1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

Scope:

Module1 - This part addresses the competencies on the following:

Plan and ensure safe loading, stowage, securing, care during voyage and unloading of cargoes

Objectives:

Module 1: Upon completion of this module, the candidate shall be able to:

a) Apply relevant international regulations, codes and standards concerning the safe handling, stowage, securing and transport of cargoes;
b) Recognize the unacceptable or unforeseen variation in the condition or specification of the cargo;
c) Keep hull stress within acceptable limits;
d) Plan and execute stowage and securing of cargoes on board ship.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.1 Effect on trim and stability caused by cargoes and cargo operations

Loading plan

While making a loading plan, the chief officer should take account of the factors listed below to make a safe and efficient loading plan and submit it to the Master for approval. Also before sailing port, the ships condition including stability, stress and draft, for port of departures and arrival calculation shall be confirmed by the Master.

Loadable quantity

Factors to be considered in determining the loadable quantity:

• Applicable load lines according to the zones and seasonal areas.
• The deadweight corresponding to the above and capacity of the vessel in volume.
• Stowage factor of the cargo to be loaded.
• Conditions of loading and discharging ports.
- Depths of water, permissible draft, under-keel clearance, specific gravity of sea water, tide, expected number of days in port.
• Sailing route.
Selection of sailing routes, depth and under-keel clearance of the route, sailing distance, speed, consumption (fuel, fresh water, etc.) during the voyage.
• Weights to be deducted from the deadweight
Fuel, fresh water (including boiler water and drinking water), constant, correction for hogging or sagging.
• Sequence of discharge for homogenous cargo or parcel cargo and number of load and discharge ports

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Note: This form is not applicable if the cargo to be loaded requires a declaration under the requirements of SOLAS 1974, chapter VII, regulation 5; MARPOL 73/78, Annex III, regulation 4; and the IMDG Code, General Introduction, section 9.

<table>
<tr><td>Shipper/consigner</td><td>Reference #</td></tr>
<tr><td>Consignee/reciever</td><td>Vessel</td></tr>
<tr><td>Load port</td><td rowspan="2">Instructions or other matters</td></tr>
<tr><td>Discharge port</td></tr>
<tr><td>General description of the cargo (type of material/particle size)*

*For solid bulk cargo</td><td>Gross mass (kg/tonnes)

o General cargo
o Cargo unit(s)
o Bulk cargo</td></tr>
<tr><td colspan="2">Specification of bulk cargo*
Stowage factor
Angle of repose
Trimming procedures
Chemical properties' if potential hazard

* If applicable
IMO class, UN No. or BC No. and EmS No.</td></tr>
<tr><td>Relevant special properties of the cargo</td><td>Additional certificate(s)*
o Certificate of moisture content and transportable moisture limit
o Weather certificate
o Exemption certificate
o Other (specify)
*if required</td></tr>
<tr><td>DECLARATION

I herby declare that the consignment is fully and accurately described and that the given test results and other specifications are correct to the best of my knowledge and belief and can be considered as representative for the cargo to be loaded</td><td>Name/status, company/organisation of signatory

Place and date

Signature on behalf of shipper</td></tr>
</table>

As an aid to paper documentation, Electronic Data Processing (EDP) or Electronic Data Interchange (EDI) techiques may be used.

This form meets the requirements of SOLAS 1974, chapter VI, regulation 2; the BC Code and the CSS Code.

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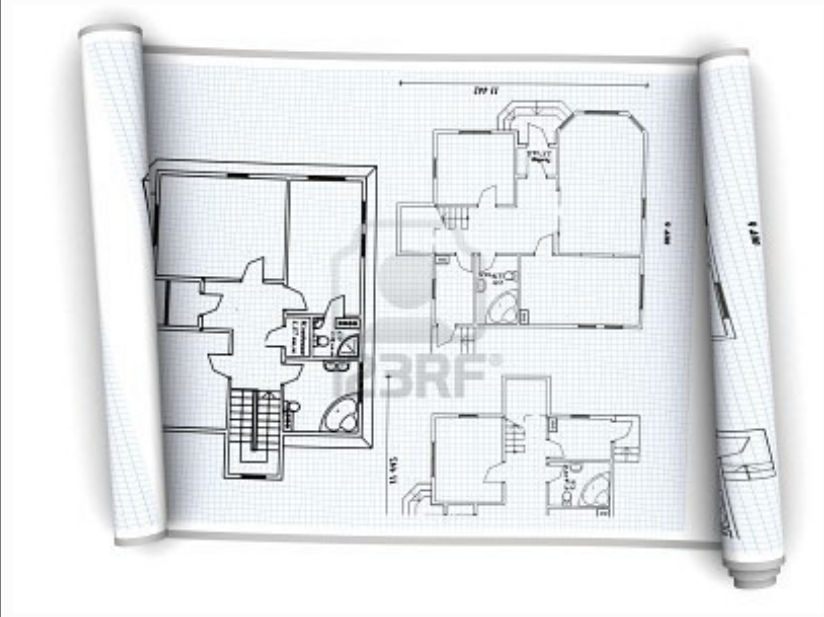
1.1 Effect on trim and stability caused by cargoes and cargo operations



Loading plan and stowage plan

• Cargo should be distributed to each hold.
Upon the completion of loading and upon entry into the discharging port, the ship should, in principle, be on an even keel or suitable trim, with such matters as the depth of water, permissible draft, etc. being taken into consideration.

• If the ship is to load more than two kind of cargo and expected to discharge at more than two port, with their discharging sequence being unknown in advance, the stowage should be made in such a manner not to hinder when her rotation of calling ports is changed.

• The sequence of loading cargo, the ship's conditions at each stage of should be checked. The de-ballasting rate should be adjusted for the loading rate.
Within the permissible hull strength and trim, the cargo loading operation should be planned to minimize the shifts of loaders. For efficient de-ballasting, the loading operation should be planned to trim the ship (by the stern) as mush as possible before commencing loading cargo into the final hold.

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1.2. Keep hull stress within acceptable limits

Hull strength

On the basis of the "Loading manual" and "Loading master" provided for the ship, calculations should be made of stresses to be imposed on respective parts of the hull upon completion of loading and during discharging to ensure that such stress is within the permissible range of safety. Also trim and draft are within the proper range. The result of each calculation shall be recorded for keeping.

Restrictions due to berth conditions

Depth and width of the fairways, depth alongside the berth, relations of the ship's draft and air-draft to the clear height and outreach of the loaders, etc.
The travelling distance, loading rate, and the number of loaders to be used.

Retention of stability

The ship's stability not only upon leaving port but also under all conditions anticipated to be experienced throughout the voyage should be calculated on the basis of the "Stability Booklet" provided for the ship.

Others

Since it is often the case that this interruption of cargo operation is not counted as laytime, it is important not only to enter port with an appropriate quantity of ballast but also to plan de-ballast operation in an efficient manner for the purpose of minimizing such time of interruption.

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Care of cargo during voyage

Ventilations

"Moisture damage" is the source of a significant number of cargo claims, often involving bagged or bulk agricultural products. Claimants typically allege that failure by the ship to ventilate correctly resulted in the development of condensation ("sweat"), causing the cargo to deteriorate.

However, it is also important to recognise that some commodities may have inherent moisture levels which exceed acceptable limits at the time of loading, making them biologically unstable. Such details may not be known to the ship, and prudent ventilation measures may be insufficient to prevent deterioration of the cargo on passage. Nevertheless, claimants may still argue that it was the fault of the ship and weak cargo stowage.

To defend cargo deterioration claims it is necessary for the vessel to produce records showing that customary ventilation routines were followed. Should the necessary evidence be missing or incomplete, it is often difficult for the Club to refute such assertions.

General

Ships are fitted with either natural or mechanical ventilation systems. In addition to minimizing the onset and degree of sweat, ventilation may also serve to remove taint and disperse any gases which some cargoes may emit.

The process requires close monitoring throughout the voyage as the moisture content of the cargo coupled with variations in air temperature, cargo temperature and sea temperature can dramatically influence the amounts of water vapour retained by and released into the air inside a hold.

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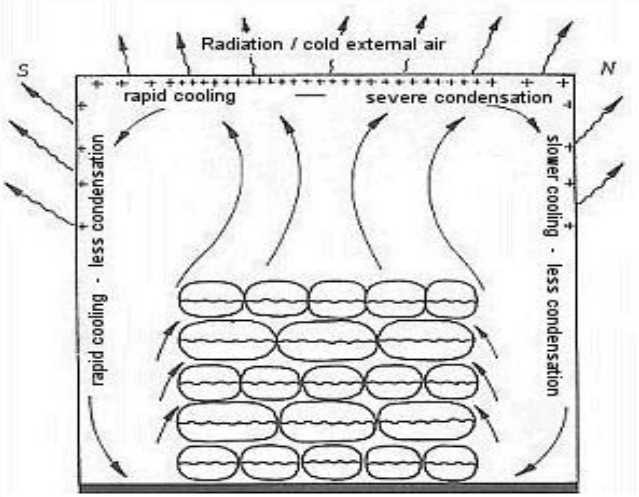

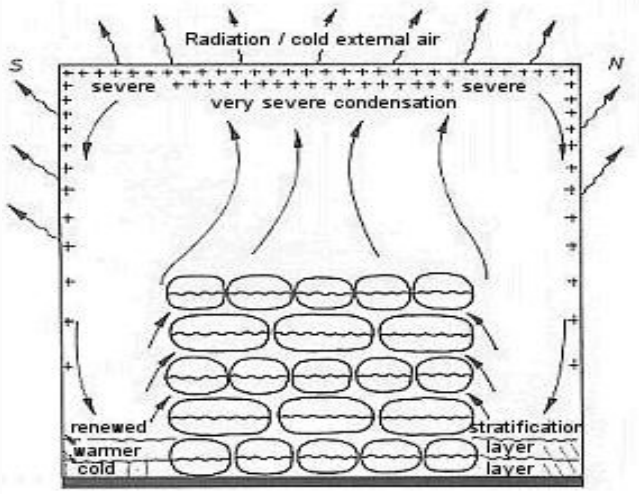

Cargoes at risk

Hygroscopic products

Hygroscopic products have a natural moisture content and are mainly of plant origin. They may retain, absorb or release water vapour, and excessive amounts of inherent moisture may lead to significant self-heating and "moisture migration" within the cargo resulting in caking, mildew or rot. Examples of hygroscopic products include grain, rice, flour, sugar, cotton, tobacco, cocoa, coffee and tea.

Non-hygroscopic products

Non-hygroscopic products have no water content. However, certain commodities (eg. steel) may be damaged if stowed in a moist environment, and others can be harmed if packaged using a hygroscopic material (eg. wood, paper).

Example can be shown by a vessel which carried a parcel of glass packed with layers of paper between each sheet. At the discharge port it was found that the paper had absorbed moisture from the air during the voyage, making it impossible for the glass sheets to be separated. The cargo was eventualy rejected by the receiver.

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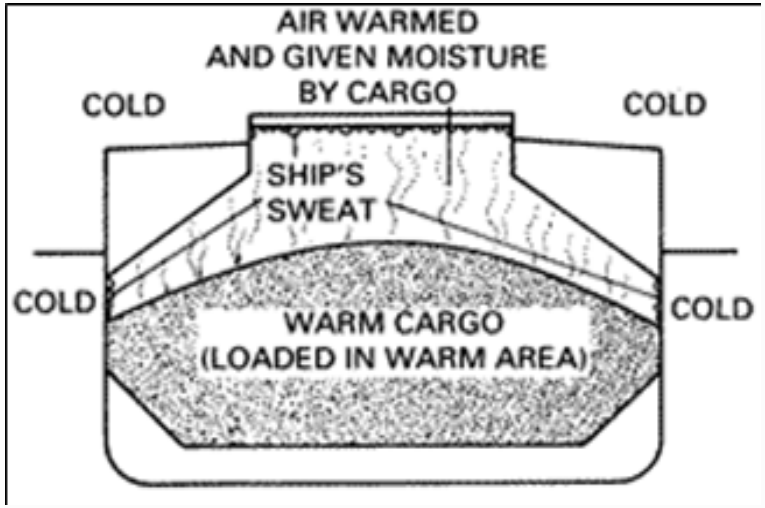

Types of sweat

Cargo sweat

Cargo sweat refers to condensation which may form on exposed surfaces of the stow as a consequence of large amounts of warm, moist air being persistently introduced into a hold containing substantially colder cargo.

Ship's sweat

Ship's sweat refers to condensation which forms directly on a vessel's structure when the air within a hold, made warm and moist by the cargo, comes into contact with cold surfaces as the vessel moves into cooler climates. Cargo may be damaged by overhead drips, by contact with sweat which has formed on the ship's sides or by condensed water which may accumulate at the bottom of the hold.

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Influencing factors

Saturation

The amount of water vapour that air may contain is highly dependent on its temperature. A given volume of air is said to be saturated when no more water can be absorbed. If the air temperature then falls, condensation will occur.

As air rises in temperature so does its saturation moisture content; its capacity to retain water climbs by ever-increasing amounts. Thus, when hot air is cooled, its potential for releasing water in the form of condensation is far greater when it is cooling from higher temperatures than when cooling from lower temperatures.

Apart from periods of fog or rain, ambient air is rarely saturated. Moreover, it will never be totally dry. Within these two extremes the amount of water retained by the air will vary according to the prevailing conditions.

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Relative humidity

Relative humidity is the actual amount of water vapour in the air compared with the saturation amount of water vapour in the air at the same temperature and pressure. The figure is usually expressed as a percentage, with saturated air having a relative humidity of 100%.

At main deck level, ambient sea air over the open oceans will normally have a relative humidity in excess of 80%.

Dewpoint temperature

When an isolated volume of air cools, relative humidity increases as the temperature falls. Once the temperature has descended to the level at which saturation occurs, water begins to condense. This temperature is known as the "dewpoint".

Dewpoint temperature may be measured by a variety of methods. Ships generally use a traditional wet and dry bulb arrangement consisting of two identical mercury thermometers, one of which has a damp wick covering the bulb. These are normally housed in a protective marine screen.

The dewpoint temperature may then be determined by using a "Dewpoint Table". This is important when considering cargo ventilation requirements.

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Wet and dry bulb thermometers

When using traditional wet and dry bulb thermometers, the accuracy of the dew point temperature will depend on the condition of the equipment. The muslin covering the wet bulb should be clean, the water in the reservoir should be distilled and the bulb itself should be wet.

In order to ensure that the readings are correct, the device should always be positioned clear of any exhaust vents, other draughts and all sources of heat.

Dewpoint measurment

Theoretically, all decisions regarding cargo ventilation should be based on dewpoint temperatures, comparing the dewpoint of the ambient air with dewpoint of the air inside the hold.

Given that most ships are customarily equipped with wet and dry bulb thermometers located close to the bridge, determining the dewpoint temperature of the ambient air is usually straightforward.

However, ascertaining the dewpoint temperature inside a cargo space is more problematic. One of the simplest methods is to use a "whirling psychrometer", swinging the instrument inside the hold until the wet bulb temperature has stopped falling and remains steady.

All readings should be taken well away from any air inlets, ensuring that only hold air is tested. Enclosed space entry procedures should always be observed.

If access to the holds is impossible or undesirable, and provided there is no significant air flow, wet and dry bulb thermometers may be placed in the trunking of an exhaust ventilator or similar pipework leading from the compartment, allowing the device to be drawn out and read from above deck.

Ventilation

Once the above information has been obtained, the rules are simple;

Dewpoint rule

- Ventilate - if the dewpoint of the air inside the hold is higher than the dewpoint of the air outside the hold.
- Do not ventilate - if the dewpoint of the air inside the hold is lower than the dewpoint of the air outside the hold.

Three degree rule

In many instances it is impracticable to measure hold dewpoint temperatures accurately, or at all.

In such cases ventilation requirements may be estimated by comparing the average cargo temperature at the time of loading with the outside air temperature several times a day. Ventilation may then be carried out on the following basis:

- Ventilate - if the dry bulb temperature of the outside air is at least 3°C cooler than the average cargo temperature at the time of loading.
- Do not ventilate - if the dry bulb temperature of the outside air less than 3°C cooler than the average cargo temperature at the time of loading, or warmer.

In order to apply the three degree rule, it will be necessary for the ship's staff to take a number of cargo temperature readings during loading.

Further observations

During periods of heavy weather, steps should be taken to prevent rain and spray from entering the cargo spaces. This may mean suspending ventilation until conditions improve. If so, the circumstances should be logged.

It is important to appreciate that ventilation should also be carried out during the night if the readings indicate that ventilation is appropriate. Ambient temperatures are usually lower at night, therefore the risk of ship's sweat developing is more likely during the hours of darkness.

In addition to ventilating the holds according to the above regimes, it is important that regular inspections of each compartment are carried out where possible. This need not involve entry into the cargo space itself - for example ship's sweat may be seen forming on the underside of manhole covers. In such instances, and especially at night, the cargo should be ventilated irrespective of the dewpoint or three degree rules, weather permitting.

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What to expect

In broad terms it is often possible to estimate ventilation requirements in advance by considering the climatic changes likely to be encountered during the voyage. The following examples indicate what may be expected on passage, but do not obviate the need for detailed monitoring and recording;

Hygroscopic cargo - cold to warm climate

If a stable cold cargo is carried to a warm climate, ventilation will always be unnecessary. Indeed, in some circumstances ventilation may lead to cargo damage.

Hygroscopic cargo - warm to cold climate

Vigorous surface ventilation of the cargo spaces will almost certainly be required due to the likelihood of ship's sweat developing.

Non-hygroscopic cargo - cold to warm climate

Ventilation is never required. Cargo sweat is liable to occur if warm moist air comes into contact with cold cargo. Therefore holds should usually remain sealed to allow the cargo and internal air to warm gradually during the voyage.

Non-hygroscopic cargo - warm to cold climate

Ventilation is largely irrelevant. Development of significant ship's sweat is very unlikely.

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Combined cargoes

Problems may arise if hygroscopic and non-hygroscopic cargoes with different inherent temperatures are loaded into the same compartment. Their ventilation requirements may differ, resulting in damage to one or other of the products in spite of normal routines being followed. As far as possible, hygroscopic and non-hygroscopic cargoes should not be stowed together.

Stowage

Given the sensitive nature of many hygroscopic products and the possibility of sweat, efforts should be made to ensure that such cargoes do not come into contact with hold steelwork. This is particularly important in the case of bagged agricultural produce intended for human consumption such as rice, beans and flour.

For bagged cargo, rows of dunnage or bamboo poles should be laid in the direction of the bilges to aid drainage, not more than 20 centimetres apart. A second layer should be placed on top at right angles to the first before covering the whole area with matting.

If the cargo space is not fully fitted with cargo battens, bamboo poles or dunnage should be positioned crosswise against the frames to keep the bags away from the sides of the ship. Ideally, they should also be lashed together at the intersections to prevent them from becoming disturbed during loading. As an extra but not essential precaution, mats may be placed against this arrangement. In the same context, the top surface of the stow may be covered with thick kraft paper.
Expert opinion is now that biologically stable bagged hygroscopic cargoes do not require ventilation channels, unless specifically demanded by the IMDG Code (eg some types of seed cake, fishmeal). Nevertheless, for certain commodities many charterers still require ventilation
channels to be built into the stow. If so, the charterers should be asked for written instructions regarding the number and position of such channels, and these should be followed accordingly.

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Bunker tanks

Hygroscopic products may be damaged by localised sources of heat. Incidents have occurred where parts of parcels of grain have been scorched or have become discoloured when lying against hot bunker tanks. As far as possible, the bunkers used during the voyage should be drawn from tanks situated well away from holds containing hygroscopic products. If impracticable, bunker tanks adjoining cargo spaces should be heated only when required, ensuring that the temperature does not rise above normal operational levels.

Records

Ventilation records are crucial. In the event of moisture damage, evidence showing that the vessel ventilated correctly may be instrumental in defending any ensuing claims.

If the dewpoint rule has been followed, wet and dry bulb temperatures and dewpoints should be logged once per watch, bearing in mind that these may change considerably over a short period. For the same reason, the sea temperature should also be noted. This information should be recorded for each hold together with the times of commencing, ceasing or resuming ventilation, and the reasons for doing so.

If the three degree rule has been followed, a record should be kept of the ambient air temperature and the sea temperature once per watch together the average temperature of the cargo at the time of loading. Once again, ventilation details should be documented for each hold.

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Proper lashing and securing of cargo is very important to prevent shifting during the voyage.

The proper stowage and securing of cargoes is of the utmost importance for the safety of life at sea.

Improper stowage and securing of cargoes has resulted in numerous serious ship casualties and caused injury and loss of life, not only at sea but also during loading and discharge.

Working cargo

- Safety arrangements prior to working cargo should ensure that adequate and suitable lifting plant is available, in accordance with the register of lifting appliances and cargo gear, and that all plant and equipment, and any special gear necessary is available and used. Cargo gear should be checked regularly throughout the cargo operation for damage or malfunction.

- Repair or maintenance work, such as chipping, spray painting, shot-blasting or welding, should not be undertaken in a space where cargo operations are in progress, if such work could create a hazard to personnel working in the space.

- Loads being lowered or hoisted should not pass or remain over any person engaged in any work in the cargo space area, or over means of access. Personnel should take care when using access ladders in hatch squares whilst cargo operations are in progress.

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- Cargo information for goods should always provide the gross mass of the cargo or of the cargo units. Where loads of significant gross mass are not marked with their weight, the loads should be check-weighed unless accurate information is available as provided by the shipper or packer of the goods.

- A signaller should always be employed at a hatchway when cargo is being worked unless the crane driver or winchman has a complete unrestricted view of the load or total working area. The signaller should be in a position where he has a total view of the operation, where this is not possible then additional signallers should be used to assist.

- Before giving a signal to hoist, the signaller should receive clearance from the person making up the load that it is secure, and should ascertain that no one else would be endangered by the hoist. Before giving the signal to lower, he should warn personnel in the way and ensure all are clear.

- Hooks, slings and other gear should not be loaded beyond their safe working loads. Strops and slings should be of sufficient size and length to enable them to be used safely and be so applied and pulled sufficiently tight to prevent the load or any part of the load from slipping and falling. Loads (sets) should be properly put together and properly slung before they are hoisted or lowered.

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- Before any heavy load is swung, it should be given a trial lift in order to test the effectiveness of the slinging.

- Except for the purpose of breaking out or making up slings, lifting hooks should not be attached to:
(a) the bands, strops or other fastenings of packages of cargo, unless these fastenings have been specifically provided for lifting purposes;
(b) the rims (chines) of barrels or drums for lifting purposes, unless the construction or condition of the barrels or drums is such as to permit lifting to be done safely with properly designed and constructed can hooks.

- Suitable precautions, such as the use of packing or chafing pieces, should be taken to prevent chains, wire and fibre ropes from being damaged by the sharp edges of loads.

- When slings are used with barrel hooks or other similar holding devices where the weight of the load holds the hooks in place, the sling should be led down through the egg or eye link and through the eye of each hook in turn so that the horizontal part of the sling draws the hooks together.

- The angle between the legs of the slings should not normally exceed 90°, as this reduces the safe working load of the sling. Where this is not reasonably practicable, the angle may be increased up to 120° provided that the slings have been designed to work at the greater angles. However it should be noted that at 120°, each sling leg is taking stress equivalent to the whole mass of the load.

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- Trays and pallets (unit loads) should be hoisted with four-legged slings and where necessary, nets and other means should be used to prevent any part of the load falling.

- Bundles of long metal goods such as tubes, pipes and rails, should be slung with two slings or strops and, where necessary, a spreader. A suitable lanyard should also be attached, where necessary.

-Logs should be loaded or discharged using wire rope slings of adequate size; tongs should not be used except to break out loads.

- Cargo buckets, tubs and similar appliances should be carefully fitted so that there is no risk of the contents falling out and be securely attached to the hoist (for example, by a shackle) to prevent tipping and displacement during hoisting and lowering.

- Shackles should be used for slinging thick sheet metal, if there are suitable holes in the material; otherwise suitable clamps on an endless sling should be used.

- Loose goods such as small parcels, carboys, small drums etc should be loaded or discharged in suitable boxes or pallets with sufficiently high sides, and lifted using four-legged slings.

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Carriage of cargo on deck

- The safe securing of all deck cargoes should be checked by a competent person before the vessel proceeds on passage. The master is responsible for ensuring that it is correctly stowed and adequately secured for the intended voyage. Areas on the deck which are not to be used for cargo stowage should be clearly marked or otherwise indicated.

- To aid unloading at sea to be carried out safely, independent cargo units should, as far as practicable, be individually lashed. Where it is not practical to lash individual pieces of cargo, then groups of lifts intended for the same delivery location should be secured together. Lashings should, where practicable, be of a type that can be easily released and maintained.

- All lashings should be checked at least once during each watch whilst at sea. Personnel engaged in the operation should be closely supervised from the bridge, particularly in adverse weather conditions. At night in bad weather, an Aldis lamp or searchlight should be used to aid remote checking of lashings to avoid placing personnel at risk.

- Where fitted, pipe posts to restrain the movement of tubulars should be used.

- Discarded rope and damaged and unserviceable equipment and cargo should not be jettisoned at sea but retained for disposal ashore. Such materials and articles can foul propellers or cause damage to fishing gear.

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Lifting, hauling and towing gear

- All mixed and running gear should be carefully maintained in good order and regularly inspected to detect wear, damage and corrosion. More frequent inspections should be made where gear has had hard use or is much exposed to sea and weather.

- In all operations which may impose large loads or shock strains upon the gear, precautions should be taken against sudden failure which may cause injury to personnel. As far as practicable, the system should be so defined that the weakest element is at a point where failure is likely to cause least danger.

- While gear is under load, personnel essential for the operation should keep in protected positions to the greatest practicable extent. Others not engaged in the operations should keep clear of the working area.

- The master should pre-plan his approach to the installation with the vessel set up prior to the final approach to take account of the prevailing wind and tide etc.

- In the event that it is necessary to drop anchor personnel should never stand forward of the windlass when letting go anchors at the installation. This is particularly important in vessels of this type because of the length of the chain and the loads thus imposed. Care should be taken when stowing the anchor cable in the locker.

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Securing of cargo

- Securing operations should be completed before the ship proceeds to sea.

- Within the constraints laid down in the approved cargo securing manual, the master has the authority to decide on the application of securings and lashings and the suitability of the vehicles to be carried. In making this decision due regard shall be given to the principles of good seamanship, experience in stowage, good practice and the IMO Code for Cargo Stowage and Securing (CSS Code).

- Personnel appointed to carry out the task of securing vehicles should be trained in the use of the equipment to be used and in the most effective methods for securing different types of vehicles.

- Securing operations should be supervised by competent personnel who are conversant with the contents of the Cargo Securing Manual. Freight vehicles of more than 3.5 tonnes should be secured in all circumstances where the expected conditions for the intended voyage are such that movement of the vehicles relative to the ship could be expected.

- During the voyage the lashings should be regularly inspected to ensure that vehicles remain safely secured. Personnel inspecting vehicle spaces during a voyage should exercise caution in order to avoid being injured by moving or swaying vehicles. If necessary, the ship's course should be altered to reduce movement or dangerous sway when lashings are being adjusted. The officer of the watch should always be notified when an inspection of the vehicle deck is being made.

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- When wheel chocks are being used to restrain a semi-trailer they should remain in place until the semi-trailer is properly secured to the semi¬trailer towing vehicle.

- No attempt should be made to secure a vehicle until it is parked, the brakes, where applicable, have been applied and the engine has been switched off.

- When vehicles are being stowed on an inclined deck, the wheels should be chocked before lashing commences.
• The tug driver should not leave the cab to disconnect or connect the trailer brake lines. A second person should do this.
• The parking brake on the tug should be engaged and in good working condition.
• As well as wheel chocks, at least two lashings holding the unit against the incline should be left in place until the trailer's braking system is charged and operating correctly.

- Where personnel are working in shadow areas or have to go under vehicles to secure lashings, hand lamps and torches should be available for use.

- Personnel engaged in the securing of vehicles should take care to avoid injury from projections on the underside of the vehicles.

- Wherever possible, lashings should be attached to specially designed securing points on vehicles, and only one lashing should be attached to any one aperture, loop or lashing ring at each securing point.

- When tightening lashings, care should be exercised to ensure that they are securely attached to the deck and to the securing points of the vehicle.

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- Hooks and other devices which are used for attaching a lashing to a securing point should be applied in a manner which prevents them from becoming detached if the lashing slackens during the voyage.

- Lashings should be so attached that, provided there is safe access, it is possible to tighten them if they become slack.

- Lashings on a vehicle should be under equal tension.

- Where practicable, the arrangement of lashings on both sides of a vehicle should be the same, and angled to provide some fore and aft restraint, with an equal number pulling forward as are pulling aft.

- The lashings are most effective on a vehicle when they make an angle with the deck of between 30 and 60 degrees. When these optimum angles cannot be achieved additional lashings may be required.

- Crossed lashings should, where practicable, not be used for securing freight vehicles because this arrangement provides no restraint against tipping over at moderate angles of roll of the ship. Lashings should pass from a securing point on the vehicle to a deck securing point adjacent to the same side of the vehicle. Where there is concern about the possibility of low co-efficients of friction on vehicles such as solid wheeled
trailers, additional crossed lashings may be used to restrain sliding. The use of rubber mats should be considered.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

- Lashings should not be released for unloading before the ship is secured at the berth, without the Master's express permission.

- Personnel should release lashings with care to reduce the risk of injury when the tension is released.

- To avoid being damaged during loading and unloading all unused securing equipment should be kept clear of moving vehicles on the vehicle deck.

- A competent appointed person should inspect securing equipment to ensure that it is in sound condition at least once every six months and on any occasion when it is suspected that lashings have experienced loads above those predicted for the voyage. Defective equipment should be taken out of service and placed where it cannot be used inadvertently. Unused lashing equipment should be securely stowed away from the vehicle deck.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Preparing the cargo

An intermodal container is essentially a ship's hold on a reduced scale. When the containers are placed aboard ship for an ocean voyage, the cargo stowed in them is subject to the same forces and damage hazards while at sea that affect cargo shipped in break-bulk fashion.
The same principles and techniques that govern export packing and cargo stowage of break-bulk shipments are equally valid when preparing cargo for intermodal shipment.

Pack for the toughest leg of the journey!

Refer to the Basic Packing Guide section of this booklet for guidance in selection of packaging.
Be certain that goods cannot move within the fiberboard box, wood crate or other shipping package. Immobilize the contents by blocking or bracing and/or providing adequate cushioning.
Fiberboard boxes or wood crates have to be able to withstand the weight of cargo stacked up to an 8-foot height. They must be able to survive lateral pressures exerted by adjacent cargo—up to 70 percent of the vertical stacking weight pressure. This will help to prevent crushing as the container leans (up to 45°) during handling or at sea.
Heavy items, machinery and cargo not uniform in shape or dimension should be crated, boxed and/or provided with skids to permit ease of handling and compact stowage.
Where possible, cargo should be unitized or palletized. Cargo handlers are then required to use mechanical handling equipment to move cargo. Use ofdesiccants (moisture-absorbing materials), moisture or vapor barrier paper, plastic wraps, sheets or shrouds will protect cargo from water contact or condensate damage. Corrosion susceptible machine parts should be coated with a preservative or rust inhibitor.

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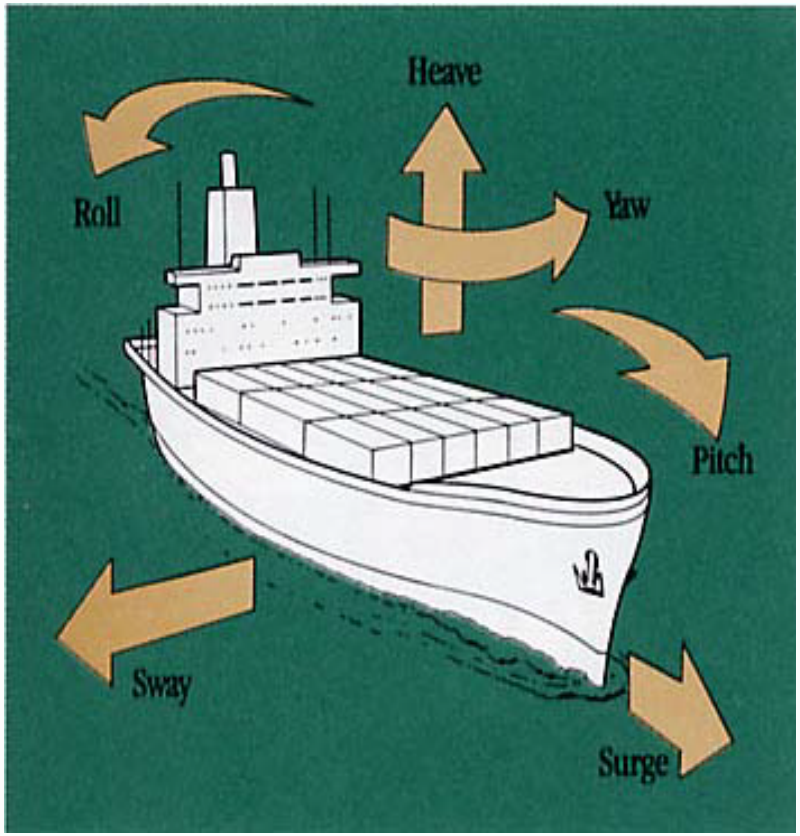
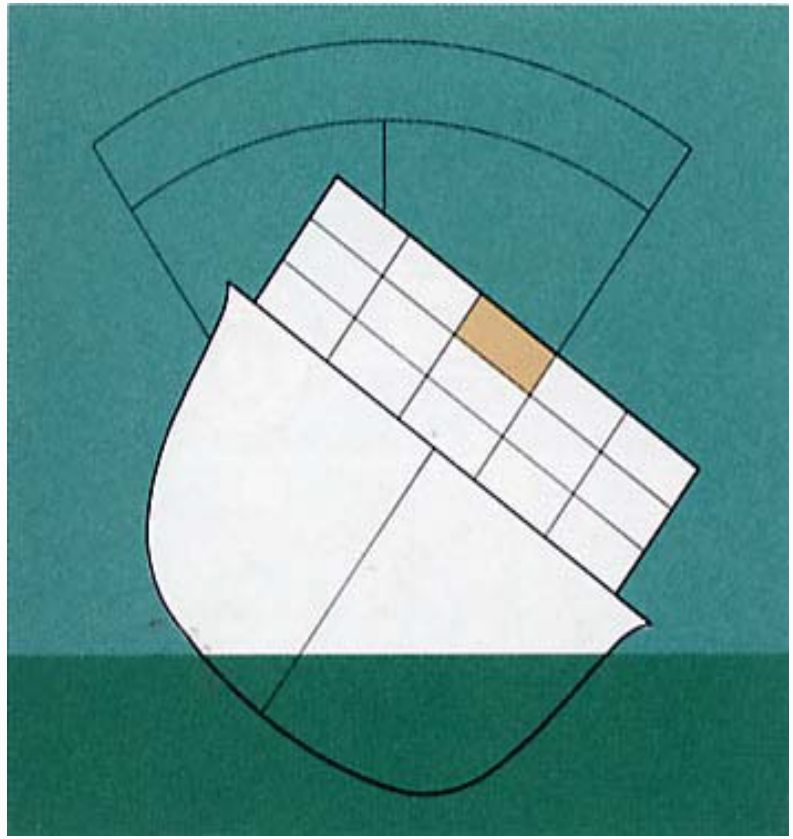
1.3. Stowage and securing of cargoes on board ships



A ship at sea may move in six different directions.



This container my travel 70 feet with each complete roll; as often as 7 to 10 times per minute

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Plan the stow

Observe weight limitations

Do not exceed rated capacity of package or intermodal container. Do not exceed permissible weight concentrations per square foot of floor load. Check highway weight-axle limitations on both sides of the ocean voyage because some containers have total capacities that exceed local limits.

Avoid mixing incompatible cargo

Cargo that emits odor or moisture should not be stowed with cargo susceptible to tainting or water damage. Items with sharp projections or awkward shapes should be segregated from other cargo by boxing, crating, padding or use of partitions. Cargo subject to leakage or spillage should not be stowed on top of other cargo.

Observe hazardous material/dangerous goods regulations

Consult with carrier/or regulations and restrictions regarding shipment of:

- combustibles
- explosives
- flammable liquids
- flammable solids
- gaseous materials
- radioactive materials
- magnetized materials
- spontaneous combustible materials
- corrosives
- poisons
- oxidizers
- infectious substances
- etiologic agents

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1.3. Stowage and securing of cargoes on board ships

After receiving information from carrier, proceed as follows:

Label and mark hazardous material/dangerous goods properly. Place warning placards on the containers' exterior. Note that placards vary throughout the world. What is acceptable at origin may not be in compliance with enroute or destination countries' regulations. Check before shipment to avoid embargo or delay.
Record the nature of the cargo on all shipping documents.

Have all cargo and materials ready before stowage begins

Planning ahead facilitates proper placement, stacking and weight distribution. Additionally, it precludes removal of cargo already stowed to accommodate unexpected items, and permits installation of blocking, bracing and filling of voids as stowing operations progress.

Plan for ease of unloading

Stow cargo in reverse order of desired cargo discharge. Be sure that cargo for multiple consignees is physically separated by partitions, dividers or other suitable means. Make sure that forklift openings in pallets or skids face doors.
Fill any voids, but avoid wedging or jamming cargo in container.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Cosmetic damage

The exterior packing of your commodity is often the first representative the consignee sees of your company. A package showing exterior damage, although per-haps only cosmetic in nature, can cause loss of market, poor shipper/consignee relationships and more importantly cause the goods to be rejected and/or not be paid for even though the contents may arrive without damage.
Repackaging commodities can be very costly as well as time consuming. Remem-ber, the appearance of your product is in many cases as important as the product itself.

Stowing the cargo

Fiberboard boxes

Fiberboard boxes containing tightly packed, dense items that support sides and ends of the box are stowed using the "bonded block" method. Fiberboard boxes containing lightweight or fragile items that provide little or no support to the box surfaces are stowed by stacking directly one atop the other. This method takes advantage of the vertical rigidity of the side walls and corrugations in each box.
Use plywood or lumber dunnage or fiberboard dividers as auxiliary decking sheets to segregate tiers of different sized fiberboard containers.
Provide plastic or water-repellent shrouds over top and sides of load to protect against damage from water (ship's sweat or leaking containers).
Use dunnage or pallets on the container floor to elevate the cargo and allow drainage should water ingress.
Fill all voids by bracing or using fillers to prevent sliding or shifting of cargo. Fill end voids to prevent sliding or shifting of cargo.

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1.3. Stowage and securing of cargoes on board ships

Use of retaining paper

Use rough paper between stowage blocks of fiberboard containers with smooth ex-teriors to prevent sliding or shifting.

Lumber

Should be clean and dry (not above 19 percent moisture content).

1. Use suitable hardwoods as filler, deck-ing, blocking, bracing and for constructing partitions/dividers.
2. Most common sizes used are nominal 2" X 4" and 4" x 4". Should be free of significant splits or knots.

Plywood

1. Use for partition faces, dividers, auxil-iary decking and blocking in limited spaces.
2. Should be clean and dry.

Inflatable

Available in paper, fabric, rubber or plas-tic; in both reusable and disposable forms. A check for sharp edges and/or protru-sions must be made to avoid punctures. Use it for filling voids; light and medium duty bracing.

Patented Systems

Various patented cargo control and dun-nage systems are available. Pre-built parti-tions, shelves, straps, laminated linerboard bulkheads and dunnage bars facilitate stowage and securing of cargo.

Fiberboard

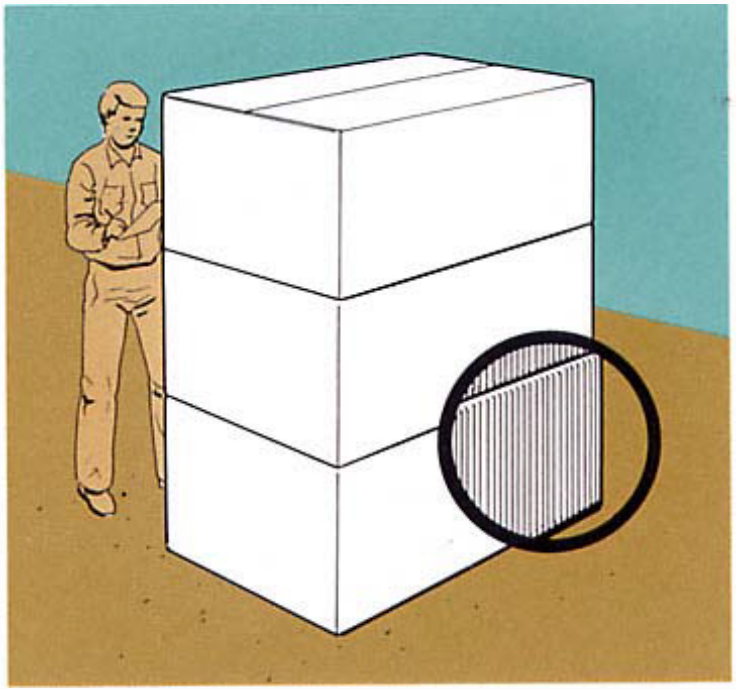
Available in sheets, rolls and in prescored structural shapes. Use sheet for dividers, decks, partition facings and auxiliary decks. Use rolled fiberboard sheets (solid or corrugated) for linings or facings and for filling voids.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

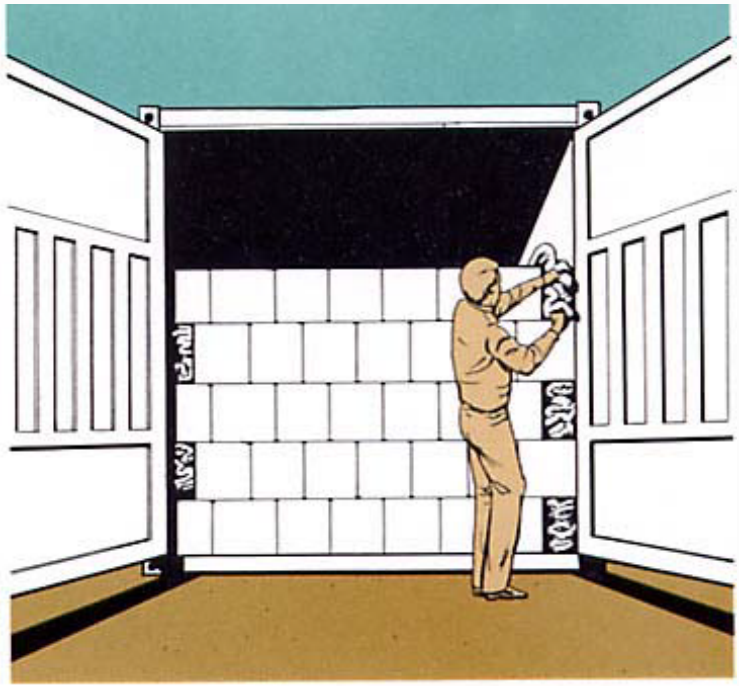
1.3. Stowage and securing of cargoes on board ships

Strapping

Heavy duty metal strapping is used to separate cargo units and for securing heavy or awkward items. Nonmetallic strapping is used for light-weight cargo and has only a fraction of the strength of similar steel material. It would not resist shearing on a sharp edge, and will stretch as much as 9 percent. Metal and plastic straps must be firmly anchored and properly tensioned.



Vertical positioning of corrugated flutes provides best support for stacking



Fill side and end voids to prevent movement of cargo.

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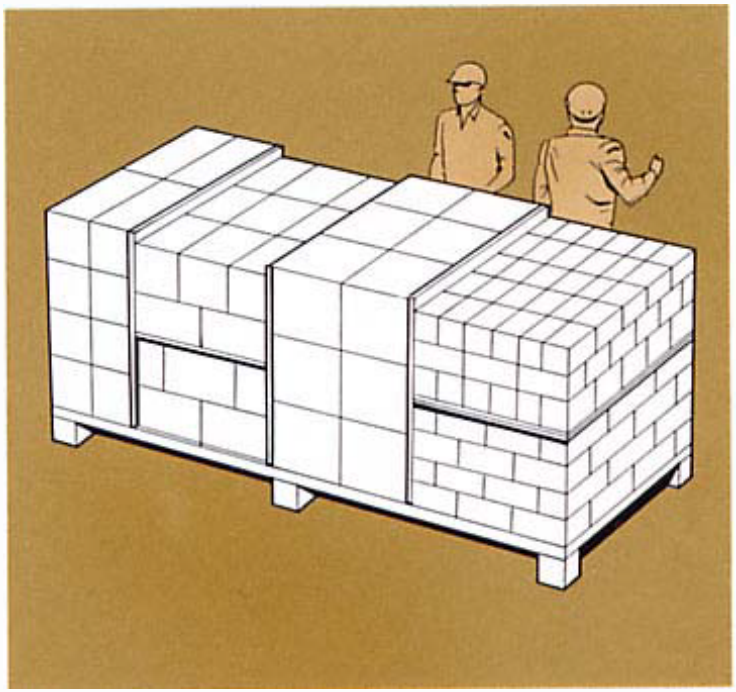

Use of dividers and auxiliary decks to segregate cargo by type, size or destination.

When stacking directly on top of lower boxes, keep voids at the center and immobilize by constructing partitions or inserting inflatable securing materials.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Wood crates

Wood Boxes and Crates

Crates of uniform size and weight should be stacked directly one on another.
Separate groups of crates with different weights or dimensions by use of partitions, dividers or auxiliary decking.
Fill voids at top, sides or ends by use of partitions or fillers.
If large voids are present, block, brace and tie down cargo to prevent movement in any direction.
When bracing crates, apply bracing to strength members only, not to panels or sheathing.

Machinery or Heavy Items

Distribute weight by proper placement and use of cradles or skids.
Use deck cleats and bracing to prevent lateral and fore-and-aft movement. Use metal strapping to prevent vertical movement.
Extremely heavy dense items should be properly secured to the container floor. Consult with carrier or container leasing operator for approved method(s).
Top-heavy items should be shored and braced to prevent toppling. Do not brace against the side panels of the container. All bracing must bear on a structural member of the container. Diagonally positioned bracing to the container floor is preferable for cargo that is top heavy.
Provide plastic or water-repellent paper.

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1.3. Stowage and securing of cargoes on board ships

Bags, Sacks and Bales

Use "crosstier" method of stacking bags and sacks. (Refer to illustration.)
Use sufficient dunnage layer on con-tainer floor to provide for condensate drainage.
Separate bags, sacks and bales from other cargo by using partitions.
When stowing bales, provide dividers be-tween rows and tiers to prevent chafing and friction between metal bands or strapping.

Liquid Cargo (Drums)

Drums of liquid cargo should be sepa-rated from other cargo by use of parti-tions. Use adequate dunnage between tiers of drums to provide a level flooring surface for
stacking.
Drums containing liquids should be floor loaded. The drums should be stowed on end with filler holes up as opposed to on their "rounds." Use dividers to protect drum rims from chafing damage.

Completing the stow

Isolate cargo from container! Jrailer/railcar doors — construct partition across rear of stowed cargo to prevent it from contacting doors and falling out when doors are opened.
Provide water damage protection — cover cargo adjacent to doors with plastic or waterproof paper sheets to protect cargo from possible water ingress via door gaskets.
Close and seal doors — be sure all locking cams are engaged. Affix locks and seals (on units with side and end doors — be certain to check both). Record seal number and enter on shipping documents.

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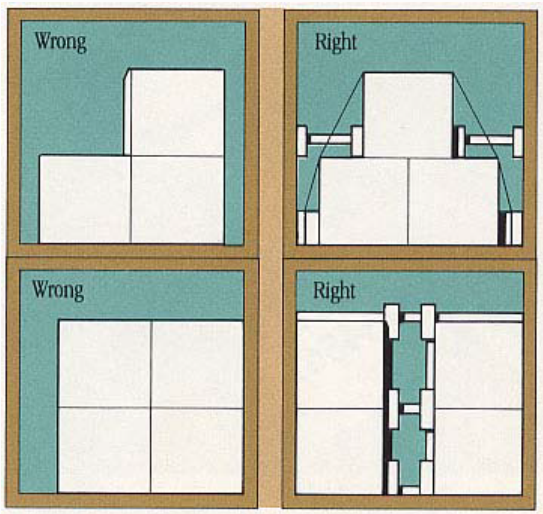
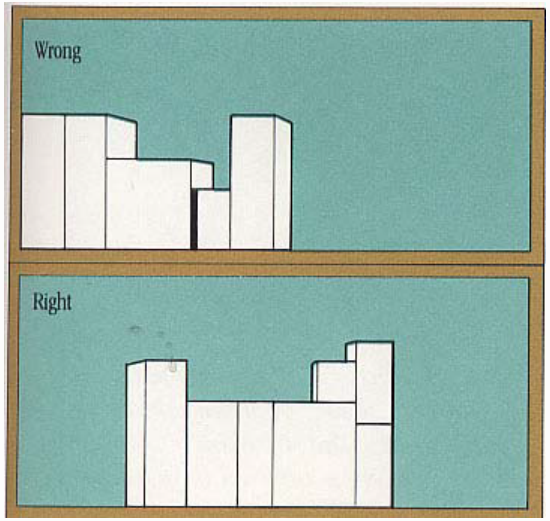
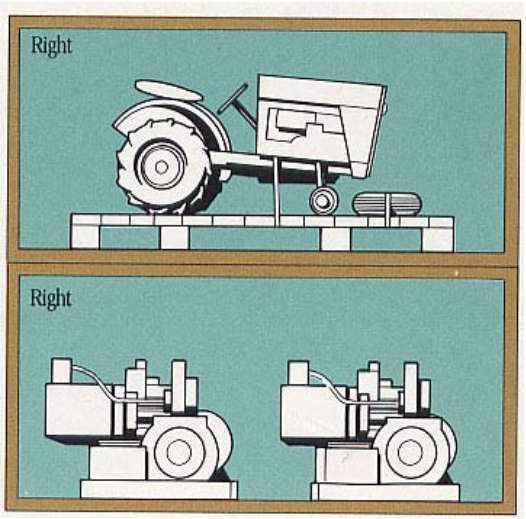
1.3. Stowage and securing of cargoes on board ships





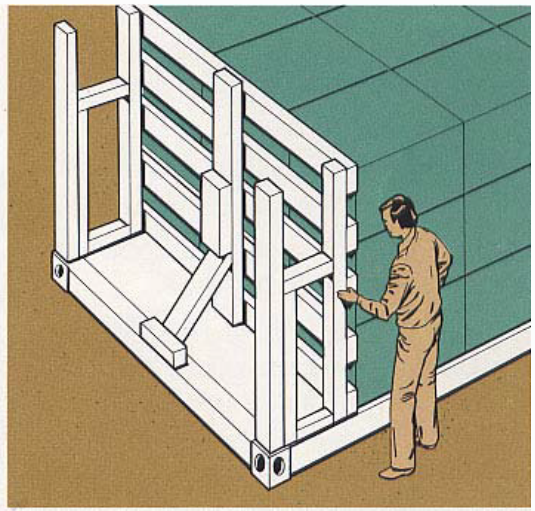


Weight distribution – heavy loads

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Bags and sacks "crosstier" loading



Bracing the completed load to prevent movement aft

Using palettes to store drums

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Cargo security seals

As previously noted, once loaded, all in-termodal and air cargo containers, trailers and railcars should be sealed. The particulars of a shipment, namely product type, value, marketability, susceptibility and routing/destination should be considered prior to seal selection. The most popular seal, usually constructed of polypropylene or galvanized tin plate can be breached and, even re-fitted, with basic tools. Stronger heavy duty cable seals or high security seal locks offer additional protection as they generally deter all but the most determined thief. In addition to de-terring physical entry of the container, trailer or railcar, other desirable properties of seals include:

- Unique and clearly visible identity.
- Corrosion — resistance especially for those containers destined for ocean carriage.
- Tamper-proofing so that it is impossible to re-fit.
- Strong enough to withstand accidental damage during handling/transit.

Technology has allowed for several sophisticated variations on these themes. Today, a shipper can choose from several seal types. There are bar-coded seals that enable automatic recording of seal num-bers, indicator seals that release a bright dye into a transparent casing that is clearly visible from considerable distances and, at least, one manufacturer has developed a seal consisting of randomly set acrylic op-tical fibers jacketed in a high impact plas-tic body. These seals each have a unique "fingerprint" that can be verified by a specially designed camera.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.3. Stowage and securing of cargoes on board ships

Regardless of the type seal used, its value is compromised if application is not properly supervised and it is not inspected at regular intervals during transit. Effectiveness is also only as good as the controls maintained over seal inventory. Seals should be stored in a controlled area and released to as few people as practical. A log indicating to whom seals identified by number, have been released, is a necessary control measure.

Through the years, the function of a seal has been to reveal evidence of entry. Given time, opportunity, and, in some cases, tools all can be defeated. Also, hi-jacking, the stealing of the entire trailer or container and contents, is a real potential (with seals serving only to inconvenience the perpetrator). In fact, in some areas of Africa, South America and Southern Europe, this is becoming a major concern.

Aside from compliance with proven in-transit security procedures such as direct routing and convoying, vehicle/cargo tracking is a viable alternative given cer-tain cost and geographical constraints. The global network of satellites and land-based terminals enables two-way messag-ing between a vehicle and a central loca-tion.

This real time communication and periodic positioning capability has cargo security implications. Available system enhancement options include driver paging, vehicle diagnostics and refrigerated trailer monitoring.

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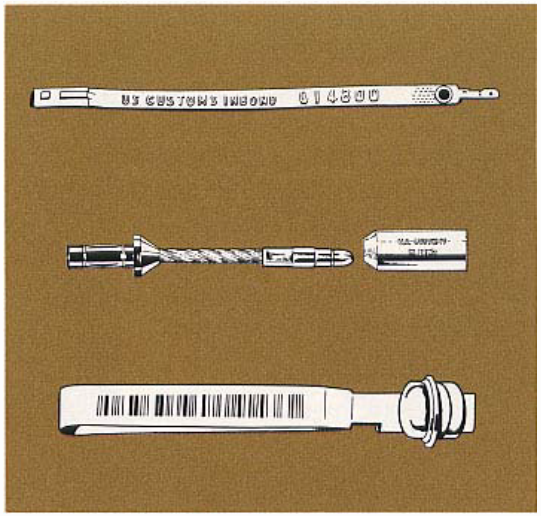
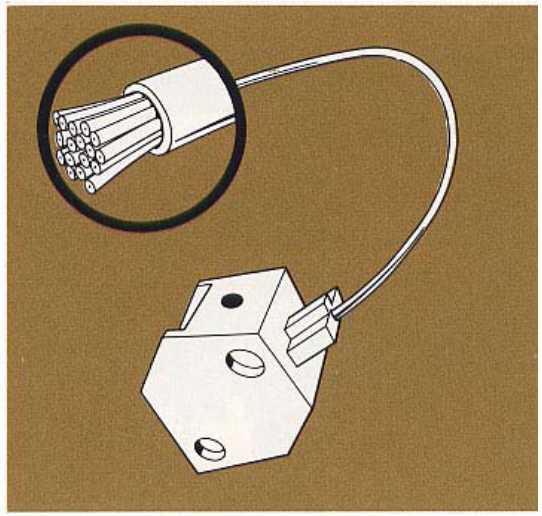
1.3. Stowage and securing of cargoes on board ships



Custom seals

Serialized indicative seal



Fiber optic seal

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

In 1991 the IMO Assembly adopted the Code of Safe Practice for Cargo Stowage and Securing. Its purpose is to provide an international standard to promote the safe stowage and securing of cargoes by:

- drawing the attention of shipowners and ship operators to the need to ensure that the ship is suitable for its intended purpose;

- providing advice to ensure that the ship is equipped with proper cargo securing means;

- providing general advice concerning the proper stowage and securing of cargoes to minimize the risks to the ship and personnel;

- providing specific advice on those cargoes which are known to create difficulties and hazards with regard to their stowage and securing;

- advising on actions which may be taken in heavy sea conditions; and

- advising on actions which may be taken to remedy the effects of cargo shifting.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

The Code is based on a number of general principles:

- All cargoes should be stowed and secured in such a way that the ship and persons on board are not put at risk.

- The safe stowage and securing of cargoes depend on proper planning, execution and supervision.

- Personnel commissioned to tasks of cargo stowage and securing should be properly qualified and experienced.

Personnel planning and supervising the stowage and securing of cargo should have a sound practical knowledge of the application and content of the Cargo Securing Manual, if provided.

In all cases, improper stowage and securing of cargo will be potentially hazardous to the securing of other cargoes and to the ship itself.

Decisions taken for measures of stowage and securing cargo should be based on the most severe weather conditions which may be expected by experience for the intended voyage.

Ship-handling decisions taken by the master, especially in bad weather conditions, should take into account the type and stowage position of the cargo and the securing arrangements.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Preparations for loading:

The Chief Officer shall confirm before starting the loading operation that the preparations described below have been completed and there is nothing obstructing the loading operation.

(1) That information on kind of cargo, quantity and loading sequence are informed to cargo watch crew.

(2)That restrictions on draft, trim, water depth allowance and air draft are informed to cargo watch crew.

(3) That equipment and machinery such as ship's cranes and ballast pumps are well maintained and adjusted by trial operation beforehand.

(4) That each hold is cleaned depending on the kind of cargo and no remains any cargo residue.

(5) That bilge wells in each hold are thoroughly cleaned depending on the kind of cargo appropriate measures are taken for discharging hold bilge.

(6) That communication means such as transceivers are arranged and they are operable.

(7) Those openings in the accommodation, which are not used, are closed.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Preliminary arrangement before loading:

The Chief Officer shall make preliminary arrangements for the items below with shore persons concerned with cargo operations.

(1) Kind of cargo, quantity and loading sequence.

(2) Stowage factor and matters relating to nature of cargoes such as moisture content, presence or absence of toxic vapour etc.

(3) Loading method and loading efficiency.

(4) Confirming communication means between the shore persons in charge of cargo operation and the ship.

(5) Safety rules and matters relating to Water Pollution Prevention Rules at the terminal and the loading port.

(6) Matters relating to water depth allowance and air draft.

(7) Matters relating to bunkering, water supply, ship's stores, provision supply etc.

(8) Check up all air pipelines of ballast tanks.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Condition survey

It is desirable that cargo spaces are inspected by the ship's staff and the terminal personnel taking practical limitations into account before and after loading/unloading operations. Reference should be made to IMO Res.A.866 (20): "Guidance to Ship's Crews and Terminal Personnel for Bulk Carrier Inspections"

Any damage affecting the seaworthiness, structural integrity or the ship's essential engineering systems etc. should be reported to the Classification Society, the flag state and the port state (SOLAS Reg I/11(c) refers).

Initial draft survey

In the majority of bulk trades and for certain other shipments, the quantity of cargo onboard is established by a draft survey, which is usually performed by an independent surveyor. This means that he has no commercial interest in the transaction, so should produce an impartial result. Even if such an independent surveyor is not appointed, it is a good practice for the ship to conduct draft survey for every load and discharge operations in order to verify the weight of cargo as provided by the shore. This may be a requirement of the charterers.
The calculations involved are usually performed by the Chief Officer, but the OOW should understand the principles involved and be able to undertake this calculation himself. With careful observations, accuracies of within 0.5% are possible.
It is most important that the data required for these surveys be obtained by personal observations, and not by verbal agreement.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Principle of draft survey

TOTAL WEIGHT OF SHIP = WEIGHT OF SHIP EMPTY + CONSTANT WEIGHT + WEIGHT OF CARGO + FUEL + BALLAST WATER + FRESH WATER + PROVISIONS + STORES

Draft survey is a means of determining the weight of material loaded onto or discharged from a vessel by measuring the displacement of water (Archimedes Principle). By reading the initial displacement of the vessel (prior to loading or prior to discharge commencing) and then reading a final displacement (at the completion of loading or discharge), the weight of the material loaded can be determined.

Although this sounds like a very simple process, it takes an experienced and highly qualified surveyor to produce an accurate weight. As well, during the draft readings, several other key factors have to be taken into account and measured before the weight of the cargo loaded or discharged can be determined. These include the density of the sea or river water, changes in the quantity of ballast between initial and final draft readings, and changes in the consumables on the vessel between initial and final draft readings (fuel oil, potable water, etc.). Access to the vessel draft tables is also required to allow for trim and deformation corrections.

The accuracy of a weight determined by draft survey depends upon sea conditions at the time of loading or discharge (pitch and swell) and the weight of the cargo loaded when compared to the total capacity of the vessel.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

<u>The outline procedure for draft surveys is:</u>

(a) <u>Loading</u>

Read the drafts of the ship before loading and with a minimum of ballast on board- i.e., just enough to give a positive forward draft. Measure the density of the dock water and calculate the displacement. Subtract the weight of ballast (this will be discharged before the ship can sail) to obtain the displacement of the ship before loading. When the cargo is loaded, read the drafts again and, after taking the density of the dock water, calculate the displacement of the ship and cargo. After taking into account any bunkers and stores taken while loading, subtract the displacement previously calculated to obtain the weight of cargo loaded.

(b) <u>Discharging</u>

Read the drafts on arrival before discharging any cargo. Obtain the density of the dock water and calculate the displacement. When all the cargo has been discharged and enough ballast taken to give a reasonable trim, read the draft again and after taking the density of the dock water calculate the new displacement. Take into account any stores ballast and bunkers taken or consumed when the ship is in port, and the difference between the two displacements will give the weight of cargo discharged. By having draft surveys taken in both the loading and discharge ports and using the same procedure in each case the results can be compared and any errors will be shown up.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Procedure in detail:

That is important to realize that no matter how carefully the frequent calculations are carried out, the accuracy of a draft survey depends primarily on the reading of the drafts and the procurement of the density of the dock water.

1. Reading the drafts

Before reading the drafts, ensure that the ship is not handling bunkers or cargo or carrying out any other operation that can have effect on the draft. Try to have the ship upright, as the ships stability information is calculated for this condition and any list will introduce errors. The stability information is especially inaccurate in the case of the empty ship with the bow out of the water, but as the measurement of ballast can also introduce errors the aim should be to only have enough ballast to provide a positive forward draft, about two metres for a ship of between 20.000 and 30.000 tonnes dw.

When reading the drafts use a boat if possible and read the drafts on both sides of the ship, averaging them to allow for any remaining list. In the case of the amidships draft, it is usually more accurate to measure the freeboard to the top of the amidships deckline. When converting this freeboard to draft remember that the moulded depth is measured from the top of the statutory deckline to the top of the keel. The ships drafts are, however, measured from the bottom of the keel.
The way to convert freeboard to draft is to add the deepest summer draft to the summer freeboard and subtract the measured freeboard. There are designed freeboard measuring instrument to smooth out the wave effect and make the readings more accurate.

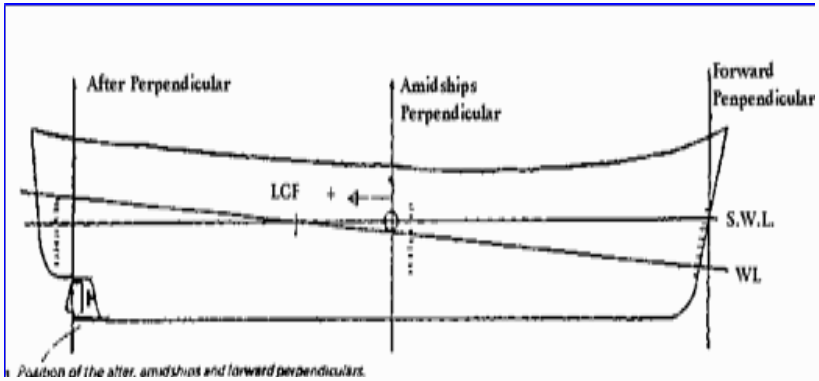
2. Taking the density

As soon as possible after reading the drafts obtain the density of the dock water. It is important to take this reading without delay as the density varies with the state of the tide. When taking water samples use a container with a perforated lid; lower the container to a depth equal to the deepest draft and raise it up again at a constant speed so that it is not full when it reaches the surface. This ensures that a uniform water sample is obtained. Take three samples along the offshore side of the ship, as it is possible to have stagnant water trapped between the ship and the jetty.
When the sample is on board take the temperature before and after reading the density to ensure that it remains constant. There are a number of different instruments on the market for measuring densities; use one designed for water not oil as the surface tensions are different. Glass instruments are more accurate than brass ones. Most instruments are calibrated for water in a vacuum and so 0,0011 and 0,002 should be subtracted from the glass and brass instruments respectively to allow for the different buoyancy of water in air. As the instruments are not being used at their calibration temperatures, further corrections supplied with the instruments must be used.


Draft survey kit

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing



Position of the after, amidships and forward perpendiculars.

3. <u>Correction to the perpendiculars</u>

The forward perpendicular is a line, at right angles to the keel, cutting the summer waterline at the stem. The after perpendicular is a line, at right angles to the keel, passing through the after end of the rudder post. It is also the position of the frame marked '0' in the plans. The ships stability data is calculated for drafts measured at the perpendiculars and, as the draft marks do not usually coincide with these lines a correction must be applied. To correct the drafts, if they are not already marked, draw in the perpendiculars and the draft marks on the ships capacity plan, and measure the horizontal distance between the draft marks and the perpendicular at the waterline.
Inspection of the plan will indicate whether this correction is to be added or subtracted from the observed drafts. In the case of the amidship draft, if it has been obtained by measuring the freeboard to the deckline, then no correction is necessary as the loadline disc can, in most cases, be considered to be at the midlength of the perpendiculars. If, however, the draft has been measured from the draft marks then it has to be corrected as the draft marks are not under the loadline disc. Again, inspection will show whether this correction is to be added or subtracted. The amidships draft is corrected in this way because it is more accurate to use the length between perpendiculars from the ships particulars than it is to measure the distance between the draft marks on the ships plan.

4. **Correction for hull deformation**

The amidships draft is only the same as the mean of the fore and after drafts when the ship is neither hogged nor sagged. There are a number of corrections for hull deformation. This correction is known as the mean of mean drafts and will provide a more accurate mean draft when the ship is hogged or sagged. This demonstrates the importance of reading the amidships draft as accurately as possible.

5. **Obtain displacement**

Using the corrected mean draft extract the displacement from the ships stability data.

6. **Corrections for trim**

When a ship is trimmed the calculated mean draft is not the same as the true mean draft measured at the LCF. Both items can be obtained from the ships stability information. To apply the correction, known as the layer correction, when the LCF is in the same direction from amidships as the deepest draft, it is added to the displacement, and when it is in the opposite direction it is subtracted. This correction does not allow for the fact that, when a ship trims, the LCF moves from its tabulated position.

7. **Correction for heel**

As previously explained, the ship should be upright for a draft survey. The correction is always added to the displacement because the effect of heel is to increase the waterplane area and so lift the ship out of the water.

8. Correction of displacement for density

The ships stability information is calculated for a standard density, usually 1.025, but other standards do exist so it is important to check on the value used fur any particular ship.

(A) Before loading cargo

1. From the calculated displacement subtract the light displacement to obtain deadweight.

2. As soon as possible after reading the drafts and density, sound all the fuel, ballast and fresh water tanks. Correct the soundings for list and trim using the calibrations tables.
Calculate the weights of fuel, fresh water and water ballast from the deadweight.
The remainder represents the constant which in turn represents the difference between the scale deadweight and the actual deadweight that the ship can load. The value from the ships data is for a new ship. However, as the ship ages its weight increases, so in many cases the figures used are too low. Therefore, a new constant should be calculated for each draft survey.

(B) After loading cargo

Read the drafts and calculate the loaded displacement. Using the constant found previously and, haying calculated the quantity of fuel, fresh water and ballast on board, calculate the quantity of cargo loaded. At the discharge port the draft survey is repeated, first with the loaded ship, then with the empty ship, and the weight of cargo is calculated. It is now possible to obtain some idea of the accuracy of the surveys by comparing both the constants as well as the cargo figures.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Procedures:

The following are considered important procedures in respect of cargo loading:

- the master and terminal representative should indicate agreement to the loading plan before commencement of loading by signing the plan in the spaces provided;
- the master should state on the agreed loading plan, the order in which the holds are to be loaded, the weight of each pour, the total weight in each hold and the amount of cargo for vessel trimming purposes, if required;
- the terminal representative, on receipt of the ship's initial loading plan, should advise the master of the nominal loading rate at which the ship may expect to receive the cargo and the estimated time required to complete each pour;
- where it is not practical for the ship to completely discharge its ballast water prior to reaching the trimming stage in the loading process, the master and the terminal representative should agree on the times at which loading may need to be suspended and the duration of such suspensions;
- the loading plan should be prepared so as to ensure that all ballast pumping rates and loading rates are considered carefully to avoid overstressing the hull;
- the quantities of cargo required to achieve the departure draft and trim should allow for all cargo on the terminal's conveyor systems to be run off and empty on completion of a loading. The terminal representative should advise the master of the nominal tonnage contained on its conveyor system and any requirements for clearing the conveyor system on completion of loading; and
- communication arrangements between the ship and terminal should be capable of responding to requests for information on the loading process and of prompt compliance in the event that the master or terminal representative orders loading to be suspended.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Consideration should be given to the disposition of cargo on the conveyor systems and to the response time in the event of an emergency stop.

The following are considered important procedures in respect of cargo unloading:

- the terminal representative, when proposing or accepting the initial unloading plan, should advise the master of the nominal unloading rate and the estimated time required for each stage of the discharge;
- the master should advise the hold order and the weight to be unloaded in each stage of the discharge;
- the terminal representative should give the ship the maximum warning when it is intended to increase, or to reduce, the number of unloading heads used; and
- communication arrangements between ship and terminal should be capable of responding to requests for information on the unloading process, and of prompt compliance in the event that the master orders unloading to be suspended.

Implemenation:

- the loading or unloading plan should be prepared.
A different form may be used provided it contains the essential information to meet the requirements of this Code. The minimum information for this purpose is that enclosed in the heavy line box on the sample form.
- the loading or unloading plan should only be changed when a revised plan has been prepared, accepted and signed by both parties. Loading plans should be kept by the ship and terminal for a period of six months.
- a copy of the agreed loading or unloading plan and any subsequent amendments to it should be lodged with the appropriate authority of the port State.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Example Loading/Unloading Plan

Loading or unloading plan version no.	Date	Vessel				Voyage no.
Load/unload port	Cargo(es)	Assumed stovage factor or cargo(es)	Pumping rate	Dock water density	Max draught available (HW)	Max air drought
To/from port	Last cargo	No. of loaders/dischargers		Load/dis-charge rate	Min draught available (LW)	Max sailing/arrival drought

7	6	5	4	3	2	1
Tonnes Grade Total	Tonnes	Grade	Tonnes	Grade	Tonnes	Total: Tonnes

Pour #	Cargo		Balast operations	Time required (hours)	Comments	Calculated values				Calculated values			Observed values		
	Hold #	Tonnes				Draught		Maxi-mum		Air drau-ght	Dra-ught mid	Trim	Draught		
						Fwd	Alt	BM'	SF'				Fwd	Alt	Mid
Total:				Signed terminal: _____ Signed ship: _____											

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Form for cargo information

Note: This form is not applicable if cargo to be loaded requires a declaration under the requirements of SOLAS 1974, chapter VII, regulation 5; MARPOL 73/78, Annex III, regulation 4; and the IMDG Code, General Introduction section 9.

<table>
<tr><td rowspan="4">Shipper/consignor

Reciever/consignee

Load port

Discharge port</td><td>Reference #</td></tr>
<tr><td>Vessel</td></tr>
<tr><td rowspan="2">Instructions or other matters</td></tr>
<tr></tr>
<tr><td>General description of the cargo
(For solid bulk cargo - type of
material/particle size)</td><td>Gross mass (kg/tonnes)

o General cargo
o Cargo unit(s)
o Bulk cargo</td></tr>
<tr><td colspan="2">Specification of bulk cargo (if applicable)
Stowage factor
Angle of repose
Trimming procedures
Chemical properties* if potential hazard

*IMO class, UN no. or BC no. and EmS no.</td></tr>
<tr><td>Relevant special properties of the cargo</td><td>Additional certificate(s) (if required)
o Certificate of moisture content and transportable moisture limit
o Weathering certificate
o Exemption certificate
o Other (specify)</td></tr>
<tr><td>REMARKS:</td><td>Name/status, company/organization of the signatory

Place and date

Signature on the behalf of consignor</td></tr>
</table>

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Example - email ??

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.4. Code of practice for cargo stowage and securing

Loading operation

During the loading operation, attention is to be given to prevent a decrement of loading quantity and suspension of cargo operations that are the ship's responsibility.

A decrement of loading quantity might be produced by the following causes:

(1) Dead spaces in hold and well trimming cargo
(2) Inclination of hull
(3) Excess trim in the loading port where sufficient water depth is unavailable.
(4) Sagging and hogging
(5) Remaining ballast water due to incomplete discharging.

Suspensions of cargo operation, which are the ship's responsibility, are usually mentioned in the loading terms. Suspension of cargo operation may be due to incorrect discharging of ballast water and failure of equipment in ballast line, in addition to the causes mentioned above.

Matters requiring attention for the ship's safety during cargo operations are as follows:

1) Securing required under keel clearance
2) Clearance between unloader and the hull
3) Condition of ballasting water
4) Overflow of ballast water
5) Mooring lines and gangway ladder
6) Tide
7) Checking loaded quantity and loading rate
8) Plimsoll Mark

Discharging operation

To be of practical use to the ship's officers, any acceptable loading or unloading sequence must, in addition to meeting strength and stability requirements, satisfy operational and commercial requirements as far as possible. Therefore, the following notes have been developed by the Nautical Institute, in association with IACS, Intercargo, BIMCO and the International Bulk Terminals Association. It is recommended that they be taken into account when compiling the typical loading and unloading sequences described in the Annexes to the IACS Unified Requirement.

Unloading

- A trim by the stern is easily achieved and is to be preferred throughout unloading to avoid disruption to the ship's machinery and domestic services. Airdraft and strength requirements both usually require that the trim by the stern should not be excessive.

- Holds which are to be ballasted for the ensuing voyage, or to reduce airdraft whilst unloading, should be the first to be completely unloaded, to allow maximum time for cleaning holds, closing bilges and opening ballast lines.

- When a full homogeneous cargo is being unloaded, there is no need for a draft survey to interrupt the unloading at any stage, although draft surveys may be required before the start and at the completion of unloading.

- Unlike deballasting, the tank sequence is not critical when taking on ballast as it is not significantly affected by heel or trim. The sequence will be governed by strength and airdraft considerations and possibly by the desire to avoid taking sediment-laden ballast in double bottom tanks from which the sediment will be most difficult to remove.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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Tankers and other ships carrying bulk liquid cargoes

General

Masters, officers and ratings appointed to work on tankers or similar vessels must meet the minimum training and qualifications requirements specified in regulation V/1 of the International Conventions on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995.

- Training in emergency procedures and in the use of any special emergency equipment should be given as appropriate to members of the crew at regular intervals. The instruction should include personal first aid measures for dealing with accidental contact with harmful substances in the cargo being carried and inhalation of dangerous gases and fumes.

- Because of the risks of ill effects arising from contamination by certain liquid cargoes, especially those carried in chemical tankers and gas carriers, personnel should maintain very high standards of personal cleanliness and particularly so when they have been engaged in cargo handling and tank cleaning.

- Those on board responsible for the safe loading and carriage of the cargo should have all the relevant information about its nature and character before it is loaded and about the precautions which need to be observed during the voyage. The remainder of the crew should be advised of any precautions which they too should observe.

- High risks require the strict observance of rules restricting smoking and the carriage of matches or cigarette lighters.

- Spillages and leakages of cargo should be taken care of promptly. Oil-soaked rags should not be discarded carelessly where they may be a fire hazard or possibly ignite spontaneously. Other combustible rubbish should not be allowed to accumulate.

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- Cargo handling equipment, testing instruments, automatic and other alarm systems should be maintained to a very high standard of efficiency at all times. Where electrical equipment is to be used in the cargo area it should be of approved design and 'certified safe'. The safety of this equipment depends on maintenance of a high order which should be carried out only by competent persons. Unauthorised personnel should not interfere with such equipment. Any faults observed, such as loose or missing fastenings or covers, severe corrosion, cracked or broken lamp glasses etc should be reported immediately.

- Work about the ship which might cause sparking or which involves heat should not be undertaken unless authorised after the work area has been tested and found gas-free, or its safety is otherwise assured.

- Where any enclosed space has to be entered, any person going in should be very cautious. Dangerous gases may be released or leak from adjoining spaces while work is in progress and frequent testing of the atmosphere should be undertaken. 'Permit-to-work' procedures should generally be adopted .

Oil and bulk ore/oil carriers

- Tankers and other ships carrying petroleum or petroleum products in bulk, or in ballast after carrying these cargoes, are at risk from fire or explosion arising from ignition of vapours from the cargo which may in some circumstances penetrate into any part of the ship.

- Additionally, vapours may be toxic, some in low concentrations, and some liquid products, especially petrol (gasoline) treated with tetra-ethyl or tetra-methyl-lead, are harmful in contact with the skin.

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- Guidance on the general precautions which should be taken is given in publications of the International Chamber of Shipping:
(a) International Safety Guide for Oil Tankers and Terminals;
(b) Safety in Oil Tankers, a handbook for crew members.
Companies are additionally required, under the ISM Code, to have their own safety regulations. These publications should be available on board and the guidance conscientiously followed.

Liquefied gas carriers

Types of gas carriers:

Type 1G - requires maximum preventive measures to preclude the escape of such cargo.
Type 2G - requires significant preventive measures to preclude the escape of such cargo.
Type 2PG - gas carrier of 150 m or less in length requires significant preventive measures to preclude the escape of such cargo.
Type 3G - requires moderate preventive measures to preclude the escape of such cargo.

Cargo containment systems
A cargo containment system is the total arrangement for containing cargo including where fitted;

- A primary barrier (the cargo tank),
- Secondary barrier (if fitted),
- Associated thermal insulation,
- Any intervening spaces, and
- Adjacent structure, if necessary, for the support of these elements.

- For cargoes carried at temperatures between –10° C and –55° C the ship's hull may act as the secondary barrier and in such cases it may be a boundary of the space.

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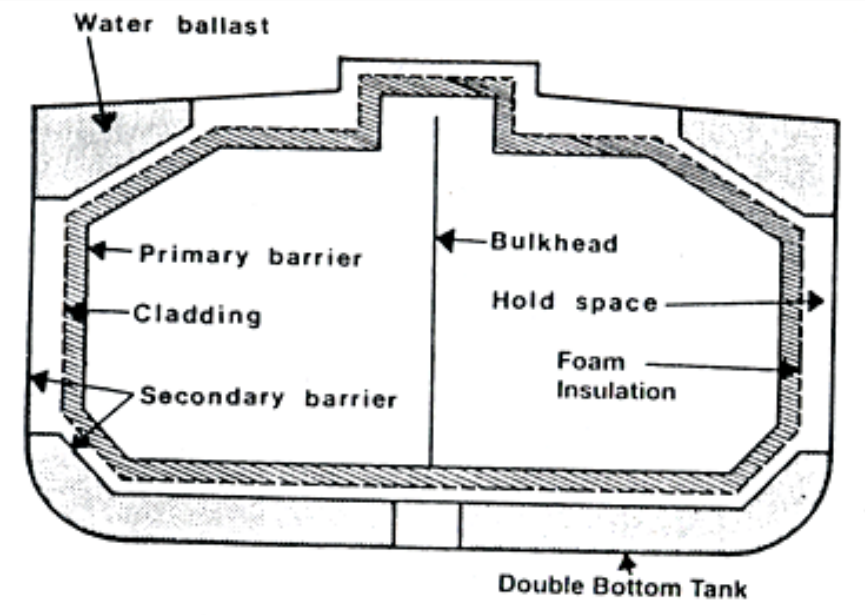
Independent tanks - a completely self supporting part of the ship's hull structure. They do not contribute to the hull strength of the ship.

Types of independent tanks

- Type "A" tanks are constructed primarily of flat surfaces. The maximum allowable tank design pressure in the vapour space for this type of system is 0.7 bars; this means cargoes must be carried in a fully refrigerated condition at or near atmospheric pressure (normally below 0.25 bars).
Prismatic self-supporting Type "A" tank – fully refrigerated LPG carrier.



1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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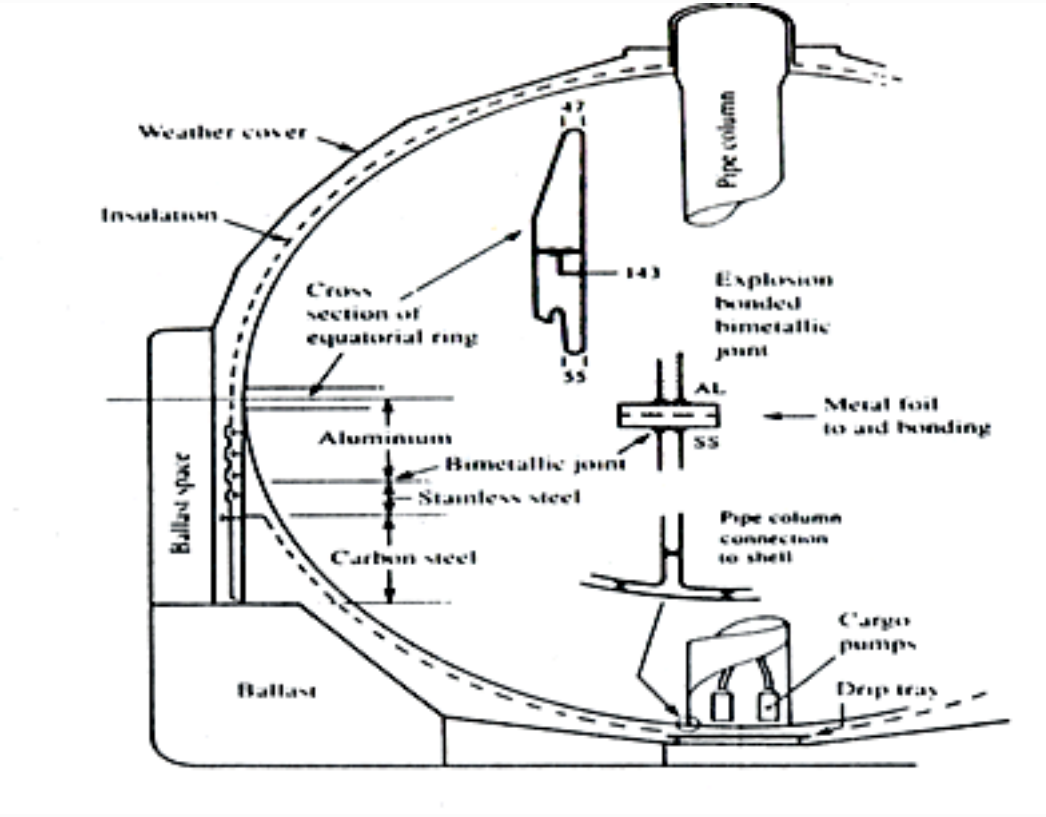
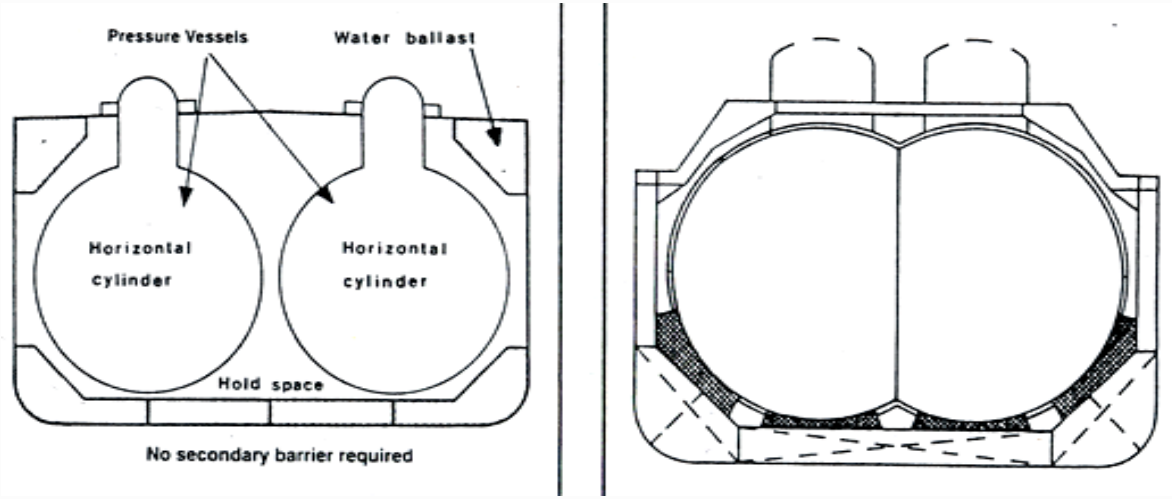
- Type “B“ tanks = can be constructed of flat surfaces or they may be of the spherical type. This type of containment system is the subject of much more detailed stress analysis compared to type “A” system. These controls must include an investigation of fatigue life and a crack propagation analysis.



1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

- Type "C" tanks are normally spherical or cylindrical pressure vessels having design pressures higher than 2 bar. The cylindrical vessels may be vertically or horizontally mounted. This type of containment system is always used for semi-pressurized and fully pressurized gas carriers. In the case of the semi-pressurized ships it can also be used for fully refrigerated carriage provided appropriate low temperature steels are used in tank construction. Design and built to conventional pressure vessel codes and, as a result, can be subjected to accurate stress analysis. No secondary barrier is required. The hold space can be filled with inert gas or dry air. A typical fully pressurized ship (where the cargo is carried at ambient temperature), the tanks may be designed for a maximum working pressure of about 18 bar. A semi-pressurized ship the cargo tanks and associated equipment are designed for a working pressure of approximately 5 to 7 bar and a vacuum of 0.5 bar. Typically, the tank steels for the semi-pressurized ships are capable of withstanding carriage temperatures of –48° C for or –104° C for ethylene. Ethylene carrier can also transport LPG. Type "C" tanks as fitted in typical fully pressurised gas carrier. With such an arrangement there is comparatively poor illustration of the hull volume; however, this can be improved by using intersecting pressure vessel or bi-lobe type tank which can be designed with a taper at the forward end of the ship. This is a common arrangement in semi-pressurised ship.



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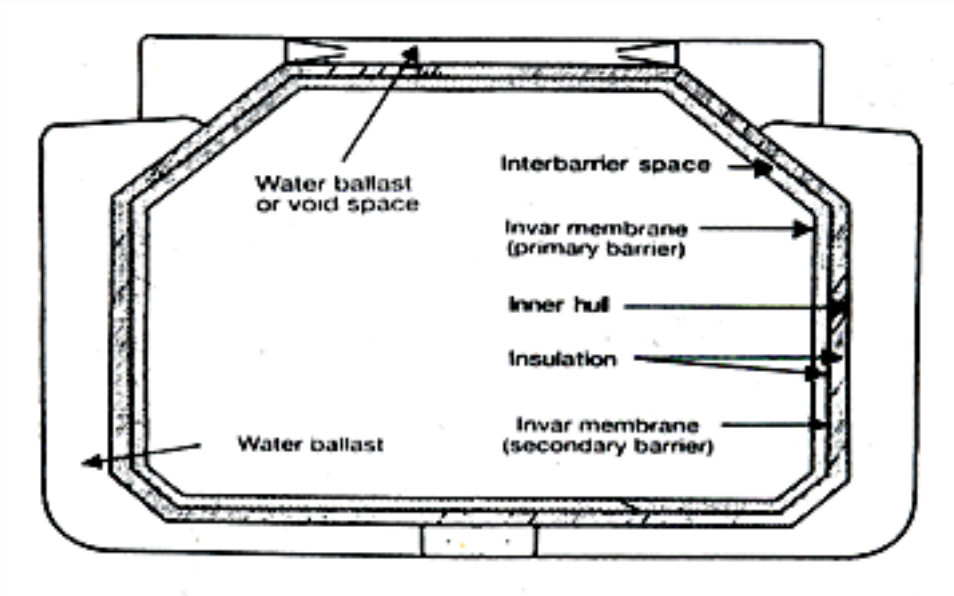
- Membrane tanks (membrane 0.7 to 1.5 mm thick)

The concept of the membrane containment system is based on a very thin primary barrier which is supported through the insulation. Such tanks are not self-supporting like the independent tanks. It always be provided with secondary barrier to ensure the integrity of the total system in the event of primary barrier leakage. The membrane is designed in such a way that thermal expansion or contraction is compensated without over stressing the membrane itself. These tanks are developed primarily for the carriage of LNG.

Gas Transport membrane containment system – larger LNG carriers



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Cargo pipelines and valves

Gas carriers are normally fitted with liquid and vapour manifolds situated amidships. These are connected to liquid and vapour headers or pipelines with branches leading into each cargo tank. The liquid line is led through the tank dome to the bottom of each cargo tank. On semi-pressurized and fully refrigerated LPG ships a vapour connection is taken from the vapour header to the cargo compressor room where reliquifaction of the boil-off takes place. After reliquifaction the cargo is piped, via a condensate return line, to each cargo tank. In the case of LNG ships the boil-off vapours are usually fed to the ship's boilers, via a compressor and heater, for use as main propulsion fuel.

Cargo valves and strainers

Isolating valves for cargo tanks must be provided in accordance with Gas Codes. Where cargo tanks have a MARVS greater than 0.7 bar (type "C" tanks) the principal liquid and vapour connections on the tank dome (except relief valve connections) should be fitted with a double valve arrangement. This should comprise one manually operated globe valve and a remotely operated isolation valve fitted in series. For types "A" and "B" cargo tanks with the MARVS less than 0.7 bar) the Gas codes allow single shut-off valves for liquid and vapour connections. Remotely operated emergency shut down valves are provided at the liquid and vapour manifolds for all gas carriers.

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- Guidance on the general precautions which should be taken on these vessels is given in the Tanker Safety Guide (Liquefied Gas) and Safety in Liquefied Gas Tankers (a handbook for crew members) published by the International Chamber of Shipping. The IMO Codes for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk contain guidance on operational aspects and are mandatory under the relevant Merchant Shipping regulations.

- It should be noted that cargo pipes, valves and connections and any point of leakage at the gas cargo may be intensely cold. Contact may cause severe cold burns.

- Pressure should be carefully reduced and liquid cargo drained from any point of the cargo transfer system, including discharge lines, before any opening up or disconnecting is begun.

- Some cargoes such as ammonia have a very pungent, suffocating odour and very small quantities may cause eye irritation and disorientation together with chemical burns. Seafarers should take this into account when moving about the vessel, and especially when climbing ladders and gangways. The means of access to the vessel should be such that it can be closely supervised and is sited as far away from the manifold area as possible. Crew members should be aware of the location of eye wash equipment and safety showers.

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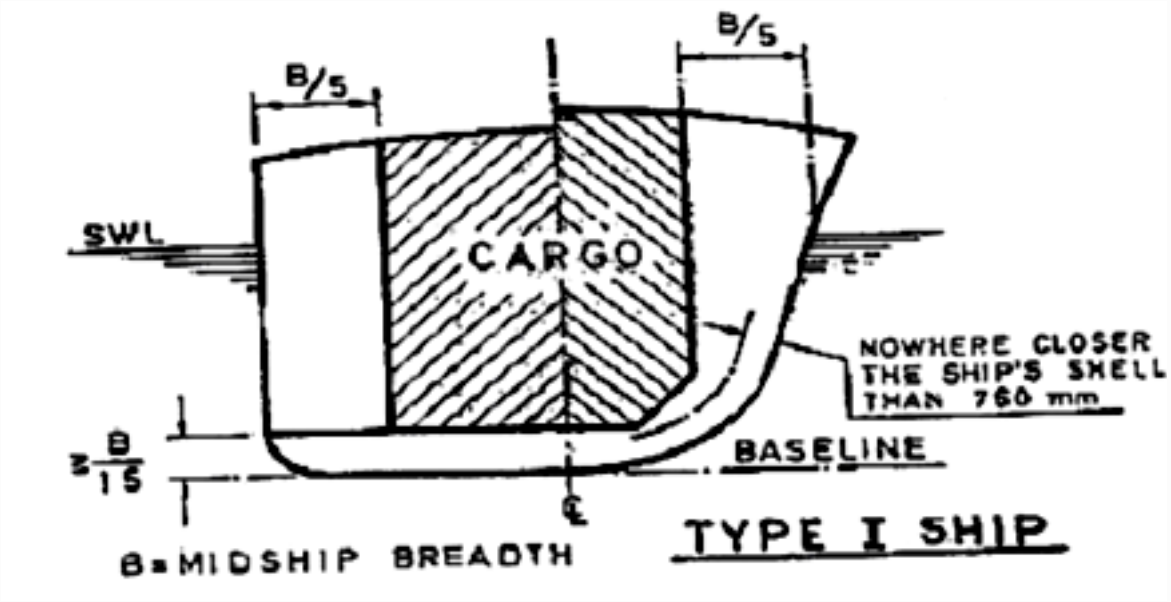
Chemical carriers

Chemical tanker is a ship constructed or adapted primarily to carry a cargo of noxious liquid substance in bulk .

Types of chemical tankers:

Type I - a ship intended to transport mixture of noxious liquid substance presenting pollution with very severe environment and safety hazard which requires maximum preventive measure to stop an escape of cargo. This type can sustained severe damage of the hull.



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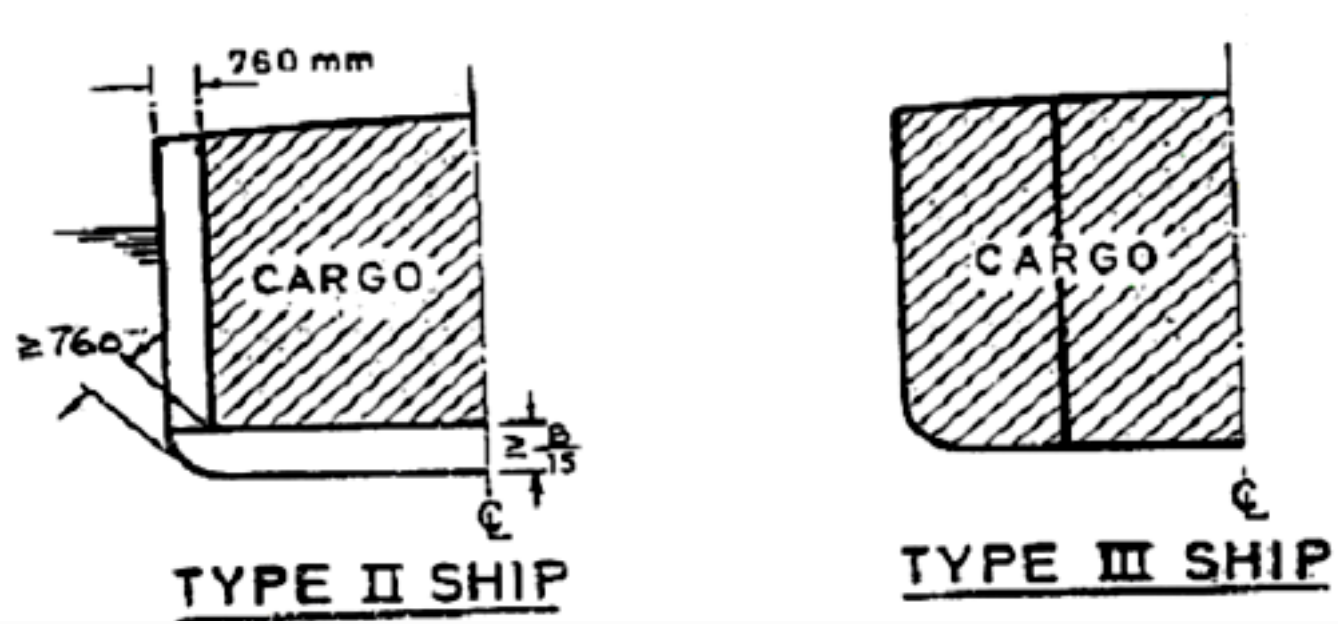
Type II - a ship intended to transport noxious liquid with appreciably severe environment and safety hazard which requires significant preventive measures to stop an escape of cargo. This type can sustained light damage to the hull.

Type III - a ship intended to transport noxious liquid with sufficiently severe environment and safety hazard which requires a moderate degree of containment to increase survival capability in a damage condition. This type can't sustained damage to the hull. The cargo will escape if there's cargo on the wing tanks.



1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

- A bulk chemical tanker may be dedicated to the carriage of one or a small number of products or it may be constructed with a large number of cargo tanks in which numerous products are carried side by side simultaneously.

- The products carried range from the so-called non-hazardous to those which are extremely flammable, toxic or corrosive or have a combination of these properties, or which possess other hazardous characteristics.

- The ship arrangements and the equipment for cargo handling may be complex and require a high standard of maintenance and the use of special instrumentation, protective clothing and breathing apparatus for entry into enclosed spaces.

- The International Maritime Organization (IMO) has produced codes (the IBC Code and the BCH Code) for the construction and equipment of ships carrying dangerous chemicals in bulk. The Codes are statutory under Merchant Shipping regulations. They contain some operational guidance, and the associated index of dangerous chemicals carried in bulk contains references to the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) published by IMO.

- Guidance on general operational procedures and precautions which should be followed on chemical tankers is given in the Tanker Safety Guide (Chemicals) and the booklet 'Safety in Chemical Tankers', both published by the International Chamber of Shipping. These publications, together with the codes referred to above and any special safety requirements issued by the company should be available on board.

- Many products carried on chemical tankers are loosely referred to as alcohols. Drinking these could lead to serious injury and death, and strict controls should be exercised when carrying such cargoes in order to prevent pilfering.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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- Ships serving offshore oil and gas installations are often expected to operate in adverse weather conditions. Cargo operations should not be undertaken, except in an emergency, if there is any danger of the crew being injured by water on deck or shifting cargo. For the avoidance of doubt, an emergency does not mean when an installation is short of water, food or drilling equipment.

- The master of the vessel has the final responsibility for ensuring that any operation is carried out with proper regard to the safety of all those on board and that measures are taken to minimise risks.

- The Offshore Installation Manager controls the entry of all vessels into the 500 metre zone around the installation and can modify or terminate any support vessel activity that they regard as hazardous to the installation or persons on it.

- The crane driver may also terminate a cargo operation on safety grounds.

- Where a vessel has open stern and deck gangway doors and a low freeboard, particular care should be taken against loss of watertight integrity by ensuring that scuttles, deadlights, hatches and ventilators are securely closed. Freeing ports should be kept clear and unobstructed to ensure the rapid drainage of water trapped on the deck.

- While work is being done on the deck the ship's heading and speed should be adjusted to provide as safe a working platform as possible. A look-out should be kept to give warning of imminent oncoming, quartering or following seas, or the operation suspended until the risk of shipping seas is over.

- At all times work is being done on the deck, there should be an efficient means of communication between bridge, crane and crew. This should be by a hand-held radio on an uncluttered working frequency, backed up by a tannoy system.

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- During hours of darkness, sufficient lighting should be provided at access ways and at any work location, to ensure that obstructions are clearly visible, that persons working on deck can be clearly seen from the bridge and installation and that the operation may be carried out safely.

- Lighting should be so placed that it does not dazzle the navigational watch and does not interfere with prescribed navigation lights.

- If working on deck cannot be avoided during bad weather, lifelines should be rigged on the working deck to facilitate safe movement. Decks should as far as practicable be kept free from ice, slush and any substance or loose material likely to cause slips and falls.

- Men working in cold and wet conditions should wear water-proof garments over warm clothing. The need to avoid undue exhaustion and hands and limbs becoming numbed should be taken into account when making the necessary arrangements for relief at suitable intervals.

- If it is necessary for a man to work in an exposed position heshould, where practicable, wear a safety harness and lifeline, and one of the approved types of self-inflating buoyancy aids which would not unduly hamper or impede working movements.

- Safety helmets and high visibility garments should be worn during work on deck.

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- In all operations which may impose large loads or shock strains upon the gear, precautions should be taken against sudden failure which may cause injury to personnel. As far as practicable, the system should be so defined that the weakest element is at a point where failure is likely to cause least danger.

- While gear is under load, personnel essential for the operation should keep in protected positions to the greatest practicable extent. Others not engaged in the operations should keep clear of the working area.

- The master should pre-plan his approach to the installation with the vessel set up prior to the final approach to take account of the prevailing wind and tide etc.

- In the event that it is necessary to drop anchor personnel should never stand forward of the windlass when letting go anchors at the installation. This is particularly important in vessels of this type because of the length of the chain and the loads thus imposed. Care should be taken when stowing the anchor cable in the locker.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

Preparation for cargo handling

Normally it is hectic on an oil tanker's ballast voyage in connection with new a transport order. There is continuous communication between charterer, shipper and the vessel to make the transport.

One of the first questions, which appear, is how much the vessel is able to load. These kinds of messages are usually marked "Urgent", and a rapid answer is necessary. It is important to react to this message as soon as possible, because there are many companies competing in the market with available tonnage. And history shows that many cargoes have away due to hesitation on such applications.
The cargo quantity is calculated from the vessel's dead weight or from the total cargo tank capacity.
With the knowledge of the cargo density and temperature it is possible to calculate the space (volume) that the cargo will occupy, and then it is possible to check if there's enough space in the vessel's cargo tanks.

- It is important to plan in advance, both at the shore terminal and offshore to aid effective cargo securing. The objective of preplanning is the safe and practical restraint of cargo carried on the deck of offshore support vessels so that personnel, ship and cargo may be reasonably protected at all stages of carriage, and during cargo operations offshore.

- The master and the offshore liaison manager or their representatives must establish liaison prior to unloading or backloading of cargo.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

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- The order of loading/discharging and stowage arrangements should be pre-planned in order to avoid wherever possible the "slotting-in" of containers and the necessity for any person to climb on top of the cargo.

- The master should ensure he is provided with details of any unusual items of cargo, including dangerous goods, cargoes requiring special sea-fastening arrangements, or heavy lifts before loading.

Approaching installation and cargo handling at installation

Stress analysys

The next step it is in the preparation for cargo distribution. This is done by testing the loading (on a loading computer etc.) with an eye for wanted draught, trim and most of all shear forces and bending moments. The load planning is based upon the demands that hull forces have limits at all times. The important forces regarding oil tankers in general, are the shear forces and bending moments.

Bending moments are the forces which bend the vessel up and down in the fore-and-aft direction. The force is comparable with a flexible rod - when the bending the rod up or down, it will bend up or down is the middle.

If the vessel is loaded with heavier weight in the ends than in the middle, the fore and aft part of the vessel will be pulled down while the middle section is forced up. This is called a "hogg moment". If the vessel is loaded with the heavier weight in the middle section than at the ends, the vessel will be forced down in the middle section. This is called "sagg moment". So, these forces must be kept within the classification company's limits.

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Another force to consider is shear force. These forces are affected between loaded and empty parts of the vessels, also between a loaded cargo tank and an adjoining empty cargo tanks. The specific vessel is supplied within the specifications, given by the classification companies, for how many empty cargo tanks the vessel is allowed to sail with.

Most of the vessels today are equipped with a cargo handling a computer for cargo calculation. These computers must be approved and must have a certificate issued, which satisfies the Classification Company regarding shear forces and bending moments. The programs are supplied with curve diagrams for these forces, and remember, in all stages of a cargo operation within limitation of force.

- The master should pre-plan his approach to the installation with the vessel set up prior to the final approach to take account of the prevailing wind and tide etc.

- In the event that it is necessary to drop anchor personnel should never stand forward of the windlass when letting go anchors at the installation. This is particularly important in vessels of this type because of the length of the chain and the loads thus imposed. Care should be taken when stowing the anchor cable in the locker.

- In bad weather and under certain conditions of trim, considerable amounts of water may be shipped over the after-deck when the vessel is approaching a installation stern-on under power. Personnel should be alert to this possibility and remain in positions of shelter and safety until it is safe to proceed onto the deck.

- Life-saving equipment, including lifebuoy, boathook and heaving line should be readily available at a suitable position on the stern and other points of particular danger when mooring and while cargo handling is in progress.

- It should be borne in mind that the transfer of cargo at sea is at any time a difficult operation and the risks are greatly increased when heavy or bulk items are being handled from a combined deck space in a seaway.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

- The master has the authority to decide the sequence of cargo discharge to and backloading from the installation.

- When cargo is being unloaded at the installation, the lashings of each individual item or cargo should not be released until the item is about to be lifted; there are grave risks if all cargo lashings are removed before loading operations are begun.

- Once unlashed, cargo should be secured against movement as much as possible, until lifted.

- Personnel should be at all times alert to the danger of being hit or crushed should items of cargo swing during a lift or become dislodged through sudden movement of the ship. For this reason, all personnel should seek positions of safety as far as practicable during the lifting and lowering of cargo. If, in some circumstances, cargo hooks have to be held until the strain is taken, as when pipes are to be unloaded, crew members thus engaged should immediately move to a safe position before the actual lift is effected.

- Lifts should be speedily effected to hoist the load well off the deck and swung clear of the ship as quickly as possible.

- If any back-loading has to take place from the installation during off-loading of cargo from the vessel, care should be taken to ensure that the cargo taken on board is immediately secured against movement until it can be properly stowed.

- It is essential that an efficient means of communication, preferably by radio link, is established by the installation crane operator and the working deck officer who should at all times be in visual contact with each other.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

Before arrival at loading port

For the loading terminals to be prepared as best as possible regarding the organization of a safe and efficient operation, the terminal needs some information about the vessel. When the vessel has provided the loading figures, and the vessel is nominated for the cargo, she receives a lot of particulars that need to be answered. Among other things this consist of:

- The vessel's draught and trim on arrival.
- Ballast on arrival. Amounts of CBT and SBT.
- How the deballasting is to be done-pumped over board or deliveries to shore.
- Type of cargo on previous voyage (usually, the three last voyages are asked for).
- Amount and location of slop on arrival
- Prospective request for LOT (load on top). This means to load or top of the arrival slop.
- To confirm that the cargo tanks are inerted on arrival, and that the inert gas plan is working properly.
- Number of manifold lines and their size.
- The manifold's height above the main deck.
- The manifold distance from rails.

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The information given to the vessels from the terminal varies port to port. If the information from the loading terminals is defective, it can be necessary to obtain the necessary information from somewhere else. Among all the reference books on board is the "Guide to Port Entry". This book contains almost all the relevant information about most ports world wide with international traffic. The book informs about tide, current condition, depth along side piers, pier size, number and dimension of loading/discharging arms (hoses, etc.)

With regards to information about the cargo load, it is usually not possible to achieve accurate information before the vessel is moored. It will now be beneficial to keep on orderly system of storing previous loading documents. The planning of a loading operation can be done in good time ahead based on the information obtained, such as:

- Available loading rate.
- Approximately density and temperature of the cargo.
- Number and dimension of loading arms (hoses). This is important to know due to connection of prospective reducers on the manifold.
- Draught along side the pier.
- Air draught limitation.
- Local circumstances like the tide, for instance regarding the moorings.

Based upon all available information, a loading plan is formed. Thorough preparations also include that personnel involved in the operation are fully informed about the plan. A good chief officer makes sure that all the involved are instructed in their duties. Such instruction is best for the personnel involved and reduces the risk of undesirable occurrences.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.6. Bulk carriers

Ship/Shore Meeting

"Code of practice for the safe loading and unloading of bulk carriers"

Following the dramatic increase in the number of bulk carrier incidents and the loss of their crews, the International Maritime Organization (IMO) developed and subsequently adopted a wide range of safety measures designed to improve the safety of bulk carriers.

Included in these safety measures are requirements for improving the strength and maintenance of bulk carriers, guidelines for their inspection at terminals (IMO Resolution A.866 (20)) and recommendations concerning the loading and unloading of bulk cargoes. The latter are published in the "Code of Practice for the Safe Loading and Unloading of Bulk Carriers" (Res. A.862 (20)), which was adopted by the IMO in November 1997. The Code is important as it addresses the issue of safety of bulk carriers in ports whereas other IMO measures are primarily concerned with the safety of bulk carriers at sea. It provides a realistic and pragmatic risk management framework, and covers all solid bulk cargoes except grain. Guidance on such matters as the suitability of ships, procedures between ships and shore, cargo transfer and ballast handling is included in the Code.

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1.5. Tankers and tanker operations

Procedures after arrival at the terminal

After the vessel is well moored at the terminals, the chief officer meets the terminal' loading master, security officer and one or more independent surveyors. During a pre-meeting the operation is lined-up and information is exchanged, such as:

- Number of loading arms (hoses) and which manifolds to use.
- The loading plan is reviewed. Agreement of quantity and which cargo tanks will be filled.
- Agreement for the deballasting.
- Establish start rate, full rate and topping up rate during loading.
- Agreement how much time is needed for stop or an emergency stop.
- Agreements of shore stop or ship stop. When dead-weight limitation is in force, which stops before the cargo tanks are full, it is better for the vessel to agree to shore stop.

Before the loading commences a lot of paper works has to be done. An obligatory transition hereby exist for the serial safety points, a so-called "Ship/Shore Safety Checklist". In addition, the captain must sign a letter, which contains the vessel's responsibility to comply with the vessel's part of the checklist, and the consequences by not doing so.

Once these formalities are worked out, the vessel's representative and an independent surveyor will check the cargo tanks before commencing loading. The cargo tanks are sound/dipped and the found amount is calculated. The amount of cargo form previous voyage is called On Board Quantity (OBQ). The calculated figures are recorded in a specific report, and total OBQ, including slop, is to be drawn off from the surveyed quantity after loading.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

Load on top (LOT)

Most of the cargo from previous voyages is to be found in the slop tank. When planning the loading operation, permission to load in top must be obtained. It is important to know if the new cargo may unite with the previous cargo without being contaminated.

On CBT-tankers, which use cargo tanks for ballast, these tanks are both crude oil washed and water washed. After ballast handling and line washing, the cargo remnants are transferred to the slop tank. Since there are still a few terminals world wide which receive slop, the slop must remain on board and be mixed with the new cargo to make use of the cargo tank's total capacity.

Concepts in cargo calculations

With volume and quantity calculations of liquid cargo, such as oil, there are many details to consider. Before going into calculating cargo, we will take a closer look at the concepts, which are necessary to be familiar with.

Let us start with the place cargo is kept, which is the single cargo tank. Each tank is calibrated when built, and the total volume is determined. From this an ullage table is worked out. Ullage is the distance between the surface of the liquid and the top of the tank, or the height of the "empty space" above the liquid.

In the ullage table, we find the liquid's volume for different tanks levels. The levels are often given as ullage (distance down to liquid surface) and in sounding (the depth liquid).

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Enclosed are the ullage tables, which is a table for trim corrections belonging to each tank. The table give the change in ullage when it is exposed to differences in trim forward or trim astern. The trim corrections are determined by the comparison of the location of the measuring point and the cross-ship center line in the tank.
Likewise, we have a list correction, which was determined by the ullage plug location compared to the fore and aft center line in the tank.

With the above mentioned corrections, we calculate from the table ullage to get the corrected ullage, which is what we are using in our tables.

The methods for the measuring of tank liquid levels passed great changes in later years. In the past, the measuring was executed standing over an open ullage plug, sounding the ullage with a tape, often with a piece of wood in the end to help, determining the distance down to the liquid surface. The topping was controlled with a wooden stick marked with inches or centimeters.

Gradually stricter demands on non-flammable tank atmosphere came into regulation and we now have closed gauging.

There are a lot of different types of devices used in sounding of liquid level in tanks. A common principle is radar echo, where device placed on deck sends signal which are reflected on the liquid surface and recorded on reading device. Usually, this is transferred for distance reading in the cargo control room.
For manual sounding, different types of measuring tapes are adjusted and connected to ball valves giving a gas tight connection. A frequently used type is UTI apparatus (ullage-temperature-interface) which has a sensor attached to the end. This can be used in both measuring ullage, temperature and can differ between oil and settled water (interface).

When measuring ullage, the apparatus gives a sound signal once the sensor hits the liquid surface the ullage can be read in the window of the device.

With the sensor well dipped in the cargo, the temperature is read digitally on the apparatus. Temperature measures are usually done on several levels in the cargo tank achieve an average cargo temperature. The UTI-instrument can also be used in confirming which level we find the separation between oil and water. By sinking the sensor well down into the water and then leading it into the oil, we will receive a sound signal once the sensor passes the separation line. This signal is obviously different from the signal for ullage.

This was a short briefing of the most common methods of measuring the liquid level in tank. To get accurate measuring is important that the liquid surface us calm. Therefore, make a note in the reports, if the ship has been rolling or pitching during ullaging.

Now we can move further on and view the other expressions and concepts used in various cargo calculations. In the calculation forms and tables on board, we frequently come across expressions and abbreviations. Here we will view some of the most frequently appearing, such as:

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

- **TOV** - Total observed volume. Total volume of oil, free water, residues, etc. at actual temperature at the time of measuring.
- **GOV** - Gross observed volume. TOV withdrawn of free water. Residues are still counted in.
- **GSV** - Gross standard volume. GOV multiplied with a volume correction factor. This is a standard volume either at 15 degrees C or 60 degrees F for use in the tables.
- **TCV** - Total calculated volume. GSV added free water. Total volume of oil, free water, residues, etc. by table temperature (15 degrees C or 60 degrees F).
- **OBQ** - On board quantity. The oil deposits from the last voyage, which are on board before loading.
- **ROB** - Remaining on board. Oil deposits of cargo left in the tanks after discharging.
- **VCF** - Volume correction factor. Factors used to correct the volume at the actual temperature, to the volume the liquid would have had by a given table temperature (15 degrees C or 60 degrees F).
- **VEF** - Vessel experience factor. Factor that is used to correct the difference experienced between the ship figure and the Bill of Lading figure.
- **Mass** - the quantity of mass (weight in vacuum), the SI description = kilograms
- **Weight in air** - Mass subtracted from the buoyancy in air. In ASTM suggested to be 1.22 kg/m3.
- **Specific Gravity 60 °/60 ° F** - is a proportional number between a volume of water and a volume measured liquid, both at 60° F. With both in equilibrium the proportion between the volumes is calculated.
- **API Gravity at 60 degrees F** - Simplified number referring to Sp.gr. 60°/60° F. The number is worked out by the American petroleum Institute, and with the following formula we use API to find Sp.gr. Sp.gr. 60°/60°F = 141.5 : (API + 131.5)
- **M.T.** - metric tonnes (1000kg)
- **L.T.** - Long tons (1016.05 kg)
- **U.S. BBLs, 1 m³** - 6.2898105 BBls

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.5. Tankers and tanker operations

For trim and list corrections, we find the ullage (corrected ullage) for the ship on even keel. With this value refer to the ullage table to get the volume (some operate in m3 and others in US Barrels). This is TOV.

After loading, some of the settled water in the bottom of the cargo tank may be measured. By subtracting the water from the volume we get GOV, which is the volume of oil and residues at an observed temperature. With the GOV, we then use VCF, which is a factor used to calculate what the volume, at observed temperature, would have been, if we had reduced the volume equal standard (table) temperature. The volume correction factor is read off the oil density table, which is valid just for oil. This is the reason why free water is drawn out.

Cargo calculations

When the loading is complete, we will calculate the loaded cargo quantity. The ship calculates how much cargo is received and the terminal calculates how much cargo delivered. The independent loading surveyor performs the calculations both places in order to compare.

The ullage and temperature and measured in each tank. We try to find the amount of water we have in the oil that settles after loading.

Note, here it is extremely important to record traces of water (if any), even if we cannot decide the amount. This way we have something to refer to at the discharging port where we will find larger amount of water settled during the voyage.
In addition, we note the actual trim and list for correction of the ullage, if needed.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.6. Bulk carriers

Loading sequence

Notes to Annexes to IACS Unified Requirement on Guidance for Loading/Unloading Sequences for Bulk Carriers.

Introduction

To be of practical use to the ship's officers, any acceptable loading or unloading sequence must, in addition to meeting strength and stability requirements, satisfy operational and commercial requirements as far as possible. Therefore, the following notes have been developed by the Nautical Institute, in association with IACS, Intercargo, BIMCO and the International Bulk Terminals Association. It is recommended that they be taken into account when compiling the typical loading and unloading sequences described in the Annexes to the IACS Unified Requirement.

Loading

Deballasting can present difficulties. The process should always be started and finished as early as possible in the loading process and should be planned to proceed in the most favourable circumstances.

The easiest ballast tanks to drain should be left until last in the deballasting sequence. In order to take into account the effects of draft, heel and trim and the characteristics of the tanks, the preferred deballasting sequence (subject to the strength requirements of the individual ship) is:
1: ballast holds, 2: double bottoms, 3: topside tanks, 4: peak tanks.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.6. Bulk carriers

A good stern trim should be maintained as far as possible throughout deballasting and final stripping of ballast.

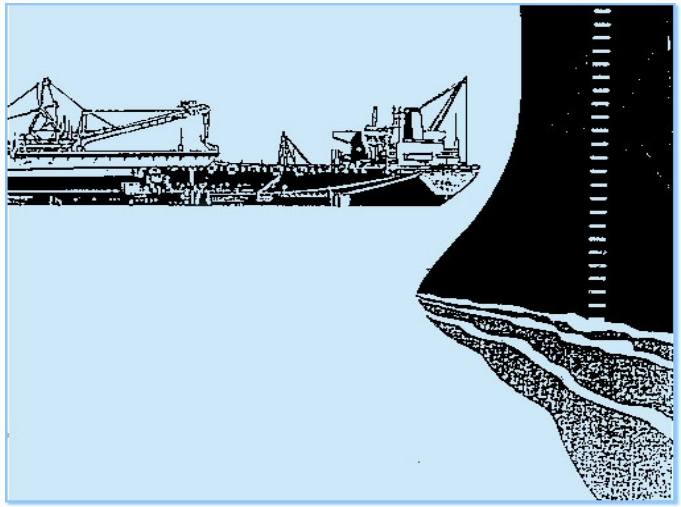
The ship should never be allowed to go "by the head" during deballasting, as the ballast suctions and sounding pipes of most bulk carriers are not designed to cope with this eventuality.

Departure draft, when laden, is usually even keel or close thereto. As this trim does not favour the stripping of ballast tanks it should be reached as late as possible in the loading process.

When loading a homogeneous cargo, one draft survey only will normally be required to interrupt the loading. The purpose of this draft survey, made after some 85-95% of the cargo has been loaded, is to make an accurate calculation of the tonnage remaining to be loaded and to calculate how it is to be distributed between a forward and an after hold, to achieve the desired final trim. Operational factors will influence which specific forward and after holds are used for the trimming.

Draft surveys will normally also be made before commencement and after completion of loading but these surveys need not be included in the loading sequence. If several grades of cargo are loaded it may be necessary to hold a draft survey before commencement and after completion of each grade and, in addition when 85-95% of the grade has been loaded, if the ship is to control the tonnage loaded.

If the ship has a ballast hold or ballast holds loading of those holds should be programmed as late as possible in the loading sequence to allow the maximum time for deballasting, cleaning, drying, open-



1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.6. Bulk carriers

IMO Resolution A.713(17)

Despite the efforts of IMO and its Member Governments, the number of bulk carriers sinking during the late 1980s and early 1990s, sometimes without trace, began to cause serious alarm. As a result, resolution (A.713(17)) which contains interim measures designed to improve the safety of ships carrying solid bulk cargoes, was duly adopted.

Owners are encouraged to fit vessels with equipment to monitor the stresses on the ship's structure during the voyage and during cargo operations. They are also encouraged to install equipment required by the Global Maritime Distress and Safety System (GMDSS), which enters into force on 1 February 1992.

The impact of this resolution was immediately beneficial. The number of bulk carrier losses dropped from around one a month to just two within the next year. It is significant that the resolution did not introduce any new measures but simply stressed the importance of implementing existing standards.

(1) For ships with a small list the metacentre may be considered to be the point on a line drawn vertically through the ship which is intersected by a line drawn vertically from the centre of buoyancy when the ship is rolling. If this point is below the centre of gravity the ship will roll over. The term GM means the vertical distance from the metacentre (M) to the centre of gravity (G).

(2) A 'tween-decker is a ship with more than one deck, thus providing space between the two adjacent decks.

(3) These sections of the Code are currently under revision, the aim being to develop new criteria for shifting of cargoes.

(4) i.e. having a large metacentric height.

(5) When a cargo space contains a liquid, the metacentric height of the ship is reduced by an amount depending mainly on the width of the free surface of the liquid. The effect is independent of the amount of liquid in the cargo space.

(6) The UN Committee of Experts on the Transport of Dangerous Goods numbers each dangerous substance, with the exception of MHB.

(7) Substances included in the IMDG Code are arranged in different classes according to their properties (e.g. explosives, flammable liquids, corrosives, etc.).

(8) The Medical First Aid Guide is intended for use in conjunction with the IMDG Code. Poisons are divided into groups and given individual numbers.

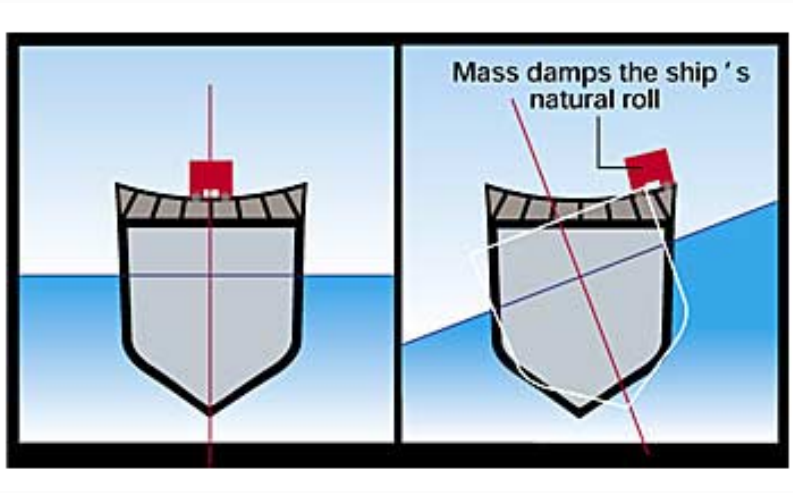
1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.7. Bulk cargoes

Virtually all liquids transported by sea - such as crude oil and finished petroleum products - are carried in bulk, and tankers now form by far the greatest percentage of the world fleet of merchant ships. The second biggest group consists of solid bulk cargo carriers. The goods carried in this way include coal, grains, ores, concentrates, fertilizers and animal feeds. From the shippers' point of view bulk carriage has numerous advantages. A bulk cargo can be loaded and unloaded far more quickly than one that is unitized, thereby leading to great savings in time and money. However, there are a number of dangers in the carriage of bulk cargoes which include the following:

1. **Improper weight distribution resulting in structural damage.** This can be caused by putting too much weight on the inner bottom of the ship or by wrongly distributing the cargo between holds, leading to excessive stresses on the ship's structure.

2. **Improper stability and cargo shift.** Another result of improper loading can be excessive stability. This leads to the normal rolls of the ship becoming shorter but much more violent. Apart from being extremely uncomfortable for those on board, this can in turn lead to damage to the ship's structure.



Stability of the ship can also be affected by the cargo shifting during the course of the voyage. This can occur because the cargo is inadequately trimmed (levelled-off) or improperly distributed. In some cases cargoes can liquify as a result of vibration and the motion of the ship and then slide or flow to one side of the cargo hold. This usually happens when the cargo consists of finely-grained material, such as fine coal and ore concentrates, which are damp when loaded. However it occurs, a shift of cargo can lead to the ship listing and ultimately capsizing.

3. **Spontaneous heating**. Some cargoes carried in bulk have a tendency to heat spontaneously during the course of a voyage. The result can be a fire or explosion.

4. **Chemical hazards**. These hazards include the emission of toxic or explosive gases, oxygen depletion, spontaneous combustion or severe corrosion.

Measures to counter these problems have been adopted at both a national and international level.

The carriage of grain

Grain has been transported by sea for many thousands of years - it was an important feature of commerce in the Mediterranean in ancient times - and nowadays, is generally carried in bulk. However, grain has one great hazard when carried at sea in bulk; it tends to shift within the cargo space of the ship. Because of this danger and the great amount of grain transported by sea, special rules governing its carriage in bulk have appeared in various international instruments including the International Convention on the Safety of Life at Sea.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.7. Bulk cargoes

General cargoes

General cargoes, even if not classed as dangerous, can pose dangers to ships or those on board, if certain precautions are not observed. If the cargo is to be discharged in generally the same condition as when loaded, further common sense considerations apply. In order to plan stowage, the responsible officer should have information on the nature, mass and stowage factor of the individual cargo. Where large items of cargoes are concerned, information on the dimensions of the cargo is required. Such information will then be used to distribute the cargo in such a way as to ensure adequate stability and workable trim at all stages of the voyage and to have the cargo gear rigged so as to ensure that heavy items can be lifted without the possibility of a stow collapsing and endangering the ship; of items of machinery or steel shafts falling and penetrating the ship's shell-plating; or of shifting deck-cargoes causing fractured deck piping and ventilation trunks.

In addition to those safety matters, the cargo officer must take into account commercial considerations and separate tainting from taintable cargoes or sweating cargoes from those that may be damaged by moisture and that heavy items are not placed on frail packages or packaged liquids on bagged cargoes. For some cargoes ventilation must be encouraged or sometimes it must be restricted but the different climatological conditions in which a ship is expected to operate must always be taken into account. In all cases, the drainage of liquids to the hold bilges or wells should be facilitated.
The securing of breakbulk cargoes is most conveniently done by planning stows to occupy the spaces from side to side, incorporating, where appropriate, built-in anchors of dunnage or using locked stows. Heavy items are individually lashed and for some cargoes, known to have given rise to difficulties in the past, IMO has published a Code of Safe Practice for Cargo Stowage and Securing (resolution A.714(17)). For the securing of freight containers a wide variety of standardized fittings are available. On open-top container ships, the need to secure cargoes is greatly diminished as all containers are placed within cells. The securing of containers on general cargo ships can cause problems unless special fittings have been provided.

Barge carrying ships have specialized arrangements to secure the barges and if problems arise, they stem from the cargoes within the barges. Ro-ro ships have fittings to secure lorries, although these are not always used.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.7. Bulk cargoes

The carriage of timber on deck

Timber is often carried on the decks of ships and sometimes cause the combined centre of gravity of ship and cargo to rise, which adversely affects stability, a situation made worse when the deck cargo absorbs rain and seawater during the voyage, especially when freezing occurs and ice accumulates on deck. However, there is usually an increase in buoyancy and the timber also gives the ship greater protection against the rough sea conditions. Thus, ships which carry timber deck cargoes may be granted reduction of the freeboard applicable under the 1966 International Convention on Load Lines except in the North Atlantic zone in winter where icing can be a problem.

The Code of Safe Practice for Ships Carrying Timber Deck Cargoes gives further information and guidance on this subject. It was adopted by IMO in 1973 and amended in 1978 and 1990. Like the BC Code and contrary to the International Grain Code, it is not a mandatory instrument but is intended to serve as guidance to Governments who can implement it if they desire, either in whole or in part. The Code is intended to apply to ships of 24 metres (79 feet) in length and over. Timber deck cargoes are defined as cargoes of timber, including logs, and sawn timber whether loose or packaged, which are carried on an uncovered part of a freeboard or superstructure deck.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.7. Bulk cargoes

Containerization

Since first introduced in the 1950s, containers have revolutionized the carriage of general cargoes which presented great advantages both in ease and speed of handling, cargo security, and together with other factors have transformed both ships and ports.

In many countries the traditional cargo berths, located in the centre of urban areas, have lost trade because they do not provide the space needed for container operations as berthing facilities in many cases have moved downriver, to where there is more land available and the water is deep enough to accommodate container ships that have steadily increased in size.

Usually ports have been developed with a close eye on land transport as well, for one of the major advantages of containers is that they enable an integrated transport system involving road, rail and sea elements to be established, the link being the port and the common feature the container itself.

More recently another innovation has affected the shipment of cargoes, especially on short-sea routes: the trailer on board ship.

1. SAFE LOADING, STOWAGE, SECURING AND CARE OF CARGOES

1.7. Bulk cargoes

The special-purpose roll/on-roll/off ship offers many of the advantages of the container ship, including speed and security. A container on a trailer can be driven straight onto a ship in one port and off again when it reaches its destination. There is no cargo handling involved and consequently no extra costs or loss of time. Both developments offer economic benefits and both raise problems.

In view of the rapid increase in the use of freight containers for the consignment of goods by sea and the development of specialized container ships, in 1967 IMO undertook to study the safety of containerization in marine transport. The container itself emerged as the most important aspect to be considered.

In the 1970s IMO and the International Labour Organisation began work on guidelines for training in the packing of cargo in freight containers. These were published in 1978 as a short guide which emphasized the effect upon the contents of the containers of sea itself. The movement of the ship in adverse weather can result in pitching, rolling and other movements greater than anything found ashore. The guidelines were revised in 1984.

Experience had by then shown that probably the greatest problem associated with ro-ro ship safety concerned cargo stowage. A survey carried out by the Norwegian classification society, det Norske Veritas, showed that 43% of ro-ro losses could be attributed to faults in this area. The danger is even greater in the case of ro-ro ships than on pure containerships, because containers are generally carried on trailers: a loading error can result in the container and the trailer both falling over or becoming dangerously unbalanced.

In 1983 IMO therefore adopted a resolution on elements to be taken into account when considering safe stowage and securing of cargo units and vehicles in ships and two years later, it adopted another resolution on securing arrangements for the transport of road vehicles on ro-ro ships. It contained guidelines intended to apply to commercial vehicles, including semi-trailers and road trains, with a total mass (including cargoes) of up to 40 tons, and articulated road trains of not more than 45 tons but does not apply to buses.

The resolution stipulates that given adequately designed ships and properly equipped road vehicles, lashing of sufficient strength will be capable of withstanding the forces imposed on them during the voyage. The side guards often required for vehicles can obstruct proper securing and the guidelines take this difficulty into account. They cover securing points both on the deck of the ship and on the vehicle, as well as lashings and stowage.

The code of safe practice for solid bulk cargoes

The dangers associated with the carriage of cargo in bulk have been known for a long time and the 1960 International Conference on the Safety of Life at Sea recommended that IMO draw up an international code of safe practice dealing with this subject. Work began immediately and in 1965 the first Code of Safe Practice for Solid Bulk Cargoes was adopted.
The Code has been updated at regular intervals since then and is kept under continuous review by the Sub-Committee on Containers and Cargoes. The practices contained in the Code are intended as recommendations to Governments, ship operators and shipmasters. Its aim is to bring to the attention of those concerned an internationally-accepted method of dealing with the hazards to safety which may be encountered when carrying cargo in bulk. The Code does not deal with the transport of grain, which is covered by the International Code for the Safe Carriage of Grain (International Grain Code).

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The Code of Safe Practice for Solid Bulk Cargoes deals with three basic types of cargo: those which may liquefy; materials which possess chemical hazards; and materials which fall into neither of these categories but many nevertheless pose some dangers, as stated above.

The Code highlights the dangers associated with the shipment of certain types of bulk cargoes; gives guidance on various procedures which should be adopted; lists typical products which are shipped in bulk; gives advice on their properties and how they should be handled; and describes various test procedures which should be employed to determine the characteristic cargo properties.

General precautions

It is of fundamental importance that bulk cargoes be properly distributed throughout the ship so that the structure is not over-stressed and the ship has an adequate standard of stability.
Loaded conditions vary according to the density of the cargo carried. General cargo ships are normally constructed so that one ton of cargo occupies about 1.39-1.67 cubic metres of space when loaded to full bale cubic and deadweight capacity. The ratio of volume of cargo to its mass is known as the stowage factor. When the high density bulk cargoes with a stowage factor of about 0.56 cubic metres per ton or lower are carried, it is particularly important to pay attention to the distribution of weight in order to avoid excessive stresses on the structure of the ship. Since hull arrangements vary, it is not possible to establish overall rules applicable to all types of ships.

It is essential that the master be provided with loading information sufficiently comprehensive to enable him to load the ship without overstressing the structure. This applies to localized stresses on the structure as well as on the bending stresses. The master must also be able to calculate the stability of his ship for the anticipated worst conditions during the voyage.

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The initial transverse stability of a ship is usually expressed as the metacentric height or GM. A large distance between the centre of gravity of ship and cargo (G) and the metacenter (M) means that the ship has adequate stability. As G approaches M, i.e. when the centre of gravity of ship and cargo rises, ships, when forced from a position of equilibrium, recover this position sluggishly.
Generally speaking, high density cargoes should be loaded in the lower hold spaces rather than the tween decks. Particular care should be taken when a ship has a high GM. Bulk cargoes having an angle of repose greater than 35 degrees should also be taken into account.

The Code gives various precautions to be followed when information on the physical properties of the cargo is not available.

The Code lists other general precautions such as the need to protect machinery and the interior of the ship from dust and to ensure that bilges and service lines are in good order and not damaged during loading.

Bulk cargoes having an angle of repose less than or equal to 35 degrees

When a bulk cargo is emptied on to a flat surface, such as the hold of a ship, it forms a cone whose angle of repose varies according to the type of cargo. This angle is the one formed between the horizontal plane and the cone slope.
Cargoes with a low angle of repose are particularly liable to dry-surface movement aboard ship. To overcome this problem, the Code states that such cargoes should be trimmed reasonably level and spaces in which they are loaded should be filled as fully as is practicable, without resulting in excessive weight on the supporting structure.
Special provisions should be made for stowing dry cargoes which flow very freely, in a similar manner to grain.
Securing arrangements, such as shifting boards or bins, should be used whenever the amount, location or properties of the cargo could cause excessive heeling through cargo shift, taking into account the density of the cargo.

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Bulk cargoes having an angle of repose greater than 35 degrees

Generally speaking, high-density cargoes, such as most iron ores, have a high angle of repose, i.e. above 35 degrees.
The Code states that high density cargoes should be loaded entirely in the lower holds of the ship unless this results in the ship being too "stiff" or in the cargo weight on the bottom structure being excessive. It should be trimmed sufficiently level to cover evenly all of the tank top, to reduce the pile peak height and equalize weight distribution. In some circumstances the pile peak may be allowed to extend through the tween-deck hatchway but the Code says that the importance of trimming as a means of reducing the possibility of a shift of cargo can never be over-stressed. This is particularly true for smaller ships of less than 100 metres in length.

Trimming also helps to cut oxidation by reducing the surface area exposed to the atmosphere. It also helps to eliminate the "funnel" effect which in certain cargoes, such as direct reduced iron (DRI) and concentrates, can cause spontaneous combustion. This occurs when voids in the cargo enable hot gases to move upwards, at the same time sucking in fresh air. This effect is obviously not desirable, since it escalates the process of spontaneous combustion.

The Code goes on to list various considerations which should be taken into account when cargo is loaded in the 'tween-decks to reduce "stiffness".

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Safety of personnel

After listing various regulations adopted by the International Labour Organisation, which should be taken into account during cargo handling operations, the Code gives details of other dangers which may exist. Some cargoes, for example, are liable to oxidation which may result in the reduction of the oxygen supply, the emission of toxic fumes and self-heating. Others may emit toxic fumes without oxidation or when wet.
The shipper should inform the master of chemical hazards which may exist and the Code gives details of precautions which should be taken.
Health hazards can arise because of dust, and some cargoes can create dust or emit flammable gases which create a danger of explosion.

Cargoes which may liquefy

These include concentrates (materials obtained from a natural ore by a process of purification, by physical or chemical separation and removal or unwanted constituents), some coals and other materials with similar properties.
One purpose of this section of the Code is to draw attention to the latent risk of cargo shift and describe precautions which should be taken. Concentrates and similar finely-particulate materials may appear to be in a relatively dry granular state when loaded and yet may contain sufficient moisture to become fluid under the stimulus of compaction and vibration. In the resulting semi-fluid state, the cargo may flow to one side when the ship rolls but not completely return when the ship rolls the other way. As in the case of cargoes liable to shift, this can result in the ship reaching a dangerous heel or eventually capsizing.

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The stability of the ship is also likely to be affected by "free surfaces" of liquids in the cargo spaces. General cargo ships should only carry bulk cargoes which have a moisture content below the transportable moisture limit (TML), which is 95% of the flow moisture point (FMP) unless they are fitted with special arrangements to restrain the cargo.

Cargo ships in which internal structural boundaries are sufficient to limit cargo shift may also carry cargoes whose moisture content exceeds the transportable moisture limit. All ships which carry cargoes of this type should carry evidence of approval of the flag State. The Code stipulates the data which should be included in submission for approval.

To prevent possible increases in the liquid content of concentrates, cargoes containing liquids (other than canned goods or the like) should not be stowed in the same compartment as cargoes which may liquify. Precautions should be taken to prevent water entering holds; this is even more important where contact with seawater could lead to serious corrosion problems for hull or machinery. In this connection masters should be aware of the possible danger of using water to cool combustible materials such as coal at sea, as this may well bring the moisture content to a flow state or create other hazards. Water, if used, is most effectively applied in the form of spray or mist.

Appendices to the code

A list of cargoes which may liquefy is contained in appendix A to the Code. The stowage factor is generally low (from 0.33 to 0.57 cubic metres per ton) and it is emphasized that the list of materials is not exhaustive. It includes concentrates derived from copper, iron, lead, manganese, nickel, and zinc ores, various pyrites, fine-particulate coal, coal slurry and various other substances.

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Find appendices so we can put them as complementary information??

Materials possessing chemical hazards

Appendix B gives an extensive list of materials of this type ranging from aluminium dross to zinc ashes. Some of the classified materials listed also appear in the International Maritime Dangerous Goods (IMDG) Code when carried in packaged form, but others become hazardous only when they are carried in bulk - for example, because they might reduce the oxygen content of a cargo space or are prone to self-heating. Examples are woodchips, coal and DRI.
The various types listed include: flammable solids; flammable solids or substances liable to spontaneous combustion; flammable solids or substances which, in contact with water, emit flammable gases; oxidizing substances; poisonous substances; radio-active substances; or corrosives.

Such materials should be carefully segregated from other dangerous goods carried in packaged or unitized form. The Code describes how this should be done.
Each entry includes either the United Nations number and IMO class or the MHB (materials hazardous in bulk) classification and a BC number; the relevant MFAG (Medical First Aid Guide) table number; approximate angle of repose and stowage factor; Emergency Schedule number; separation and stowage requirements; and properties, observations and special requirements.

Bulk cargoes which are neither liable to liquefy nor possess chemical hazards

These cargoes do not normally have special hazards and are covered in Appendix C. The list ranges from alumina to zircon sand as well as many of the more commonly-carried bulk cargoes such as clay, cement, iron ore, pig iron, sand and sugar. The list includes the angle of repose of each material, its approximate stowage factor, and the properties and special requirements connected with each one.

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1.8. Relevant instruments and information

Cargo information

The master should be provided with at least the following information:
- dimensions of the receptacle and commodity if non-dangerous and, if dangerous, the information as required in accordance with the IMDG Code;
- gross mass of the receptacles; and
- Whether or not the receptacles are equipped with hoisting devices of sufficient strength.

For captain - The material that should be here is mentioned throughout the module, and I couldn't find anything more that can be added here. As I said, some of the Codes are missing though.

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1.9. Relationship between ship and terminal personnel

- Effective means of communication are to be established between the ship's deck officers and the cargo terminal, and should remain effective throughout the cargo operation.

This communication link should establish:

- An agreed procedure to stop cargo operations.
- Personnel responsible for terminal cargo operations.
- The ship's officer responsible for the cargo loading/unloading plan and the officer in charge responsible for the on deck cargo operation.
- Confirmation of information received in advance.
- An agreed procedure for draught checking.
- The reporting of any damage to the ship from the cargo operations.

The ship's officer responsible for the cargo operation plan should submit the proposed loading/unloading plan to the cargo terminal representative at the earliest opportunity to allow sufficient time for any subsequent modifications and to enable the terminal to prepare accordingly. The ship's officers should be familiar with the IMO ship/shore safety checklist.

From 1st July 1998, it will be mandatory requirements of the SOLAS Convention that:

- the plan, and any subsequent amendments thereto, shall be lodged with the appropriate authority of the port state
- the ship's Master and the terminal representative shall ensure that the cargo operations are conducted in accordance with the agreed plan.

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1.9. Relationship between ship and terminal personnel

Procedures between the ship and terminal prior to cargo handling

Principles:

The master is responsible at all times for the safe loading and unloading of the ship, the details of which should be confirmed to the terminal representative in the form of a loading or unloading plan. In addition, the master should:

- ensure that the loading or unloading of cargo and the discharge or intake of ballast water is under the control of the ship's officer in charge;
- ensure that the disposition of cargo and ballast water is monitored throughout the loading or unloading process to ensure that the ship's structure is not overstressed;
- ensure that the terminal representative is made aware of the requirements for harmonization between deballasting and cargo loading rates for his ship;
- ensure that ballast water is discharged at rates which conform to the agreed loading plan and do not result in flooding of the quay or of adjacent craft;
- retain on board sufficient officers and crew to attend to the adjustment of mooring lines or for any normal or emergency situation, having regard to the need of the crew to have sufficient rest periods to avoid fatigue;
- ensure the loading or unloading plans have been passed to and agreed with the terminal representative;
- ensure that the terminal representative is made aware of the cargo trimming requirements;
- ensure that appropriate information about the cargo to be loaded has been received to enable safe stowage and carriage to be achieved;

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- ensure that there is agreement between ship and shore as to the action to be taken in the event of rain, or other change in the weather, when the nature of the cargo would pose a hazard in the event of such a change; and
- ensure that no hot work is carried out on board the ship while the ship is alongside the berth except with the permission of the terminal representative and in accordance with any requirements of the port administration.

The terminal representative is responsible for loading or unloading cargo in accordance with the hatch sequence and tonnages stated on the ship's loading or unloading plan. In addition, the terminal representative should:

- complete the check list in consultation with the master before loading or unloading is commenced;
- not deviate from the loading or unloading plan unless by prior consultation and agreement with the master;
- trim the cargo, when loading or unloading, to the master's requirements;
- maintain a record of the weight and disposition of the cargo loaded or unloaded and ensure that the weights in the hold do not deviate from the plan;
- provide the master with the names and procedures for contacting the terminal personnel or shipper's agent who will have responsibility for the loading or unloading operation and with whom the master will have contact;
- avoid damage to the ship by the loading or unloading equipment and inform the master, if damage occurs;
- ensure that no hot work is carried out on board or in the vicinity of the ship while the ship is alongside the berth except with the permission of the master and in accordance with any requirements of the port administration; and
- ensure that there is agreement between the master and the terminal representative at all stages and in relation to all aspects of the loading or unloading operation

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Quantity of cargo

The same quantity of cargo must be delivered to the consignee as it was received by the vessel from the shipper.

The carrier must verify this quantity as the time of loading to ensure that the figures stated in the bill of lading is correct. This can be achieved by tallying, draft survey or by calibration tables of each hold or tank of a vessel.

In case of cargo discrepancy between shore and ship figures

The Master cannot be asked to sign for goods which he knows have not been loaded. It is quite common for there to be a small discrepancy between the figure obtained from shore weighing, and the draft survey by ship's officers. The Charter Party or the practices of the trade, will dictate which figure is to be used in the bill of lading. If the shore figure is used, and the ship's figure by draft survey is less, it is normal for the Master to fear that he will be unable to deliver the full quantity of cargo as stated in the bill of lading.

If cargo discrepancy between shore and ship figure is found, immediately prepare a protest letter about the cargo discrepancy, detailing the course of events including the ship's figure by draft survey against the shore scale figure, stating that he believes the correct figure is the ship's figure (of course the Master should be absolutely sure that his draft survey figure was calculated correctly). Let the Charterers/Shipper's/Receivers representatives/servants and Agents signed receipt and acknowledgment. If not time-constrained, please have it notarized prior ship's departure otherwise have it notarized on the next port reserving the right to do so at any time/place convenient.

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1.9. Relationship between ship and terminal personnel

Communications

- Prior to undertaking the tow, relevant information should be exchanged and an effective means of communication established between the tug and the tow. Secondary/alternative means of communication when possible should also be agreed.

- Internal communications are equally important and the Tug Master should ensure that the crew are aware of the intended operation, including any special circumstances or instructions, and that an effective means of communication is established between the master and crew during the towing operation.

Interaction

- Interaction and its effects on the tug and its handling are well known and appreciated in port/harbour towage. Masters and crew are reminded that these effects increase with speed. MGN 199(M) provides guidance on the effects of interaction.

- In areas where interaction exists, and when manoeuvring alongside a tow, the master should be aware of the possibility of underwater obstructions such as bulbous bows, stabiliser fins etc, and areas of the ship's sides, such as pilot doors, which are to be avoided. The use of bow thrusts by the tow may present a hazard to the tug.

- When in close proximity to or coming alongside a tow, the crew should be aware of interaction and the effect it may have on the tug. This may take the form of sudden movement or contact and result in loss of balance or movement of equipment and other objects.

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Claused the Mate's Receipt with remarks such as " quantity loaded or discharged in dispute" (whichever is applicable), "signed without prejudice, received only, without liabilities or responsibilities whatsoever". Endorsements such as "said to be, said to weigh", "quantity and quality unknown", or "weight and quantity unknown" may be issued when the ship's figures do not agree with the shore figures, but this practice will not necessarily protect the Owner from claims where there are very large differences which should have been noted. A Master may be held liable if, for example, he states "weight and quantity unknown" in a situation where he knows the figures submitted are incorrect.

Put remarks in the Statements of Facts (SOF) same as above clauses as in Mate's Receipt and duly noting the cargo discrepancy between shore and ship figure. Master's should check the accuracy and remarks made by the agent on the SOF before he signs it. Again when signing it, put remarks "quantity loaded or discharge in dispute", "signed without prejudice, received only, without liabilities or responsibilities whatsoever".