transport each bulk CTU shall be:**~~

~~**5.3.2.3.1 checked externally in accordance with Chapter 8 clause 8.2.2 including any damage to service or operational equipment**~~

~~**5.3.2.3.2 checked internally in accordance with Chapter 8 clause 8.2.3**~~

~~**5.3.2.3.3 cleaned in accordance with Chapter 8 clause 8.2.4**~~

~~**5.3.2.4 In the case of specialist bulk CTUs, service or operational equipment shall mean any equipment or fittings applied or attached to the CTU that facilitates the packing and / or unpacking of the cargo while fully containing, and preventing any escape of, the cargo.**~~

5.3.3 Use of Bulkheads

5.3.3.1 For the transport of solid bulk cargoes in containers, preferably non-pressurized containers for dry bulk, designed and tested in accordance with ISO 1496-4, should be used. When general cargo containers for general purpose according to ISO 1496-1 are used, applicable dangerous goods regulations require that the end walls are strengthened to the same level as provided in ISO 1496-4. In case of solid bulk cargoes which are not subject to the applicable dangerous goods regulations, a similar reinforcement of the end walls is recommended. ~~**Cargoes categorised as a dangerous good in the IMDG Code (or similar) are required to be carried in accordance with packing instruction BK2 which states that bulk containers are designed and tested in accordance with ISO 1496 -4:1991 "Series 1 Freight containers- Specification and testing - Part 4: Non pressurized containers for dry bulk". Unfortunately, there are a very limited supply of containers built to this standard, so the IMDG Code states "*Freight containers designed and tested in accordance with ISO 1496-1:1990 "Series 1 Freight containers - Specification and testing - Part 1: General cargo containers for general purposes" shall be equipped with operational equipment which is, including its connection to the freight container, designed to strengthen the end walls and to improve the longitudinal restraint as necessary to comply with the test requirements of ISO 1496-4:1991, as relevant*." This can normally be fulfilled by fitting a partial height false bulkhead against the front wall (see figure 7.71).**~~

Figure 7.71 False bulkhead

5.3.3.2 Reinforcement can normally be fulfilled by fitting a partial height false bulkhead against the front wall (see figure 7.71). The front false bulkhead consists of two full-width plywood panels with horizontal softwood timber cross beams extending the whole width of the CTU and resting against the strong corner posts. The panels should be plywood (internal grade) and have a minimum thickness of 12mm. The height of the panels should be at least 200mm above the height of the cargo when packed but at least 1,800mm high with the lower panels as high as possible (preferably 1,200mm high). When the cargo is very fluid greater hight may be required. Panels with a height less 600mm should have one full width 150 x 50 mm softwood timber cross beams and all other panel heights at least two full width beams. ~~**The front false bulkhead consists of two full-width panels with horizontal softwood timber cross beams extending the whole width of the CTU and resting against the strong corner posts. The panels should be birch plywood (internal grade) and have a minimum thickness of 12mm. The height of the panels should be at least 200mm above the height of the cargo when packed but at least 1,800mm high with the lower panels as high as possible (preferably 1,200mm high). Panels with a height less 600mm should have one full**~~

~~**width 150 x 50 mm softwood timber cross beams and all other panel heights at least two full width beams.**~~

5.3.3.3 At the door end, the ~~IMDG Code~~ applicable dangerous goods regulations for relevant modes of transport requires that "*operational equipment of bulk containers designed to be emptied by tilting shall be capable of withstanding the total filling mass in the tilted orientation.*" This means that the rear bulkhead should be sufficiently strong so as the retain the cargo with the door open.

5.3.3.4~~(5.3.1)~~ **Many ISO box** ~~freight~~ 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 ~~general purpose freight~~ **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 (see figure 7.53)~~

~~Figure 7.53 Lining a 40-foot container with chipboard panels~~

5.3.3.5 Timber beams may be used so long as they satisfy the strength requirements, however, the length of the beams should be long enough so that they are not able to slide out when moved horizontally (see figure 7.72 and figure 7.73).

Figure 7.72 Beam too short

Figure 7.73 Beams too short

5.3.4 Preparation of CTUs for the carriage of bulk cargoes

5.3.4.1~~(5.3.2)~~ **A** CTU intended to carry a bulk cargo should be cleaned and prepared adequately as described ~~in subsection 5.2.5~~ **under clause 5.3.2.3**~~, in particular if a cargo-specific liner will~~ **~~shall~~** ~~be used for accommodating bulk cargoes like grain, coffee beans or similar sensible materials (see figure 7.54)~~**. It may be necessary to place plywood facing not only the front wall but also to the side walls of the CTU to protect them from bulging or scratching (see figure 7.74). A cargo specific siftproof liner should be used for accommodating bulk cargoes like grain, coffee beans or similar sensible materials (see figure 7.75).**

Figure 7.74 Lining a 40-foot container with chipboard panels

~~Figure 7.54 CTU with liner bag for accommodating a sensitive bulk cargo~~ **Figure 7.75 CTU with liner bag for accommodating a sensitive bulk cargo**

5.3.4.2 When using box type CTUs, it should be recognised that it will have been used to transport a variety of cargoes, some of which may constitute a contaminate to powder or granule cargoes carried subsequently. While CTU operator will endeavour to ensure that CTUs are clean before delivery to a shipper, it is the shippers' responsibility to ensure that the CTU is fit for use before loading. Likewise, after the shipment has been made, it is the unpacker's responsibility to ensure that the interior

is clean, and all traces of the cargo carried removed. Siftproof liners make the cleaning process easier, but they do not totally eliminate the need for pre and post laden cleaning.

5.3.4.3 Small and fine powders and grains if not contained within a liner may fall out through the doors during transport due to vibration. It is therefore recommended that all dry bulk cargoes are only carried within a suitable liner.

Figure 7.~~55~~**76 Lined container** ~~CTU with liners and door barrier loaded~~ **packed** with scrap

5.3.4.4~~(5.3.3)~~ 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 **(see figure 7.76).** In all cases an appropriate door protection should be installed consisting of battens fitted into suitable recesses and complemented by a strong plywood liner ~~(see figure 7.55).~~

5.3.4.5(5.3.4) 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.

~~5.3.5 **Packing bulk cargoes**~~

~~**5.3.5.1 Informative Material 3 – *Cargo Transport Units (CTU) types*, section 1.5 Non pressurised bulk container types – describes the various designs of bulk containers. These containers have an outward appearance of a general-purpose container but are fitted with loading and discharge hatches to the roof, front end or rear doors. Bulk containers designed just to carry solid bulk cargoes will generally have loading hatches in the roof which would allow gravity filling (see figure 7.75) or from ground level by means of an elevator (see figure 7.76). Bulk containers with a top loading hatch at the front of the container (see figure 7.77) can be packed using a gravity chute or a screw loader (see figure 7.78).**~~

~~**Note: 5.3.6.1 describes dry bulk containers, however, bulk CTU for other modes are available and their designs are generally similar and present the same packing and unpacking solutions.**~~

~~**Figure 7.75: Top loading**~~

~~**Figure 7.76: Elevator**~~

~~**Figure 7.77: Front chute**~~

~~**5.3.5.2 Box type CTUs can only be loaded and discharged through the rear doors so typical processes can include a screw loading elevator (see figure 7.78), a belt thrower (see figure 7.79), a retractable belt (see figure 7.80) or a pneumatic blowing system (see figures 7.81 and 7.82).**~~

~~**Figure 7.78: Screw loading**~~

~~**Figure 7.79: Belt thrower**~~

~~**Figure 7.80: Retractable belt**~~

~~**Note: When packing bulk CTUs through a front chute and or using a screw loading device, packers are reminded that inclining the CTU during the packing process may cause damage to the CTU's structure (see 5.3.1.4).**~~

~~**Figure 7.81: Pneumatic**~~

~~**Figure 7.82: Pneumatic blower**~~

~~**5.3.5.3 Abrasive cargoes, such as sugar and some grains, can cause damage to the liner if the flow of the material is directed directly at the liner, particularly during gravity loading through the top hatches (floor) or thrown or pneumatic loading through the rear doors (roof or front wall).**~~

~~**5.3.5.4 These loading methods do have restrictions, and it requires the loading operators to understand the "flowability" of the product being loaded so that it is evenly distributed across the entire container by gradually withdrawing the conveyor / blow pipe. Powders and grains which have a high angle of repose may settle unevenly and cause the eccentricity of the bulk material in the CTU which could result in handling difficulties.**~~

~~5.3.5.5~~(~~5.3.5~~) **5.3.5 Abrasive cargoes, such as sugar and some grains, can cause damage to the liner if the flow of the material is directed directly at the liner, particularly during gravity loading through the top hatches (floor) or thrown or pneumatic loading through the rear doors (roof or front wall). These loading methods do have restrictions, and it requires the loading operators to understand the "flowability" of the product being loaded so that it is evenly distributed across the entire container by gradually withdrawing the conveyor / blow pipe. Powders and grains which have a high angle of repose may settle unevenly and cause the eccentricity of the bulk material in the CTU which could result in handling difficulties.** 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 designed and tested for this method of handling.

5.3.6 Packing problems

5.3.6.1 It is frequently seen that the packing method used may cause damage to the CTU's interior surfaces even when a liner has been fitted. Damage can be caused by a number of ways:

- **abrasion**
- **wear**

- **tearing**

resulting in additional costs for cleaning and remedial work on the CTU's interior. Damage to a liner used to render a CTU siftproof may result in substantial cleaning costs onboard ship and in terminals. Therefore, correct supervision and spot checking of packing operations should be performed regularly.

~~**5.3.7 Weighing**~~

~~**5.3.7.1 All packed CTUs should comply with international and national regulations concerning the gross mass of the CTU and transport vehicle. However, containers carried by sea are covered by specific requirements.**~~

~~**5.3.7.2 The international convention for Safety Of Life At Sea (SOLAS) requires that all packed containers are weighed prior to loading on board a ship, and that a verified gross mass certificate (VGM) is presented to the carrier and the marine terminal.**~~

~~**5.3.7.3 Under the current terms of SOLAS, dry bulk cargoes can only have a VGM produced by method 1, therefore, on completion of packing and after the container has been sealed, the packer should weigh the packed and sealed container on a calibrated weighing device.**~~

~~**5.3.8 OPRC-HNS Protocol**~~

~~**The 2000 OPRC-HNS Protocol[5], designed for preparedness and response, describes HNS as a substance identified in one or more lists in the International Maritime Organization's Conventions and Codes. When transporting these noxious substances, it is essential that the consignor provides the shipper with full details including the appropriate measures required to respond to a pollution incident. This information should be forwarded to the carrier to minimise the risk of a major ecological event should multiple substances combine.**~~

~~**5.3.9 Temporary storage**~~

~~**5.3.9.1 CTUs, particularly freight containers, are frequently used as temporary, or long-term storage for bulk cargoes, and care must be taken that the cargo does not deteriorate during the storage or, in the case of dangerous goods, become unstable. The Warehousing White Paper[6] provides advice on storing Dangerous Goods in Warehouses. It should be noted that multiple CTUs carrying one or more dangerous goods and stored in close proximity to each other presents similar risks to those described in the White Paper.**~~

~~**5.3.9.2 Where concentrations of CTUs carrying different dangerous goods are found, the following guidance should be consulted:**~~

- ~~**Operations, particularly relating to good housekeeping and the prevention of combustion or explosion.**~~
- ~~**Dangerous Goods Storage, particularly relating to documentation, chemical inhibitors and marking.**~~
- ~~**Fire and explosion prevention, particularly relating to fire alarms, water supply and hot operations being carried out in the area.**~~
- ~~**Security, specifically relating to policies and procedures to allow quick response to incidents.**~~
- ~~**Emergency Response plans, particularly relating the hazard, nature and extent of possible emergencies.**~~

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[5] Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol).

[6] arehousing White Paper – Storage and handling of Dangerous Goods in preparation for, or after, sea-transport, 2021, jointly published by ICBCA International, IVODGA, National Cargo Bureau and the World Shipping Council.

~~5.3.10~~5.3.7 Unpacking dry bulk cargoes

~~5.3.10.1~~5.3.7.1 Unpacking regulated dry bulk cargoes may require specialist discharge equipment to ensure that there is no escape of the cargo during the process. Fine powder if it becomes airborne may present a risk of explosion.

~~5.3.10.2~~5.3.7.2 Unpacking CTUs is generally far easier than loading as gravity can greatly assist the process. All box type CTUs apart from the vertical hopper type CTU may be tipped either on specialist tipping equipment or, as is becoming more popular, using tipping chassis / trailers. During the tipping operation, extra care should be taken to ensure that:

1 the CTU is not overstressed during the unpacking operation.

2 the rear doors or wall are not over stressed and, for CTUs with rear doors and wherever possible, the rear false bulkhead should take all of the load caused by the tipped load.

3 the tipping device is stable and that the risk of it falling is minimised.

Note: Freight containers are not designed or tested for tipping discharge, therefore, the unpacker must satisfy themselves that the operation is safe, and that the container is not damaged during the operation.

~~5.3.10.3~~5.3.7.3 Specialist bulk containers, such as shown in figure 7.77 are designed with discharge hatches and a front or rear structure that can withstand the forces associated with a tipped load.

~~5.3.10.4~~5.3.7.4 Discharging a CTU generally is undertaken using a tundish system attached to the rear of the container, a piped discharge or a general discharge into a receiving hopper. As the following three pictures show the CTU will need to be tipped to a lesser or greater degree.

Figure 7.77 Tundish discharge

Figure 7.78 Grid discharge

Figure 7.79 Piped discharge

~~5.3.10.5~~5.3.7.5 CTUs can be tipped in one of three ways, using the trailer tipping chassis (figure 7.77 and 7.80), a tipping platform (figure 7.81) or a tipping frame (figures 7.78, 7.79 and 7.82). Using the tipping chassis or platform means that CTU does not need to be lifted off the road vehicle, which in the case of some specialist bulk CTU with a gross mass of 38 tonnes would require special handling equipment. A tipping frame may be able to lift the CTU directly off the trailer as shown in figure 7.82 or may require handling equipment that positions the CTU within the frame (see figure 7.78).

Figure 7.88 40ft Tipping trailer

Figure 7.81 100t Tipping platform

Figure 7.82: 40ft Tipping frame

~~5.3.10.6~~5.3.7.6 When handling CTUs, especially longer than 20ft, extra care is required to ensure that the stability of the CTU is maintained during the whole unpacking process. As the cargoes moves within the CTU during the operation, the centre of gravity will change, and if associated with potentially uneven ground or side winds, the stability may be compromised, resulting in the CTU falling.

Figure 7.83: locking twistlock

Figure 7.84: Backstop

~~5.3.10.7~~5.3.7.7 When tipping a freight container on a trailer, it is important to ensure that the container is properly attached and there is no risk of the unit moving during the unpack process. Sudden movement of the cargo can place extraordinary loads on the twistlocks, therefore, it is essential that the correct attachment devices are used and properly tightened. Figure 7.83 shows a tightened screw-down twistlock which should be used at all four corners and figure 7.84 shows a backstop, which prevents the container from slipping.

(The following figures will need to be renumbered).

H.2 Corresponding change to Chapter 11. On completion of packing

11.3 Documentation

11.3.1 In conformance with paragraph 4.2.4, the shipper is responsible for ensuring that all documents required by applicable international and national regulations are received from the consignor and the packer, that the documents are accurate, and, where required, are provided to the carrier before the transport commences respectively as early as required by the carrier.

11.3.2 ~~The packer is responsible for accurately determining the gross mass of the packed CTU.~~ **When the CTU is a container and sea transport is involved,** ~~A~~**a**pplicable international and national regulations **requires that** ~~may prescribe how~~ the gross mass ~~should be determined, and should be followed.~~ **of the container is verified either by:**

.1 weighing the packed container using calibrated and certified equipment; or

.2 weighing all packages and cargo items, including the mass of pallets, dunnage and other securing material to be packed in the container and adding the tare mass of the container to the sum of the single masses, using a certified method approved by the competent authority of the State in which packing of the container was completed.

Certain types of cargoes (liquid and solid bulk cargoes) do not lend themselves to individual weighing of the cargo to be packed in the container. In such cases, the method described in .1 above should be used instead.

11.3.3 The packer of the CTU should inform the shipper of the identification number of the CTU (container number or vehicle number as appropriate), the verified gross mass of the unit and the identification number of the seal (if applicable), thus to ensure that the verified gross mass and the identification numbers are included in all transport documents, such as bills of lading, way bills, consignment notes or cargo manifests, and are communicated to the carrier as early as required by the carrier.

11.3.4 Whenever the cargo projects beyond the overall dimensions of the CTU the information described in paragraph 11.3.3 should state the exact maximum over-height, over-width or over-length, as appropriate.

11.3.5 If a freight container having an allowable stacking mass of less than 192,000 kg marked on the safety approval plate (see subsection 8.2.1) is intended to be carried by ship, the carrier should be informed of the reduced stacking capability of that freight container.

11.3.6 In addition, whenever dangerous goods are packed into a CTU for transport by sea or where a maritime leg is included in the transport route, the IMDG Code and other transport regulations may require that those responsible for the packing of the CTU provide a “container/vehicle packing certificate” specifying the identification number of the container 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 should be referred to.

- I. Unit of measurements – editorial corrections to chapters 5, 6 and 7

Chapter 5

5.2 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~~**tonne**, multiplied by the acceleration (a) which is measured in m/s²:

Chapter 6

Clause 6.4.1:

Class A: 12.2 to 13.6 m long (maximum gross mass 34 ~~tons~~**tonnes**);

Class B: 30ft (9.125 m long);

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

Chapter 6

6.4.5 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 forklift trucks with a lifting capacity of 2.5 ~~tons~~**tonnes**.

Chapter 7

7.2.7 Heavy cargo items lifted by a forklift truck may result in a front axle load exceeding the maximum permissible concentrated load inside a CTU. For example, modern freight containers are designed to withstand a force of 0.5 kN/cm^2 which may limit package masses to approximately 3 to 3.5 ~~tons~~**tonnes** depending on the type of forklift truck used. For heavy cargo, open top, open side 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 with the forklift truck. ~~For load distribution, see annex 7, section 3.1.~~

Chapter 7

7.3.1 Freight containers, including swap bodies and regional containers designed for stacking and approved under the CSC are basically suitable for all modes of transport.

However, **some designs of** freight containers **may be built with reduced stacking capacity (less than 192,000kg superimposed load) or built and tested with a lower allowable stacking load than is required in the latest version of ISO 1496 shall be marked in accordance with the latest edition of ISO 6346 and** ~~having an allowable stacking mass of less than 192,000 kg marked on the approval plate (see annex 4, section 1)~~ **may** 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 and swap bodies may have a gross mass of 34 ~~tons~~**tonnes** or higher for which some road chassis and railcars will not be capable of carrying such heavy units. Therefore, especially for heavy massed containers, it is of utmost importance to arrange for an appropriate chassis and tractor vehicle or railcar, as applicable.

Chapter 7, first row in table in clause 7.3.4.2

Gross vehicle mass (GVM (~~tons~~**tonnes**))

- J. Acceleration coefficient – changes to chapter 5, table with rail acceleration coefficient

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/**1.2**)†	0.5 (1.0/**1.2**)†	-	1.0 (0.7)†
Transverse direction	-	-	0.5	1.0 (0.7)†
†The values in brackets apply to shock loads only with short impacts of 150 milliseconds or shorter, and may be used, for example, for the design of packaging. **Shippers should contact their carriers for the applicable shock loads acceleration coefficient values.**				

- H. Illegal wildlife trafficking

H.1 Changes to chapter 1 to introduce new section on prohibited cargos after section 1.3

“Prohibited Cargoes

The CTU Code addresses the packing and handling of cargoes that are traded legally and legitimately between contracting and consenting parties to a shipment.

Users of the CTU Code are alerted to the existence of illicit shipments of prohibited cargoes and trade in goods that are illegal under international or national law but that may be presented for packing in CTUs or attempted to be concealed in CTUs.

All parties, in particular consolidators, receiving goods for packing or carriage in a CTU should take steps to prevent the shipment of cargoes from the following categories:

- **Illegal wildlife, as defined in Chapter 2 (‘illegal wildlife trafficking’)**
- **Illicit drugs**
- **Firearms, subject to export restrictions**
- **Contraband, such as counterfeit or smuggled goods**
- **Goods subject to national or international sanctions legislation**
- **Trafficked humans and smuggled migrants**

All parties in the supply chain have a responsibility for checking on the legitimacy of cargoes handled and, based on a risk assessment, alerting appropriate national authorities of suspicious activity.

If any shipments are suspected of containing cargo from the above categories, they should be thoroughly reviewed by a responsible person, which may include an inspection of the CTU.

With regard to wildlife, this review should involve checking the species against the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to determine its protected status and whether trade is permissible. Each shipment of wildlife should be accompanied by valid documentation, including where applicable a CITES permit.

If there is strong evidence of wildlife smuggling, such as false declarations, forged documents or permits, or prohibited items, a responsible person should report this to the relevant authorities."

H.2 Changes to chapter 13

13.3 Training

13.3.1 Personnel engaged in the packing of CTUs should be trained in the contents of this Code commensurate with their responsibilities. Employees should be trained before assuming responsibilities and should only perform functions for which training has not been provided under the direct supervision of a trained person. If appropriate, such training should be supplemented by a period spent assisting knowledgeable planners and packers so that practical experience can be gained.

13.3.2 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. Topics for consideration, to be included in the training as appropriate, are given in annex 10.

13.3.3 Persons responsible for planning and supervision of packing as well as personnel responsible for the actual packing should receive appropriate education and training about risks of illegal goods smuggling, including wildlife, and the latest trends in the concealment methods and trafficking routes used by criminals. Topics for training, as appropriate, are given in annex 10, point 16.

To note: Changes regarding the issue of prevention of wildlife trafficking are also reflected in chapter 4 provided in section B.

H.3 Changes to Annex 10.

		• 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 all means of transport and CTUs
	•	• Damage to cargo
	•	• Economic consequences
• 2	•	Liabilities
	•	• Different parties involved in cargo transport
	•	• Legal responsibility
	•	• Goodwill responsibility
	•	• Quality assurance

		• Topics to be included in a training programme
• 3	•	Forces acting on the cargo during transport
	•	• Road transport
	•	• Rail transport
	•	• Sea transport
• 4	•	Basic principles for cargo packing and securing
	•	• Prevention from sliding
	•	• Prevention from tipping
	•	• Influence of friction
	•	• Basic principles for cargo securing
	•	• Dimensions of securing arrangements for combined transport
• 5	•	CTUs – types
	•	• Freight 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~~ **arrangements**
	•	• Increasing friction
• 8	•	Safe handling of packages
	•	• Manual handling
	•	• Mechanical handling devices
	•	• Personal protective equipment
• 9	•	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
• 10	• On completion of packing • • Closing the CTU • • Marking and placarding • • Documentation • • Verifying gross mass
• 11	• Packing and securing unitized cargo • • Cases • • Palletized cargoes • • Bales and bundles • • Bags on pallets • • Big bags • • Slabs and panels • • Barrels • • Pipes • • Cartons
• 12	• Packing and securing of non-unitized cargo • • Different types of packaged cargoes packed 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
• 13	• Packing and securing of paper products • • General guidelines for the packing and securing of paper products • • Vertical rolls • • Horizontal rolls • • Sheet paper on pallets
• 14	• Packing and securing of cargo requiring special techniques • • Steel coils • • Cable drums • • Wire rolls • • Steel slabs • • Steel plates • • Big pipes • • Stone blocks • • Machines
• 15	• Packing and securing of dangerous cargoes

• Topics to be included in a training programme	
	• • Regulations for the transport of dangerous goods • • Definitions • • Packing regulations • • Packing, separation and securing • • Labelling**, marking** and placarding • • Information transfer when transporting dangerous cargoes • • Liabilities
• 16	**• Prevention of transport of illicit cargo including illegal wildlife trafficking, drugs and human trafficking** • **• Common methods used to conceal illegal transport**

Annex II

• Text modification proposals in progress

The following text modification proposals have not been concluded:

A. Stabilizers – text modification to chapter 10, new section 10.4, and

B. Prevention of pest contamination

- A. Stabilizers

A.1 Proposal for addition of section 10.4 regarding Stabilizers to chapter 10

10.4 Stabilizers

10.4.1 The shipper should advise the carrier of critical information which pertains to controls implemented to ensure stabilization for an inhibited polymerizing substance. Such information is essential to safe carriage of goods in particular in situations of significant delays in supply chain. Such information should include the Self-accelerating decomposition temperature (SADT) or Self-accelerating polymerization temperature (SAPT), any temperature control measures applied, including operations controls considered and/or imposed, together with the duration of effectiveness of chemical inhibitors.

10.4.2 Carriers are encouraged to use the SADT/SAPT to validate that the corresponding regulatory requirements are met as a condition of acceptance. Similarly, if operational controls are used as a means to stabilize a substance, carriers would need this information to ensure that the operational controls are properly implemented and that mitigation actions can be considered when delays occur.

10.4.3 Carries are also encouraged to use the SADT/SAPT and anticipated duration for the effectiveness of inhibitors to anticipate contingencies and/or prepare for imminent dangers in the event of delays. Furthermore, carriers are encouraged to share this information with their service providers.

A.2. Alternative text proposal

For stabilised polymerising substances, specific information on stabilisation are required. The details are promulgated in the applicable dangerous goods regulations for the relevant mode of transport.

- B Prevention of pest contamination

Consolidated proposal on changes to the CTU Code addressing prevention of pest contamination was pending. Such a proposal should be elaborated in consultation with the Focus Group on Sea Containers of the Commission on Phytosanitary Measures under the International Plant Protection Convention. Under discussion was elaboration of a new chapter (referred in the discussion as 10bis), changes to annex 6, and modifications to terms on prevention of pest contamination throughout the text of the CTU Code.

The following change to chapter 1. Introduction was prepared and should be incorporated in the consolidated proposal addressing prevention of pest contamination:

1.3bis Prevention of Pest Contamination

1.3bis.1 There is international consensus among competent authorities that CTUs (especially containers) and their cargoes can carry and facilitate the introduction and spread of pests that may pose a serious risk to agriculture, forestry and natural resources. While the packing of CTUs with cargo is the most likely stage in the international CTU supply chains at which pest contamination can occur, the cleanliness of the CTUs is important. Consignors, shippers and packers should implement

measures to minimize pest contamination prior to and during packing. Others in the international CTU supply chains should also implement measures to reduce the risk of pest contamination while the CTU is in their control. Such measures, or best practices, should be in accordance with the parties' roles and responsibilities in the supply chains and should take into consideration all safety and operational constraints.

1.3bis.2 Minimizing pest contamination of CTUs and their cargoes is a shared responsibility and by applying practices set out in [chapter 10 bis and][*] Annex 6 of this Code, all parties can help keep CTUs and their cargoes clean. This will help to prevent the introduction and spread of pests through international commerce. CTUs are also likely to move through ports and other international borders and reach their final destinations faster and with less expense if they are clean."

*** [ ] includes reference to a section that would need to be still developed and agreed upon.**