

## **Informal meeting on Code of Practice for Packing of Cargo Transport Units**

### **at the request of the United Nations Economic Commission for Europe Working Party on Intermodal Transport and Logistics**

Geneva and virtual, 17-18 March 2022

## **Bulk transport**

Submitted by ETS Consulting

### **Introduction**

This document proposes changes to Annex 7, clause 5.3. This new text is meant to replace the existing clause 5.3 on non-regulated solid bulk cargoes, sub-clauses 5.3.1 to 5.3.5. This new text extensively elaborates on the practices for carriage of bulk cargoes in CTUs. In particular, information is added/elaborated on:

- Packing all types of solid bulk cargoes
- Packing and unpacking techniques
- False bulkheads
- Cargo and container protection

In view of the changes proposed to the clause 5.3, this document further proposes incorporation in Chapter 2 of the CTU Code of new definitions – please see section on new definitions.

This document also proposes inclusion of new appendix (as Appendix 2 to Chapter 7, which consequentially would require renumbering of the existing Appendices) on CTU and cargo protection. Also, another appendix on “Specific cargoes carried in liners - Hides and skins” is proposed.

### **Proposal for Amended clause 5.3**

- 5.3 Solid dry bulk cargoes
  - 5.3.1 General
    - 5.3.1.1 Regulated and non-regulated solid bulk cargoes may be packed into a CTU provided the boundaries of the cargo space are capable to withstand the static and dynamic forces of the bulk material under the foreseeable transport conditions (see Chapter 5 of this Code).
    - 5.3.1.2 Dry bulk cargoes can be carried in a variety of CTUs however the density of such cargoes 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 dry bulk cargoes, especially free flowing powders and granules. For instances extremely free flowing materials can damage the side (see Figure 7.53) 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 7.53 Bulging wall**

- 5.3.1.3 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.
- 5.3.1.4 Substances which may become liquid at temperatures likely to be encountered during transport are not permitted in bulk containers.
- 5.3.1.5 Bulk solids shall be packed into bulk containers and evenly distributed in a manner that minimises movements that could result in damage to the container or leakage of the cargo.
- 5.3.1.6 Not all bulk cargoes transported by sea are considered hazardous. The 2000 OPRC-HNS Protocol, 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. However, should a disaster occur and the contents of multiple CTUs escape then the combination of the chemicals can form a toxic mix resulting in serious ecological damage. HNS spills differ from oil spills as the oil is expected to float on the surface, while other chemicals can sink, creating toxic, moving underwater plumes, or float on the subsurface. These differences mean that the spills require other types of mitigation and remediation strategies.
- 5.3.2 Regulated solid dry 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:
- BK1: the transport in sheeted bulk containers is permitted;
  - BK2: the transport in closed bulk containers is permitted;
  - 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 CTU is such that it cannot be made siftproof then it should be fitted with a liner to achieve this (see appendix 2 for examples).
- 5.3.2.3 Before being filled and offered for transport each bulk container shall be:
- 5.3.2.3.1 visually examined to ensure it is structurally serviceable, its interior walls, ceilings and floor are free from protrusions or damage and that any in inner liners or substance retaining equipment are free from rips, tears or any damage that would compromise its cargo retention capabilities. Structurally serviceable means the bulk container does not have major defects in its structural components, such as top and bottom side rails, top and bottom end rails, door sill and header,

floor cross members, corner posts, and corner fittings in a freight container. Major defects include:

- bends, cracks or breaks in the structural or supporting members that affect the integrity of the container;
- more than one splice or an improper splice such as a lapped splice in top or bottom end rails or door headers;
- more than two splices in any one top or bottom side rail;
- any splice in a door sill or a corner post;
- door hinges and hardware that are seized, twisted, broken, missing, or otherwise inoperative;
- gaskets and seals that do not seal;
- any distortion of the overall configuration great enough to prevent proper alignment of handling equipment, mounting and securing chassis or vehicle, or insertion into ships cells;
- any damage to lifting attachments or handling equipment interface features; or
- any damage to service or operational equipment.

5.3.2.3.2 inspected and cleaned to ensure that it does not contain any residue on the interior or exterior of the bulk container that could:

- cause a dangerous reaction with the substance intended for transport;
- detrimentally affect the structural integrity of the bulk container; or
- affect the dangerous goods retention capabilities of the bulk container.
- Substances, for example wastes, which may react dangerously with one another and substances of a different classes and goods not subject to these regulations, which are liable to react dangerously with one another shall not be mixed together in the same bulk container. Dangerous reactions are:
  - combustion and/or evolution of considerable heat;
  - emission of flammable and/or toxic gases;
  - formation of corrosive liquids; or
  - formation of unstable substances.

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

5.3.4 Use of Bulkheads

5.3.4.1 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.

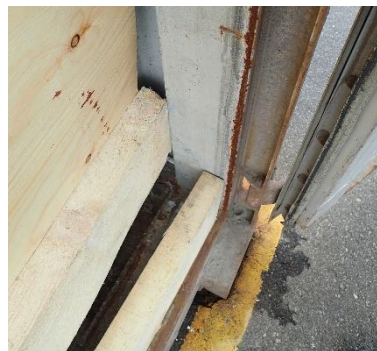


**Figure 7.54 False bulkhead**

- 5.3.4.2 The front false bulkhead could be constructed from 12 mm birch plywood (internal grade) with three full width 6 x 2in softwood timber cross beams. The false bulkhead is made from two pieces both full width and lower 1,200mm high (with two beams attached) and a half height (600mm) panel with one horizontal beam. The height of the front panel should be greater than the expected height of the cargo during packing.
- 5.3.4.3 At the door end, the IMDG Code 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 to retain the cargo with the door open.
- 5.3.4.4 ISO box containers are equipped with shoring slots in the door corner posts which are suitable to accommodate transverse steel bars of 60 mm square cross section. This arrangement is particularly designed to strengthen the container door end for taking a load of 0.6 P, as required for solid bulk cargoes. These bars should be properly inserted. The relevant transport capability of the CTU should be demonstrated by a case-related certificate issued by a recognised consultative body or by an independent cargo surveyor. This requirement applies to multi-purpose ISO box containers and to similar closed CTUs on road vehicles, which are not explicitly designed to carry bulk cargoes.
- 5.3.4.5 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 23 and Figure 24).



**Figure 1 Beam too short**



**Figure 2 Beams too short**

- 5.3.5 Preparation of CTUs for the carriage of bulk cargoes
  - 5.3.5.1 The CTU intended to carry a bulk cargo should be cleaned and prepared adequately as described under paragraph 5.2.5, in particular if a cargo-specific liner (see appendix 2) shall be used for accommodating bulk cargoes like grain, coffee beans or similar sensible materials.
  - 5.3.5.2 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 shipping companies and owners 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, the consignee must clean the interior of the container to remove all traces of the cargo carried. Sift-proof liners make the cleaning process easier, but they do not totally eliminate the need for pre and post laden cleaning.

5.3.5.3 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.

5.3.5.4 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 20). In all cases an appropriate door protection should be installed consisting of battens fitted into suitable recesses and complemented by a strong plywood liner.



Figure 3: Lined container loaded with scrap

5.3.5.5 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.

5.3.6 Packing bulk cargoes

5.3.6.1 Informative Material 3 – *Cargo Transport Units (CTU) types*, section 1.5 Non pressurised bulk container types – describes the various designs of bulk container. 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 (Figure 4) or from ground level by means of an elevator (Figure 5). Bulk containers with a top loading hatch at the front of the container (Figure 6) can be packed using a gravity chute or a screw loaded (see Figure 7).



Figure 4: Top loading



Figure 5: Elevator



Figure 6: Front chute

5.3.6.2 Box type CTUs can only be loaded and discharged through the rear doors so typical processes can include a screw loading elevator (Figure 7), a belt thrower (Figure 8), a retractable belt (Figure 9) or a pneumatic blowing system (Figure 10).



Figure 7: Screw loading



Figure 8: Belt thrower



Figure 9: Retractable belt



Figure 10: Pneumatic



Figure 11: Pneumatic blower

- 5.3.6.3 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).
- 5.3.6.4 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.
- 5.3.6.5 Depending on the internal friction and the angle of repose of the solid bulk cargo, the CTU may be inclined to a certain degree, to facilitate the loading or unloading operation. However, it should always be ensured that the walls of the CTU are not overstressed by the filling operation. It is not acceptable to turn a CTU by 90° to an upright position for filling, unless the CTU is especially approved for this method of handling.
- 5.3.7 Packing problems
  - 5.3.7.1 It is frequently seen, that despite correct lining procedures, the packing method used may cause damage to the liner and thus defeating the objective of the liner. Damage can be caused by a number of ways:
    - abrasion
    - wear
    - tearing
 Such damage can result in additional costs for cleaning up onboard ship and in terminals wherefore correct stuffing supervision and spot checking of hide shipper's stuffing operations should be performed regularly.
- 5.3.8 Weighing
  - 5.3.8.1 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.



- 5.3.8.2 The international convention for Safety Of Life At Sea (SOLAS) requires that all containers are weighed prior to loading on board a ship, and that a verified gross mass certificate (VGM) is presented to the master.

The following is an extract from SOLAS:

4 In the case of cargo carried in a container, except for containers carried on a chassis or a trailer when such containers are driven on or off a ro-ro ship engaged in short international voyages as defined in regulation III/3, the gross mass according to paragraph 2.1 of this regulation shall be verified by the shipper, 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.

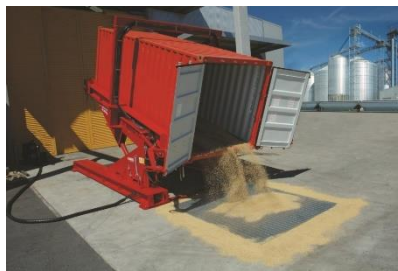
- 5.3.8.3 Under the current terms of SOLAS, dry bulk cargoes can only have a VGM produced by method 1, therefore, on completion of packing and after the container has been sealed, whole container should be weighed on a calibrated weighing device.
- 5.3.8.4 A report produced by PEMA investigated the available technologies for weighing containers in ports and found that the reach stacker system was unreliable, suggesting serious unreliability because such weighing facilities are associated with overload, rather than accuracy. Therefore, following the packing of the container, the gross mass of the container should be obtained using a weighbridge or a spreader mounted weighing system.
- 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<sup>1</sup> provides advice on storing Dangerous Goods in Warehouses, however, 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 such concentrations of CTUs are found the following sections provides guidance:
- Section 4 - Operations, particularly relating to good housekeeping and the prevention of combustion or explosion.
  - Section 5 – Dangerous Goods Storage, particularly relating to documentation, chemical inhibitors and marking.
  - Section 6 – Fire and explosion prevention, particularly relating to fire alarms, water supply and hot operations being carried out in the area.
  - Section 7 – Security, specifically relating to policies and procedures to allow quick response to incidents.
  - Section 8 – Emergency Response plans, particularly relating the hazard, nature and extent of possible emergencies.
- 5.3.10 Unpacking dry bulk cargoes

<sup>1</sup> Warehousing White Paper – Storage and handling of Dangerous Goods in preparation for, or after, sea-transport, 2021, jointly published by IBCA International, IVODGA, National Cargo Bureau and the World Shipping Council.

- 5.3.10.1 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 Unpacking containers is generally far easier than loading as gravity can greatly assist the process. All types of container apart from the vertical hopper type container can 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 the rear doors are not overstressed and, wherever possible, the rear false bulkhead should take all of the load caused by the tipped load. Specialist bulk containers, such as shown in Figure 12 are designed with discharge hatches and a front or rear structure that can withstand the forces associated with a tipped load.
- 5.3.10.3 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 12: Tundish discharge**

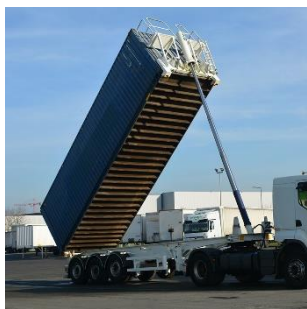


**Figure 13: Grid discharge**



**Figure 14: Piped discharge**

- 5.3.10.4 CTUs can be tipped in one of three ways, using the trailer chassis, a tipping platform or a tipping frame. Using the chassis or a platform means that CTU does not need to be lifted off the road vehicle, which in the case of some specialist bulk containers 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 17 or may require handling equipment that positions the CTU within the frame (see Figure 14).



**Figure 15: 40ft Tipping trailer**



**Figure 16: 100t Tipping platform**



**Figure 17: 40ft Tipping frame**

- 5.3.10.5 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 18: locking twistlock**



**Figure 19: Backstop**

- 5.3.10.6 When tipping a 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 18 shows a tightened screw-down twistlock which should be used at all four corners and Figure 19 shows a backstop, which prevents the container from slipping.

## Consequential Changes

1. Add new definitions

BK1	<p>Sheeted bulk container. An open top bulk container with rigid bottom (including hopper-type bottom), side and end walls and a non-rigid covering,</p> <p>Source: United Nations Recommendations on the Transport of Dangerous Goods Model Regulations</p>
BK2	<p>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.</p> <p>Source: United Nations Recommendations on the Transport of Dangerous Goods Model Regulations</p>
BK3	<p>Flexible bulk container. A flexible container with a capacity not exceeding 15 m<sup>3</sup> and includes liners and attached handling devices and service equipment.</p> <p>Source: United Nations Recommendations on the Transport of Dangerous Goods Model Regulations</p>
Bulk container	<p>Container for the transport of dry bulk solids, capable of withstanding the loads resulting from filling, transport motions and discharging of non-packaged dry bulk solids, having filling and discharge apertures and fittings. There are two variants:</p> <ul style="list-style-type: none"> <li>• non-pressurized dry bulk container - dry bulk container permitting packing and unpacking by gravity</li> <li>• pressurized dry bulk container - dry bulk container which may be packed or unpacked by gravity or pressure discharge.</li> </ul> <p>Source: ISO 830</p> <p>Note: further detail is shown in 6.2.14 of the Code.</p>
Bulk materials	<p>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.</p>
Hazardous and noxious substances (HNS)	<p>a substance other than oil which if introduced into the marine environment is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.</p>
Siftproof	<p>means impermeable to dry contents including fine solid materials produced during transport</p> <p>Where a liner is used to make the container sift-proof it shall be made of a suitable material. The strength of the material used for, and the construction of, the liner shall be appropriate to the capacity of the container and its intended use. Joins enclosures of the liner shall withstand pressures and impacts liable to occur under normal conditions of handling and transport. For ventilated bulk containers any liner shall not impair the operation of ventilating devices</p> <p>Source: United Nations Recommendations on the Transport of Dangerous Goods Model Regulations</p>

## Appendix 2 CTU and cargo protection

### 1 Introduction

1.1 CTU and cargo owners both require that their asset needs to be protected from the other. Often this will be achieved by the wrapping of the cargo in some form of packaging, usually card or stretch wrap film. However, many cargoes carried in CTU are packed in bulk form and therefore impossible to wrap.

1.2 CTUs need to be protected from cargoes that may scratch or contaminate the interior surfaces:

- scrap steel
- old engine parts
- wet salted hides
- corrosive chemicals, such as sulphur.

1.3 Conversely cargoes may be contaminated by the internal condition of the CTU and corrosion, flaky surface coating or condensation may fall into the cargo:

- grains
- plastic granules
- certain food stuffs

1.4 CTUs may be lined with timber panelling, matting or film.

### 2. Solid liners and bulkheads

2.1 The simplest form of liner is a plywood or chipboard or similar facing (Figure 20) to the side and end walls, and this provides both protection and assists in reinforcing the walls. Dry scrap steel with sharp edges can seriously damage the internal surfaces during packing and unpacking and such bulk cargoes may cause bulging of the walls.



**Figure 20 Lined 40' container**

2.2 Cargoes carried in bulk present the CTU with particular problems. Liquids and solids that are susceptible to free flow can both destabilise the CTU during transport but may also damage the walls. Non-regulated liquid cargoes may be carried in a general purpose CTU within a flexitank (see Annex 7 sub section 5.2).

2.3 Dry bulk cargoes, whether regulated or not, may be carried in specialist bulk CTUs or in general purpose CTUs (see Annex 7 sub-section 5.3) subject to extra provisions:

- the CTU is sufficiently siftproof to retain the cargo for the entire duration of the transport chain;
- the end and side walls of the CTU are strong enough to prevent any permanent deformation as a result of handling;
- adequate protection is provided if the CTU is to be tipped to unpack.

2.4 Cargoes categorised as a dangerous good in the IMDG Code (or similar) are required to be carried in accordance with packing instruction BK2 which requires 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."*

2.5 This can normally be fulfilled by fitting a partial height false bulkhead against the front wall and a rear bulkhead using the shoring slots at the door end.

2.5.1 While there is no regulation to prevent the carriage of dry bulk cargoes in general purpose CTUs, it is highly recommended that the provisions required for dangerous goods are followed for non-regulated cargoes.



**Figure 21 Preparing container**



**Figure 22 False bulkhead**

2.5.2 The front false bulkhead could be constructed from 12 mm or thicker birch plywood (internal grade) with at least three full width 6 x 2in softwood timber cross beams. At the front (blind) end the beams must extend to either corner post so that the load is take mostly by the strong points of the CTU structure. The false bulkhead is made from two or more pieces of panel material, both full width. Each panel must be supported by two of the full width beams and the height of the front panel should be at least 100mm greater than the expected height of the cargo during packing.

2.5.3 The Packer must ensure that the combined front end wall strength and that of the false bulkhead achieve the strength required by the latest version of ISO 1496-4.

2.6 At the door end, the IMDG Code 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.

2.6.1 ISO box containers are equipped with shoring slots in the door corner posts which are suitable to accommodate transverse steel bars of 60 mm square cross section. This arrangement is particularly designed to strengthen the container door end for taking a load of 0.6 P, as required for solid bulk cargoes. These bars should be properly inserted. The relevant transport capability of the CTU should be demonstrated by a case-related certificate issued by a recognised consultative body or by an independent cargo surveyor. This requirement applies to multi-purpose ISO box containers and to similar closed CTUs on road vehicles, which are not explicitly designed to carry bulk cargoes.

2.6.2 Timber beams may be used so long as they satisfy the strength requirements, however, the length of the beams should so long enough so as not to be able to slide out when moved horizontally (see Figure 23 and Figure 24).



**Figure 23 Beam too short**



**Figure 24 Beams too short**

### 3 Cargoes

3.1 CTU operators will endeavour to ensure that CTUs are clean before delivery to a shipper, however, it is the shippers' responsibility to ensure that the CTU is fit for use before packing. Likewise, after the shipment has been made, the consignee must clean the interior of the container to remove all traces of the cargo carried. Siftproof liners make the cleaning process easier, but they do not totally eliminate the need for pre and post laden cleaning.

3.2 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.

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 20). In all cases an appropriate door protection should be installed consisting of battens fitted into suitable recesses and complemented by a strong plywood liner.

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.



**Figure 25: Lined container loaded with scrap**

### 4 Liners

4.1 Many cargo owners feel that the internal condition and cleanliness of containers is inconsistent therefore sought other methods to retain and protect the cargo. Likewise, container owners also sought methods their containers from cargoes, especially corrosive, or those requiring extensive cleaning after discharge.

4.2 Additionally, the IMDG Code states "*Bulk containers shall be siftproof. Where a liner is used to make the container siftproof, it shall be made of a suitable material. The strength of the material used for, and the construction of, the liner shall be appropriate to the capacity of the container and its intended use. Joins and closures of the liner shall withstand pressures and impacts liable to occur under normal conditions of handling and transport.*"

4.3 Liners are best described as oblong sacks or envelopes whose size is equivalent to the inner space of a 20 foot or longer CTU. It is attached to hooks in the upper corners after which loose cargo is blown, or poured in, gradually filling the entire CTU with the cargo. CTU liners are used in the bulk shipment of dry free-flowing cargo such as coffee. They are quick and simple to install and enable bulk cargo to be shipped door to door with a minimum of handling, thereby minimizing cargo spillage and waste.

4.4 Liners are usually made from virgin polyethylene (film or woven polyolefins), allowing the cargo to be transported safely in an enclosed chamber, thus avoiding contamination from pollutants and salt sea air. The liner therefore protects the cargo from external influences such as moisture and, in case of condensation occurring on the CTU's inside walls, it ensures that this does not affect the cargo.



4.5 Container liners were originally developed for 30ft bulk containers with three or four top loading hatches. Delicate cargoes, mainly plastic granules, were contained within a liner to ensure that the material was not contaminated. More recently grain shipments are increasingly carried in bulk in containers and although originally carried without a liner, almost all shipments are now made with them fitted, partially to protect the cargo from the damp and partially to protect the container. Cargoes such as hides (wet or dry) may release corrosive liquids that will damage the container metal work and paint, therefore, these cargoes require containers that are partially lined to protect the cargo. Differing cargoes may release gases or moisture that may attack the structure or paintwork. In all of these cases, the shipper, consignee or the container operator may require that the container is lined internally.



Figure 26: Open rear



Figure 27: Bulk (top load)



Figure 28: Open top



Figure 29: Top & bottom rear



Figure 30: Fluid liner



Figure 31: Open rear - thermal



Figure 32 Thermal blanket

Figure 26 to Figure 32 show typical liner designs to cater for different cargoes and packing processes.



Figure 33: Container with bulk material liner



Figure 34: Container with bulk material liner and integral bars



Figure 35: Half height liner

4.6 Figure 33 and Figure 34 show examples of bulk liners fitted to general purpose containers where the cargo is blown in through the opening or central circular access hole and then discharged through the flap at the bottom. Figure 35 shows an example of a half-height liner that would be used to retain liquids or heavy cargoes that does not require a siftproof enclosure.

4.7 For the best integrity a welded construction is required, especially when carrying fine powders and dangerous goods.

4.8 Such Container liners are generally made from one of the following materials:

4.8.1 Low Density Polyethylene Film (LDPE)

4.8.1.1 This term is generally considered to include polyethylene's ranging in density from about 0.915 to 0.925 g/cm<sup>3</sup>. In low density polyethylene's, the ethylene monomeric units are linked in random fashion, with

the main chains having long and short side branches. This branching prevents the formation of a closely knit pattern, resulting in material that is relatively soft, flexible and tough, and which will withstand moderate heat.

4.8.1.2 LDPE is soft, low barrier, good clarity film. It is also the least expensive of all polymer packaging films.

4.8.1.3 Very flexible, natural milky color, translucent with high impact strength. Excellent for mild and strong buffers, good chemical resistance. Good water vapor and alcohol barrier properties. Poor gas barrier, sterilizable with EtO or gamma radiation. Good stress crack and impact resistance.

#### 4.8.2 High Density Polyethylene Film (HDPE)

4.8.2.1 High density polyethylene or HDPE is a low cost, milky white, semi-translucent thermoplastic. It is flexible but more rigid and stronger than LDPE and has good impact strength and superior puncture resistance. Like LDPE, it also has good chemical resistance, good release properties, and good vapor but poor gas barrier and weathering properties. Other limitations or disadvantages include: subject to stress cracking, difficult to bond, flammable, and poor temperature capability.

4.8.2.2 Typically, high-density polyethylene is more linear and consequently more crystalline than LDPE. The higher crystallinity leads to a higher maximal service temperature up to about 130°C and results in somewhat better creep resistance. The lower service temperature is about -40°C.

4.8.2.3 HDPE tends to be stiffer than other polyethylene films, which is an important characteristic for packages that need to maintain their shape. HDPE is easy to process and can be blended with other polymers and/or additives, like (surface treated) fillers, other polyolefin (LDPE, LLDPE), and pigments to alter its basic properties.

#### 4.8.3 Polypropylene Films

4.8.3.1 The density of (PP) is between 0.895 and 0.92 g/cm<sup>3</sup>. Therefore, PP is the commodity plastic with the lowest density. With lower density, mouldings parts with lower weight and more parts of a certain mass of plastic can be produced. Unlike polyethylene, crystalline and amorphous regions differ only slightly in their density. However, the density of polyethylene can significantly change with fillers.

4.8.3.2 Polypropylene is normally tough and flexible, especially when copolymerized with ethylene. This allows polypropylene to be used as an engineering plastic, competing with materials such as acrylonitrile butadiene styrene (ABS).

4.8.3.3 Polypropylene has good resistance to fatigue.



**Figure 36: Woven PP Sheet**



**Figure 37: Stretched stitching**

4.8.3.4 When used for liners, the sheets will be woven (see Figure 36) and therefore cannot be welded.

4.8.3.5 Overstressing the material can result in the stitching used to join sheets becomes stretched (see Figure 37) and may result in leakage of liquids, moisture or powder.

#### 4.9 Thermal liners

4.9.1 Certain industries - including pharmaceuticals, food and beverage, and chemicals – must ensure that their commodities maintain a specific temperature range during the shipping process, whether that lasts hours or days. It is in these circumstances that thermal packaging and thermal CTUs and thermal liners are used to help protect valuable cargo from temperature spikes that would make it worthless upon arrival.

4.9.2 Even using refrigerated CTUs, thermal liners provides additional temperature protection throughout the transport chain. Thermal packaging protects the cargo from radiant heat exposure from the sun and moisture from precipitation before packing and after unpacking but additional thermal linings provide “keep from freezing” protection for cargoes transported in general purpose CTUs. In addition to protecting from hot and cold spikes, thermal packaging and liners reduce the amount of temperature fluctuation that a cargo experiences, even with longer shipping times.



**Figure 38 Thermal blanket**



**Figure 39 Thermal coverall**



**Figure 40 Thermal liner and coverall**

4.9.3 Blankets similar to the thermal blanket shown in Figure 38 made from a woven material can also be used to protect the cargo packages from contamination or condensation falling from the roof.

## 5. Lining procedures

### 5.1 Stowage and Fastening of Bulk Goods

5.1.1 The inner surfaces of the walls and floor of a container shall not have any mechanical damage and sharp edges, protruding or loose screws, welded seams, or marks indicating repairs that are made on the inner surface.

5.1.2 The height of the false bulkheads shall exceed the height of loading not less than by 100 mm.

5.1.3 The liner installation shall be executed from the rear wall of a container to the doorway opening. Sequentially, beginning with the rear wall, the upper part of the liner shall be fixed to the upper bracing facilities of a container, using the strips sewn to the liner for this purpose. The lower part of the liner shall be fastened by the lower bracing facilities of a container, and the liner material’s adjoining the container walls shall be provided by the tension of strips (Figure 22).



**Figure 22**

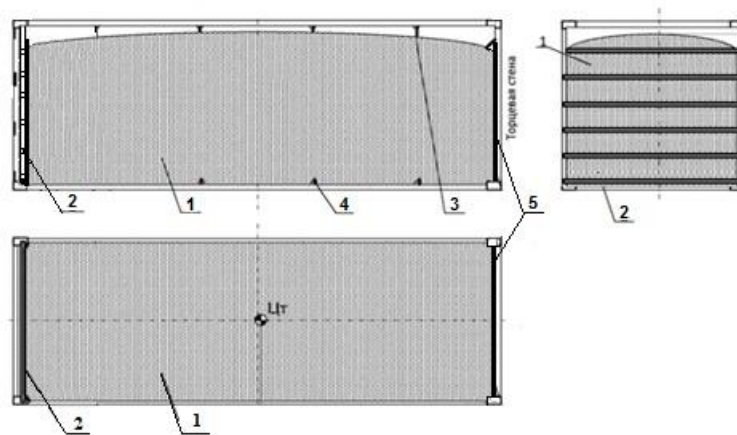
5.1.4 If available, the liner unloading chute located below shall, prior to loading, be firmly tied by strings available (Figure 23).



**Figure 23**

5.1.5 Packing of bulk goods shall be executed through the loading opening of a liner or loading chute, which shall, after completion of loading, be buttoned or tied subject to the container's design.

5.1.6 Packing shall be performed in a smooth flowing manner in the container floor space (Figure 24). The maximum loading height shall not exceed the level by 100 mm lower than the upper edge of the doorway opening safeguard or end wall of a container.



**Figure 24 – Pattern of stowage and fastening of a liner with goods**

- 1 – liner with goods;
- 2 – shield for safeguarding the doorway opening;
- 3 – strips for fastening a liner with upper bracing facilities of a container;
- 4 – strips for fastening a liner with lower bracing facilities of a container;
- 5 – shield made of a sheet of plywood

## 5.2 Hides and skins

5.2.1 To minimise the risk of damages to the CTU, protective liners made of good material with sufficient thickness to catch leakage must be used in addition to spreading and an effective absorbent medium over the floor, prior to the packing of cargo. Protection liners may vary in thickness and might be made of extremely lightweight material. Some of those liners appear to do very little to protect the product from leaking and are easily punctured and torn and do not withstand the rigours of vanning.

5.2.2 Before fitting the liner, the floor should be covered with 6 mm thick cardboard or corrugated plastic sheeting to ensure that imperfections in the flooring do not damage the liner. Make sure this fits neatly into all corners. A few pieces of tape will be required to stop cardboard from moving towards the centre of the CTU. Leave a flap of cardboard hanging out past the door end by about 1.5 metres (Figure 41).





**Figure 41 Pre liner**



**Figure 42 Liner in place**



**Figure 43 Supporting the liner**

5.2.3 A one-piece woven polythene liner of minimum 200/250-micron thickness or polyethylene woven liners (10x 10 mesh per square inch) of 850 denier, coated on both sides with polyethylene, having all seams welded (not sewn), with aluminium eyelets punched along the top of the liner edge that is reinforced with a cord to allow the liner to be hung securely, may also be utilised. The liner should be of sufficient size to cover the entire container to a height of 2.20m (floor, front wall and sidewalls), with a full width flap of 2.4 meters must be used. This is to form a full envelope around the cargo to capture any moisture that originates from the cargo and to prevent any leakage. Access skirts or base liners may be used for extra protection.

5.2.4 To establish a fixing point for the liner a bail lash or 4mm rope is run through the lashing points around the top of the CTU and tied off ensuring that the lash is tight. After threading plastic bungee clips through the lashing rings of the liner, beginning at the front wall, the liner is clipped onto the lashing (Figure 43). Using tape to support the liner is not recommended as the length of the voyage and the prevailing weather conditions, tape may tend to lose its adhesive quality due to the build-up of heat.

5.2.5 There must be minimal slackness in the liner on the walls and floor to reduce snagging and slipping and it should be pushed into the corners to avoid damage during packing.

5.2.6 During packing an additional 6 mm thick cardboard should be fitted to protect the liner bag from being damaged when driving in and out with a forklift and from rough handling of pallets. Once again make sure this fits neatly into all corners with a few pieces of tape to stop cardboard moving towards the centre of the container and leave a flap of cardboard hanging out past the door end by about 1.5 metres.

5.2.7 Finally place a sufficient amount of fine grade absorbent sawdust into the container, so that the floor is completely covered. Coarse sawdust or wood shavings are not suitable due to their bad absorbent qualities.



**Figure 44 Bagged sawdust prior to laying**

5.2.8 The CTU is now ready for packing the hides or skins.

**5.3 Bulk powders and grains**

5.3.1 Depending on the nature of the cargo any of the liners shown in Figure 26 to Figure 35 can be used. Fully enclosed (6-sided) liners should be used where the cargo should be protected from contamination or condensation or if the cargo presents a risk to the environment, such as one recorded as a dangerous good.

5.3.2 To establish a fixing point for the liner a bail lash or 4mm rope is run through the lashing points around the top of the CTU including across the doors and tied off ensuring that the lash is tight. After threading plastic bungee clips through the lashing rings of the liner, beginning at the front wall, the liner is clipped onto the lashing.

5.3.3 The inner polypropylene liner must fit snugly against the walls, roof and floor when full - improper placing of the inlet could cause tearing - and the load must be as evenly levelled as possible. The liner's roof must not sag but must be tight so at no time will the inlet or roof rest on the cargo after packing. Ideally, built-in reinforced straps in the liner's front panel (bulkhead) will prevent bulging when the CTU is full, thus allowing for easy closing of the doors (strapping ropes can also be used.) There should not be any pressure on the doors when closed after packing. The liner must be properly fastened to the CTU's interior, also at the far end: at the point of discharge the CTU is tilted to enable the cargo to slide out of the liner, rather than the filled liner sliding out of the CTU.



## 5.4 Closing liners

5.4.1 For cargo packed as unit or unitized loads the liner will need to be closed after the completion of packing. It is essential that the following procedure is followed to ensure that the cargo cannot escape.

5.4.2 Ensure that all materials within the liner are folded into the cargo area before the liner itself is secured.

5.4.2.1 Take the end of the liner and secure it to the line across the door (arrowed in Figure 29). Ensure that there is no material trapped in the folds

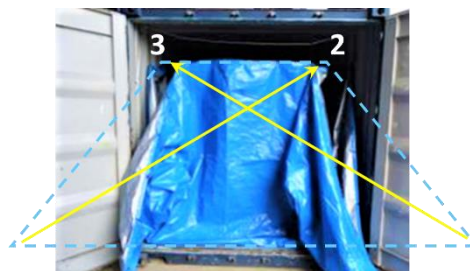
5.4.2.2 Pull the liner to form a trapezoid and fold one point up to the other side of the CTU. Ensure that it is properly secured to the top lashing ring or to the 4 mm rope down the side. Do not secure it to the line across the door opening.

5.4.2.3 Fold the other point up to the opposite side and secure in the same way as 2 above.

5.4.2.4 The finished envelope should contain all the cargo and not permit any egress of material and the folded end should look like Figure



**Figure 29 End folded up**



**Figure 30 Folding steps**



**Figure 31 Sides folded in**

5.4.3 Once full the liner is sealed and not opened again until discharge at destination, either into the reception system of the destination plant, or into a silo storage system, for example in a port.

5.4.4 For cargoes carried loose in bulk a suitable rear false bulkhead should be fitted prior to the completion of packing.



**Figure 32 Partially filled**



**Figure 45 Use of shoring slots**



**Figure 46 Rear false bulkhead**

5.4.5 When packing bulk materials manually fitting the rear bulkhead would normally be completed in two stages. The bulk cargo is packed until the pile within the CTU is approaching the rear end (see Figure ). At this stage the bottom portion of the rear bulkhead is fitted with at least three horizontal beams being located into the shoring slot groove (see **Error! Reference source not found.**). The liner would be pulled up over the top of the false bulkhead whilst packing is completed. Packing continues to pack more or the bulk material through the space above the rear bulkhead. On completion the liner should be secured as described above and the top portion of the rear bulkhead is fitted (see Figure 46). Care must be taken that the fixings do not protrude into the cargo space and it is best practice for any fixing to be made from the interior, i.e. through the plywood bulkhead into the horizontal beam.

**Note:** The cargo shown in Figure is bulk lump sulphur and the liner should fully enclose the cargo to form a siftproof enclosure.

## Specific cargoes carried in liners - Hides and skins

Transporting hides in containers can cause a variety of problems for terminals and ships if the wet hides are improperly treated or inappropriately stowed. The problem of wet hides or sheep skins carried in CTUs is predominately due to the run-off of excess brine. If this liquid leaks at any stage between origin and destination costs are incurred for cleaning this liquid which can have an offensive odour and could possibly be deemed a health hazard. Leakage of liquid from the hides can also result in damage and degradation of the CTU. When the leakage comes into contact with the interior of the CTU it can cause permanent damage through corrosion of metal surfaces and rubber seals and contamination of timber floors. In addition, leakages of brine from CTUs onboard a vessel may contaminate CTU stowed adjacent to or underneath and corrode the ship's decks and fittings.

The risk of problems occurring when carrying hides are minimised when the CTU is properly prepared prior to packing and care exercised during the packing process. Prior to packing cargo preparation is essential and requires the container to be inspected, lined and an effective absorbent medium spread over the floor. By following the guidelines set out in this factsheet shippers/packers may be able to reduce their potential liability for damage.

The following are the common types of Hides/Skins being offered for transport:

### Wet Salted hides:

Wet salted hides and skins are a raw product, only temporarily saturated in a brine solution of salt water. This concentrated salt solution ensures protein destroying organisms cannot function. This process takes about 12-18 hours to "cure" (salt) the hides. However, they are an unstable organic material that may slowly degrade activity which can be accelerated by increasing temperature especially when sealed inside a shipping container. The raw hides and skins are covered in hair or wool and of course fat and blood with a fair share of insects and bacteria feeding on this food source. By its very nature salted hides and skins will purge the salty brine continually as the product ages.



Figure 47 Wet salted hides

### Wet Blue hides

These hides have already undergone vigorous cleaning processes which begin with the soaking of the hides in detergents, various chemical treatments and then several water cleaning treatments containing salts. All hair and fat and protein have been removed in the tanning process and the hides are chemically stable. Since any water is chemically bonded to the collagen proteins in the hides then during storage and transit this wet blue tanned leather does not deteriorate in quality and does not lose any moisture.



Figure 48 Wet blue hides

### Dry Salted / Air Dried hides

In this process the flesh side of the hide is covered with salt. After some time, excess salt is removed, and hide is then dried in the air. Since product contains no water no leakage should be expected. However condensed water released due to climate change might result in brine leakage.

Air dried hides which are properly dried and devoid of any wetness or dripping, and have a maximum moisture content of 10-15% may be shrink-wrapped and carried without sawdust absorbent material and, with the CTU Operators permission, without a liner.

## **Shipment / storage / usage**

Hides and skins are shipped in bales, bundles, casks, barrels, bags, loose or palletised in freight containers. Any animal hide or skin is of fibrous texture and from the moment of slaughter is liable to decomposition due to bacterial action. This decomposition is only completely stopped when the hide or skin is tanned but can be halted temporarily by salting and/or drying.

Hides are shipped as Wet-Salted (Brine-Cured), Dry-Salted and Dry. These methods of preservation are effective for fairly long periods, provided that the curing or drying has been satisfactorily carried out, and conditions of storage and transit have not caused the curing or drying to become ineffective. Climatic conditions at the time of preparation may have some bearing upon the condition and appearance at destination, e.g. , skins which have been salted and dried in the heat of the summer may tend to become somewhat overdried and although not damaged are liable to be broken or torn if roughly handled, more particularly in the case of a poor type of skin. Surveys should be called before the skins have been put to work and thereby lost their identity. The surveyor has a better opportunity of examining skins in the original bales and thus of ascertaining the cause and extent of the damage.

Salted skins once having been wetted will readily absorb moisture from the atmosphere. This may give rise to a wrong impression as to the length of time which has elapsed since wetting.

## **Heating**

Wet-salted hides are liable to decompose through heating if not adequately salted or if exposed to high temperatures in stowage or to a fairly high temperature for an extended period. Hides may be lightly cured to preserve them for short periods, or more thoroughly cured when they need to be transported over long distances. Hides stored under salt for a long period have a stale appearance and if deterioration has started to set in, the first indication will be looseness of the hair or 'hair slip'. In advanced cases this is accompanied by a smell of ammonia and obvious signs of decomposition. Hides already stale when shipped will lack resistance to adverse conditions during transit and may deteriorate when well-cured fresh hides would not be affected. 'Hair slip' may also arise in hides which have been subjected to heating, as the looseness of the hair is brought about by bacterial action. Red stains on the flesh side of the hides ('red heat') are also an indication of heating; in early stages this need not signify damage, but in more advanced stages will be accompanied by other signs of damage. When hides are seriously heated, the fibrous structure of the pelt will have been destroyed with serious results. 'Red Heat' may also be found in dry-salted hides and skins, but in this case the skins will usually have been wetted or have been damp at some time. It is the result of salt-loving bacteria which progressively break down the hide substance.

## **Wetting**

Hides and skins of all descriptions can be seriously damaged if wetted by fresh or salt water. The effects are more rapid on dry hides and skins than on salted, but the latter will become severely damaged if wetting has been sufficient to remove much of the salt. Wetting allows bacteria to thrive to the detriment of the pelt, and decomposition will be accentuated if the wetting is accompanied by heating, which is particularly liable to occur in press-packed bales. Salted hides and skins may absorb a certain amount of moisture from the humidity of the atmosphere, but this does not constitute damage, and normally does not affect the skins. Dry hides and skins may absorb moisture to a limited extent if the atmosphere is very humid; a slight mould will form on the surface of the skin. This may not be harmful, but much will depend on the degree of moistening and the length of time the skins have been in this condition. Wetting prior to shipment or from sweat during the voyage may produce similar effects. If skins have been packed damp, a mildewed condition may exist, but this will clearly be of an internal character inside bales, as distinct from the effects produced by external wetting. Dry and dry-salted hides and skins are not liable to sweat from inherent causes.

## **Holing**

Inferior quality hides are liable to develop holes due to a skin defect, and care should be taken not to attribute this holing to the use of hooks or other fortuitous cause. The skins concerned are usually those with a rough

surface, and careful examination of the holes will make it comparatively easy to determine whether this has arisen through the use of hooks or other fortuity, or whether it is a defect in the skin itself. When the hole is due to a defect, the surface immediately surrounding the hole is not usually as smooth as the remainder of the hide or skin. The skin may also suffer from blemishes which may eventually result in further holes. These holes and blemishes are usually accepted in the trade as being defects of the hide or skin itself.

### **Hides and Skins in CTUs**

Hides and skins may be carried palletised in freight containers. CTUs must be lined with plastic or other impervious material. Heating may occur if insufficient ventilation is provided. Packed CTUs should not be exposed to direct sunlight or heat as this will lead to heating and heavy damage. CTUs should be so stuffed as to allow adequate circulation of air.

**Contact with metal** - Contact with iron or copper can, if allied to moisture, lead to serious damage in a relatively short time.

**Treatment** - Where damage is not severe enough to warrant goods being classed as useless, damaged skins should be put into work immediately; discarded skins may be sold for glue manufacture. Unless water-damaged hides are dealt with promptly, damage will be considerably aggravated as the result of bales being left unopened or stored, decay in the skins advancing rapidly if air has no access to them.

### **Basils**

(Australian tanned Sheep and Lambskins) - Usually satisfactory cargo. Liable to damage from wetting. Damp packing very rare.

### **Goatskins**

**Dry Salted** – Mostly India. Usually well packed and prepared for shipment in press-packed bales. Most likely cause of damage is external wetting. May become mildewed internally if packed slightly damp under monsoon conditions.

**Shade Dried** – East and West African, etc. Usually well dried and prepared for shipment. Liable to heavy damage from wetting, slight wetting may cause considerable mildew. Mildew may also result from damp packing. Liable to worm damage.

**Wet Salted** – Mostly Indian – Packed in casks. Are liable to heavy damage from exposure to heat and heating. Similar troubles arise from improper salting before packing.

### **Lizard Skins**

Susceptible to heating which ‘cooks’ skins. These tear easily, rendering them useless.

### **Pickled Pelts**

Lamb and Sheep – Mostly shipped in casks. Liable to deterioration and damage if exposed to heat and water. Will also deteriorate if pickled unsatisfactory.

### **Rabbit Skins**

Improper curing can cause mould damage which is easily mistaken for damage due to contact with water or sweating in transit.



## **Raw Calfskins**

These are shipped dry, dry-salted and wet-salted. The same conditions apply as above, except that wet-salted skins are usually shipped in casks.

## **Raw Hides**

Dry Salted - Usually carry well but can be damaged by wetting. Sometimes absorb moisture during very humid weather, but this dampness may not result in damage.

**Shade Dried** – African, Ethiopian, Indian, etc. – Can deteriorate quickly after wetting by fresh or sea water. Dampening by rain before shipment may result in heavy mildew on bales or hides, not to be confused with similar mildew which may result from insufficient drying before packing. Liable to attack by worm or weevil (*Dermestes vulpinus*) which may be inherent or contracted in transit.

**Sun Dried** – Similar to above, usually more common types. May suffer from incorrect drying in too great heat. Wet Salted – Australian, New Zealand and South American – Freezer works and abattoir hides are usually well prepared for shipment. Can be damaged by wetting due to loss of salt content. Chief danger is from heating usually resulting from exposure to heat, faulty stowage, inadequate ventilation, or delays in transit. Damage may result from insufficient salting, but this is most unlikely with freezer works and abattoir hides.

## **Raw Sheepskins and Lambskins**

Australian, New Zealand, South African, South American – These are usually shade dried in abattoir conditions and shipped in press-packed bales. The chief cause of damage is wetting, but they can become heated and badly mildewed, or attacked by black mould, through damp packing. These skins are also subject to attack by worm or weevil which may be inherent or contracted during transit.

**Dry Salted** – Indian – Usually well packed and prepared for shipment in pres-packed bales. Most likely cause of damage is external wetting. May become mildewed internally if packed slightly damp under monsoon conditions.

**Dry Salted** – Red Sea Area – Most likely cause of damage is wetting from external causes.

**Dry Salted** – Australian, New Zealand, South African, etc. – Usually well prepared for shipment in bales. Chiefly subject to damage by water, but liable to absorb moisture during very humid conditions, which may be harmless but may give rise to red heat or black mould.

**Dry Raw Hair** – Arabian, Ethiopian, etc. – These are usually well prepared for shipment in bales with naphthalene and gammexane as protection against worm. They will deteriorate rapidly if wetted.

**Shade Dried** – East and West African, etc. – Usually well dried and prepared for shipment. Liable to heavy damage from wetting. Slight damage cause considerable mildew. Mildew may also result from damp packing. Liable to worm damage

**Wet Salted** – Indian – Packed in casks. Are liable to heavy damage from exposure to heat and heating. Similar troubles can arise from improper salting before packing.

## **Sheepskins and Goatskins, East India Tanned Hides**

Usually most satisfactory cargo but can be severely damaged by wetting and subsequent heating. May be packed damp during monsoon conditions, resulting in mildewed condition inside bales.

**Sheepskins and Goatskins, Semi-Tanned** Baghdad, Syrian etc. – As above but tend to deteriorate more rapidly after wetting. Contain salts used in manufacture which may attract moisture in very humid conditions.

**More information on hides**

Hides are normally only accepted in DRY CTU - The hides are only acceptable if they are shrink wrapped and the container is fitted with one of the approved hide Liner Bags and then only with ample use of absorbent sawdust on the floor. It is important that the liner is not cut in the container doorway to facilitate door opening/loading as once cut, the liner loses any liquid retaining ability when the container is handled/tilted. Shrink-wrapping is not sufficient.

Hide CTUs must not be stowed in the bays next to the accommodation, preferably they should be stowed in the foremost bays in rows close to outboard side but not over walkways.

All hide CTUs must be stowed on deck and must never be stowed on top of any reefer containers (live, NOR or empty). Hides may be stowed beside or under a live FROZEN REEFER or live CHILLED REEFER only with VENTS SHUT but may not be stowed beside or under a live CHILLED REEFER requiring ventilation.

Vessel masters must be presented with stow positions of on board hide CTUs at time of loading to enable pinpointing of leakage.

Leaking CTUs are not allowed to be loaded at all and should be returned to the shore at once.

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