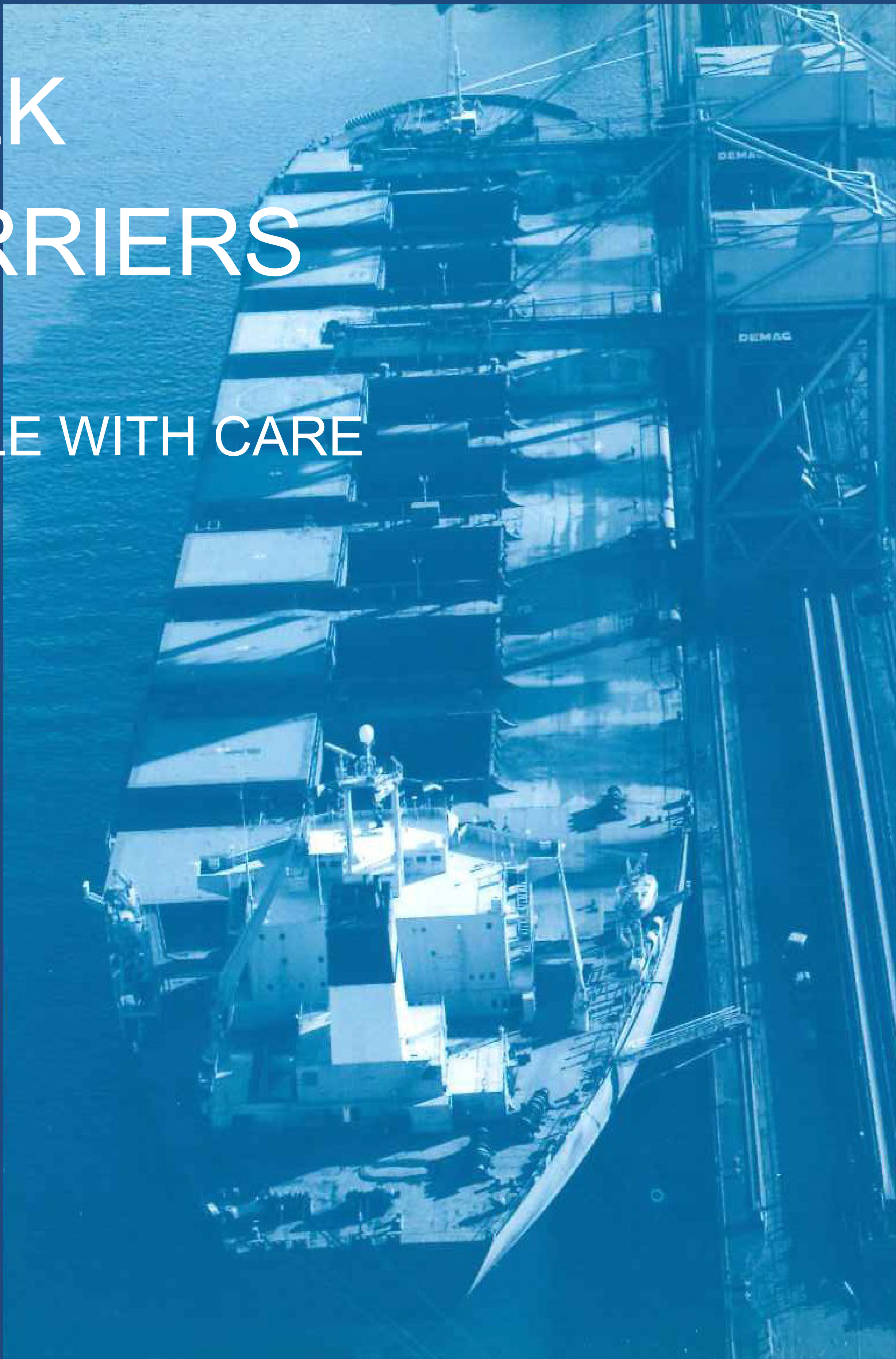
BULK CARRIERS

HANDLE WITH CARE

(New 1998)

(Rev.1 Mar 2020)



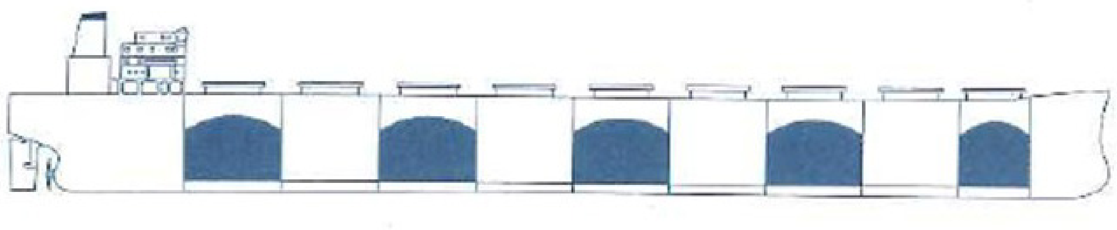
IACS
International Association of Classification Societies

CONTENT

Cover photo: Bulk carrier discharging in Rotterdam - Aeroview b.v./Port of Rotterdam

INTRODUCTION

In 2019 about 11 700 bulk carriers represent 35% of the world fleet gross tonnage. Heavy and high-density cargoes - mineral ores for example - make high physical demands on ships' structures, especially in the cargo hold area.



Bulk carriers must be handled with care in port as well as at sea. Stevedores and ships' officers responsible for cargo operations become key partners for ship safety, because the lives of seafarers may ultimately depend on careful cargo handling. Ship-to-shore planning, information and communication become vital.

Port and terminal authorities, together with owners and classification societies, therefore have a role to minimise risk in bulk carrier operations. IACS - whose members class over 90% of the world bulk carrier fleet - has investigated why bulk carriers have become vulnerable to structural problems... how their safety margins can be increased... and how day-to-day operations can become safer for their seafarers.

IACS' research shows that improper handling of heavy, high density cargo during cargo loading and discharge may cause excessive stress - and physical damage to holds and transverse bulkheads. Over time, this may reduce or threaten structural safety margins when the ship is at sea in heavy weather. Careful cargo handling helps maintain bulk carrier safety - bad practice lowers safety margins and increases risk for damage.

This IACS booklet is part of continuing series of publications dedicated to safer bulk carrier operations. Summarising the main problems in loading and discharging heavy and high-density cargo, it then considers technical factors from the viewpoints of design limitations and the ship safety responsibilities of the ships' officers.

The main cargo handling risks are:

- **Poor ship-to-shore communications**
- **Ignoring Loading Plans**
- **Inadequate pre-planning of cargo operations**
- **Improper load distribution between holds**
- **Overloading by high-capacity systems**
- **Physical damage during discharging**

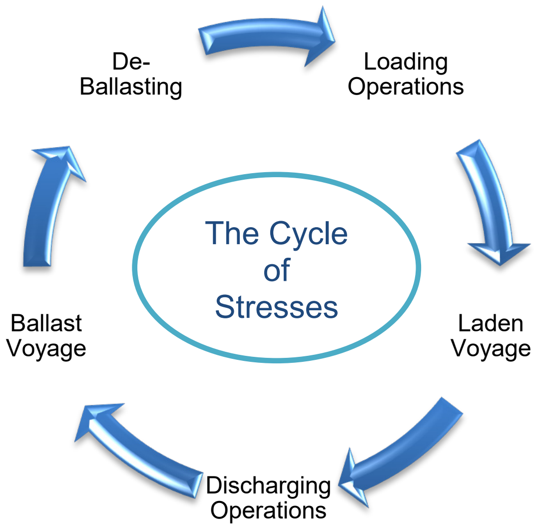


Figure 1: Typical Bulker Operations

1 HULL STRUCTURAL FAILURE

Accidental stress or damage caused during the loading or discharging of bulk carriers could ultimately lead to catastrophic structural failure either alongside or at sea. Factors which are important with respect to hull structural failure are:

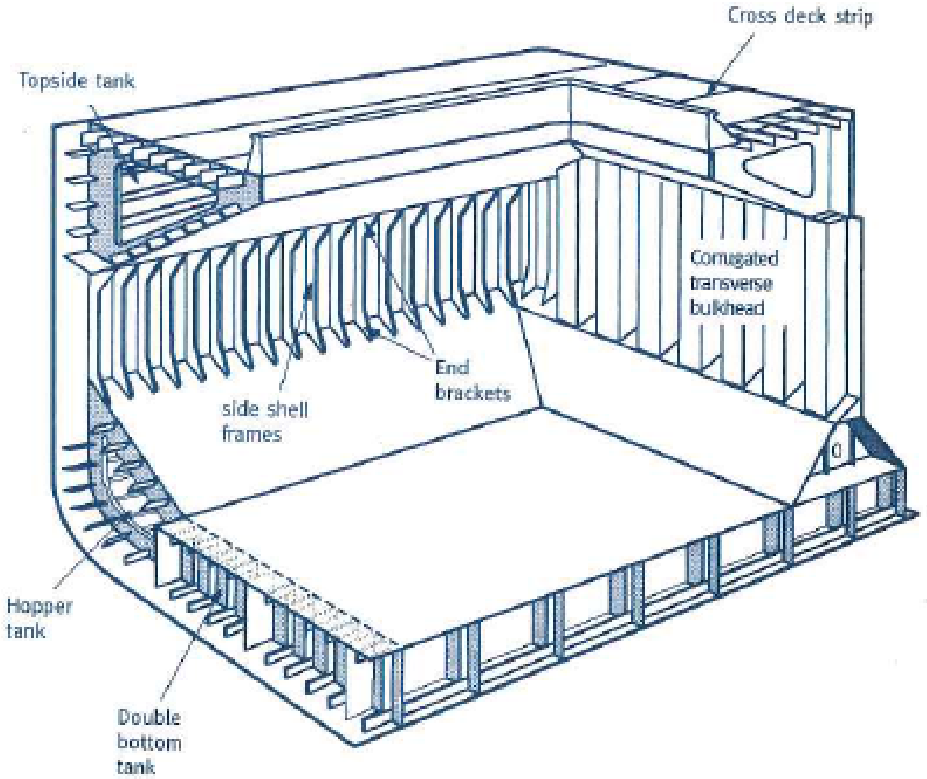


Figure 2: A typical cargo hold structural configuration - single side skin bulk carrier

- corrosion and cracking of the structure within the cargo spaces.
- over-stressing due to incorrect loading
- physical damage to side structures, hopper or transverse bulkhead during cargo discharging.

2 POTENTIAL PROBLEMS

Terminal operating staff need to share with ships' officers an awareness that heavy/high density cargo operations with bulk carriers involve the following nine main risks of hull or local structure over-stressing and consequent weakness.

THE POTENTIAL PROBLEMS ARE:

1. Deviations from the Loading Manual:

Exceeding permissible limits in the ship's Approved Loading Manual will result in over-stressing of the ship's structure - and may lead to catastrophic failure of the hull structure.

It is important to be aware that over-stressing of the local structural members can occur even when the hull girder Still Water Shear Force (SWSF) and hull girder Still Water Bending Moment (SWBM) have remained within their permissible limits. (See Section 3)

2. Shallow draught loading:

Loading cargo while the ship is in a shallow draught condition can impose high stresses in the double bottom, cross deck and transverse bulkhead structures if the cargo in the hold is not adequately supported by the buoyancy up thrust. The cargo weight limits for each cargo hold, and two adjacent cargo holds, as a function of draught, i.e. the local loading criteria are not to be exceeded.

To minimise the risks of over-stressing the local structure, the largest possible number of non- successive cargo pours should be used for each hold.

3. High loading rates:

High loading rates may cause significant overloading within a very short space of time.

The terminal should be prepared to STOP cargo operations if the ship's officer in charge of the loading is concerned by deviation from the agreed Loading Plan.

Sensitivity of the hull girder to overloading; local structure overloading and synchronisation of ballasting - where ballast pumping capacity is low versus cargo loading rate - are the three main problems associated with high loading rates.

4. Asymmetric cargo and ballast distribution:

Cargo and water ballast distribution have an important influence on the resultant hull structural stresses.

- High density cargo should be stowed uniformly over the cargo space and trimming applied to level the cargo as far as practicable. This will minimise the risks of cargo shift in heavy weather and of damage to the hull structure.
- When heavy cargo is poured into a cargo space at one end of the cargo hold, and piles up, the lateral cargo pressure acting on the transverse bulkhead will increase loads carried by the bulkhead structure - and the magnitude of transverse compressive stresses in the cross-deck structure, see 1) in Figure 3. The double bottom structure may also be severely overloaded.
- If the same loading pattern is applied to an adjacent hold, lateral pressure on the transverse bulkhead will be largely cancelled out - but vertical forces will be transferred to the bulkhead, see 2) in Figure 3.

Cargo should always be stowed symmetrically in the longitudinal direction, and trimmed, as far as practical.

- Stowing cargo asymmetrically, see 3) in Figure 3), about the ship's centreline in a cargo space induces torsional loads, causing twisting of the hull girder, and warping of the hull structure.
- Asymmetrical distribution of water ballast induces torsional loads and torsional loading of the hull girder is considered to be an important contributory factor in recurring cracking at the hatch corners,

and to problems with hatch cover alignment and fittings. Extreme cases may even lead to buckling of the cross-deck structure between hatch openings.

STRESSES RESULTING FROM ASYMMETRICAL CARGO DISTRIBUTION

1. On transverse bulkheads and cross-deck structures
2. On transverse bulkheads if cargo is asymmetrically distributed in adjacent holds
3. Asymmetric stowage about the ship's centreline can induce torsional loading and twisting of the hull girder

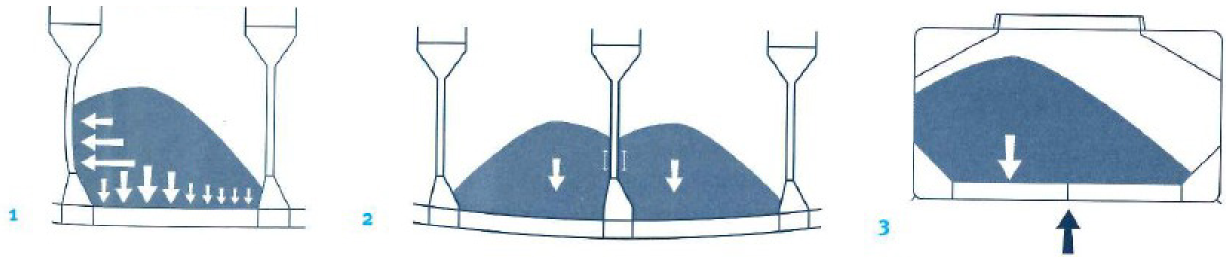


Figure 3: Stresses Resulting From Asymmetrical Cargo Distribution

5. Lack of effective ship/shore communications:

Will increase the risk of inadvertent overloading of the ship's structure.

It is important that there is an agreed procedure between the ship's officers and the terminal operators to STOP cargo operations or to adjust the speed of cargo operations as necessary. The ship-to-terminal communications link should be maintained throughout the cargo operation.

6. Exceeding load line marks

It is a statutory requirement that the ship is not to be loaded beyond the limits specified in its Load Line Certificate.

The ship must not be loaded such that at any point in time during the seagoing voyage the load line mark in use would normally be submerged. Hogging and sagging are to be considered while checking the load line marks. In other words, the average of forward and aft drafts are to be checked rather than just checking if the load lines are submerged.

End-hold trimming to maximise cargo carrying capacity, and inducing a hogging deflection of the ship is to be avoided - as it may result in the overloading of end holds beyond allowable limits, increasing local and global stresses.

7. Partially filled ballast tanks or holds:

Sailing with partially filled ballast holds or tanks is prohibited unless the Approved Loading Manual permits such practice. In partially filled ballast holds or tanks, there is the likelihood of sloshing, due to the ship's motion in a seaway. Sloshing will magnify dynamic internal pressures acting on the hold/tank boundary surfaces - and may ultimately damage the hold/tank's internal structure.

8. Inadequate cargo weight measurement during loading:

Overloading the cargo hold through inaccurate weighing will increase the stress levels in the ship's structure.

- During cargo operations, it is important to determine the cargo weight loaded into each individual hold and the associated loading rate.

- Exceeding the permissible local tanktop loading strength may over stress and in time, damage the double bottom in cargo hold.
- At high loading rate ports without suitably positioned cargo weighing equipment, the ship's cargo officer should request that the terminal stops loading, to allow draught surveys and displacement calculations to be carried out to verify compliance with the agreed Loading Plan. It may also be necessary to check the loading/unloading to allow for ballasting and de-ballasting operations to remain in permissible draft ranges at all stages of the operation.
- IACS considers that suitably positioned weighing equipment should be installed at all terminals - but especially those with high loading rates.
- Inaccurate terminal weighing equipment, limited checking time at high loading rate terminals, and hold overloading to compensate for partial bunkers may all contribute to structural overloading.
- The terminal shall inform the ship of the remaining amount of cargo on the conveyor belt that must be loaded after a "STOP".

9. Structural damage

Cargo handling equipment can damage the ship's structure, both through impact loads (grabs, hydraulic hammers) and by damaging the coating protection in the cargo holds.

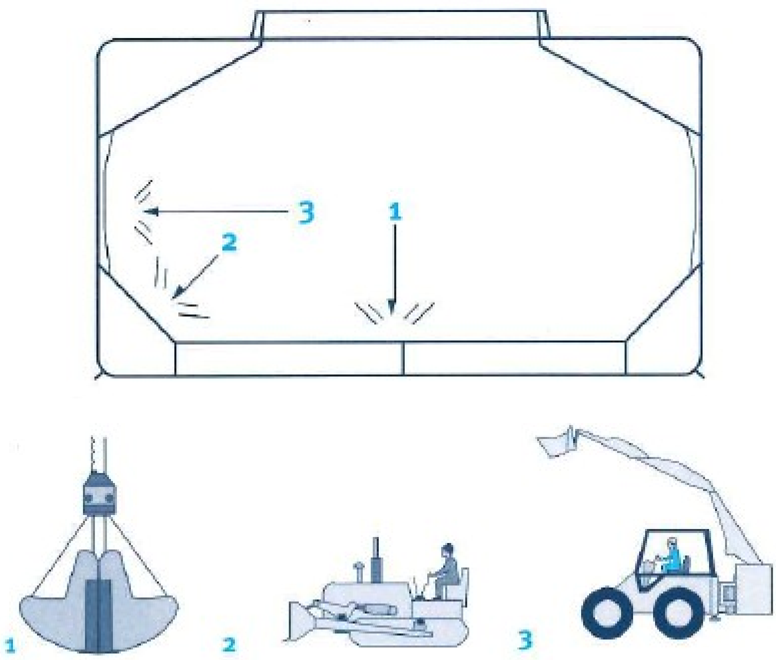


Figure 4: Mechanical Equipment Damage

- Structural damage and coating breakdown will contribute to local weaknesses and may ultimately threaten the ship's structural or watertight integrity.
- Hold internal structures and coatings are notably vulnerable to damage from grabs during cargo discharge, and from hydraulic equipment used to free and clear cargo. Cargo hold protective coatings are also vulnerable to breakdown from the corrosive, temperature or abrasive characteristics of cargoes such as coal.
- On completion of cargo discharge, the ship's officers should inspect cargo holds and deck areas for signs of mechanical, corrosive or coatings damage. Damage potentially affecting the integrity of the hull, its machinery systems or equipment should be reported to the classification society.

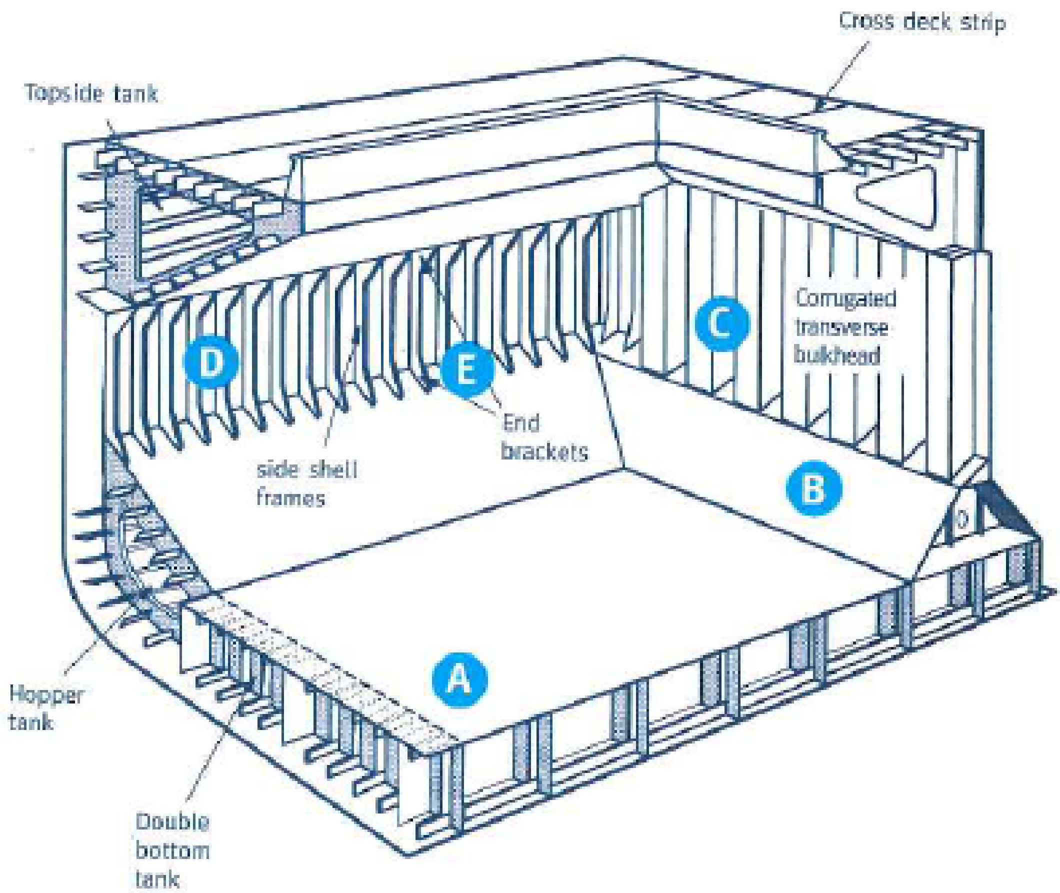


Figure 5:
Mechanical and coatings damage during cargo discharge will contribute to local weaknesses. Hold inner bottom (A); Bulkhead stool plating (B); Corrugated Bulkhead (C) and Side shell frames (D) inclusive End Brackets (E) are each vulnerable to damage from cargo handling operations

3 LOADS, HULL STRUCTURE AND DESIGN

All ships are designed with limits deliberately imposed on their operations to ensure that structural integrity is maintained.

Exceeding these limits may over-stress the structure and lead to catastrophic failure.

The ship's hull structure is designed to withstand the static loads of the ship's weight and sea water pressure acting on the hull and the dynamic loads on the hull due to waves and ship motions. Bow flare impact loads and bottom slamming in the forward region can occur due to emergence of the fore end of the ship from the sea in heavy weather.

Overloading in any one cargo hold space will increase static stress in the hull structure and reduce the capability of the hull structure to withstand dynamic loads when the ship is at sea.

Carriage of intended cargoes which may liquefy at moisture content in excess of the transportable moisture limit will significantly increase the pressure on the cargo hold boundaries, and will also increase the risk for capsizing. This issue is not considered in this booklet.

Except for Ore carriers or Very Large Ore Carriers (VLOCs) which are not considered in this booklet, Bulk carrier hull configuration does not alter significantly with size. The most widely recognised structural arrangement is a single deck ship with a double bottom, hopper tanks, single skin transverse framed side shell, topside tanks and deck hatchways.

Shear Forces and Bending Moments:

A ship floating in still water is subject to buoyancy up thrust acting on the hull. Local differences in the opposite-acting vertical forces of weight and buoyancy will cause the hull to shear and to bend. Continuous, but varying wave action at sea brings an additional dynamic component to these forces.

All bulk carriers classed with IACS societies are assigned permissible Still Water Shear Force (SWSF) and Still Water Bending Moment (SWBM) values. There are normally two sets of permissible SWSF and SWBM limits assigned to each ship; Seagoing (for use at sea) and Harbour (for use in port). In addition, permissible Seagoing Flooded limits are assigned for BC-A and BC-B ships defined in Section 4, for which flooded conditions are required to be assessed.

The ship's loading instrument provides a means to calculate the shear forces and bending moments in any load or ballast condition, and to assess these against the assigned permissible values.

The equivalent Seagoing SWSF and SWBM figures give the limits of shearing and bending of the main hull girder when subject to cargo loading and the continually changing wave - induced forces acting on the hull when the ship is at sea.

Local strength:

All bulk carriers of 150 m in length and above are provided with local loading criteria, which define the maximum cargo weight allowed in each hold - and each pair of adjacent holds - (block hold loading) for various draught conditions.

Overloading will induce greater stresses in the double bottom, transverse bulkheads, hatch coamings, hatch corners, main frames and associated brackets of individual holds.

Capability to withstand normal dynamic loads at sea - typically from slamming and bow flare impacts - will be reduced if static stress in the hull structure has been increased by overloading.

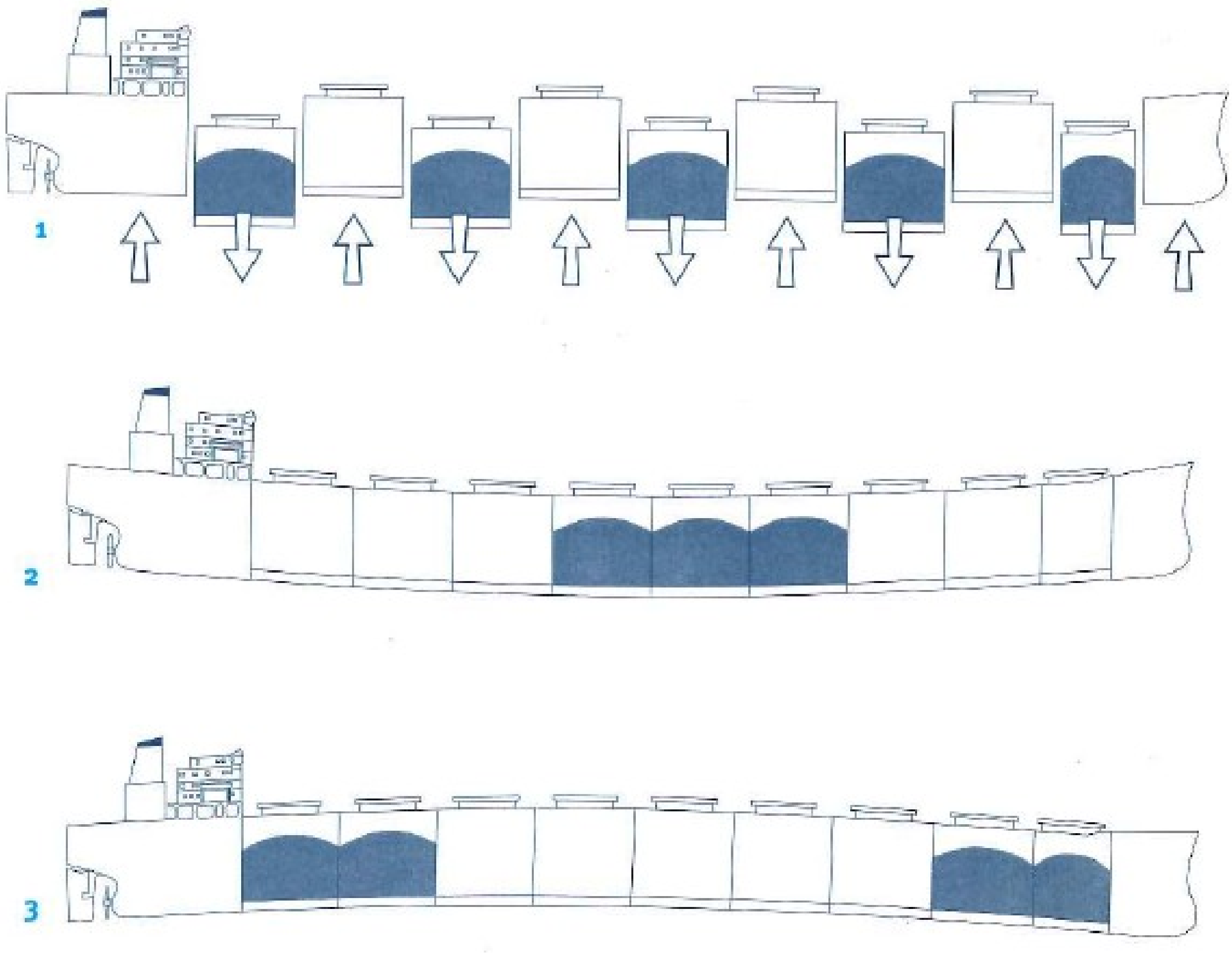


Figure 6: Shearing and Bending

1. Shearing of the hull girder results from local differences in the opposite-acting vertical forces of hull/cargo weight versus buoyancy.
2. Bending of the hull girder will produce sagging if weight is incorrectly concentrated in the middle of the ship.
3. Bending will produce a hogging effect if weight is wrongly concentrated at opposite ends of the ship

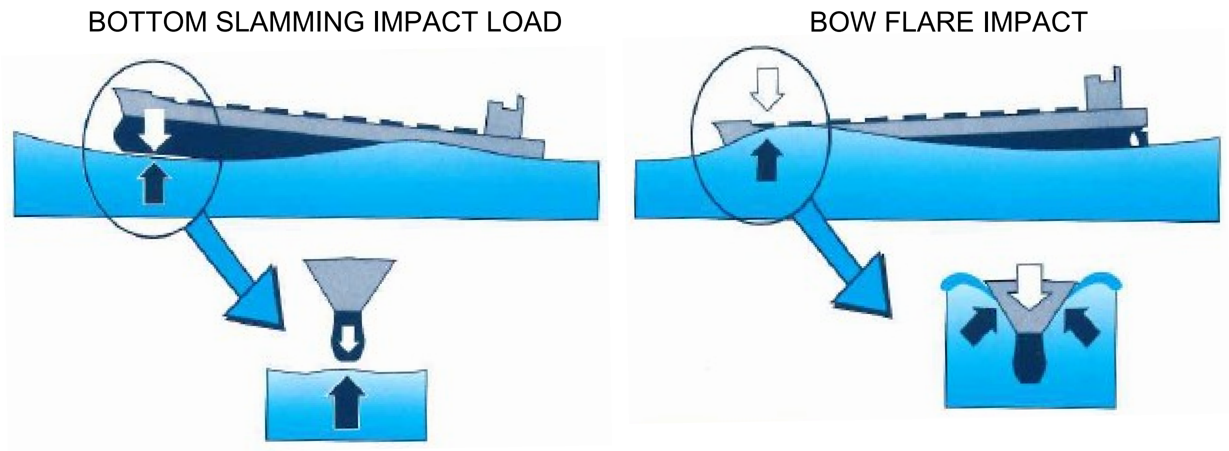


Figure 7: Bottom slamming and bow flare impact

4 CARGO DISTRIBUTION

Cargo distribution along the ship's length has a direct influence on the bending and shearing of the hull girder - and on the stresses in the local hull structure.

COMMON CARGO DISTRIBUTIONS ARE:

Homogeneous Hold Loading:

Cargo evenly distributed in all holds. Usually adopted for low density cargoes - such as coal and grain.

Alternate Hold Loading:

Large bulk carriers often stow high density cargo - such as mineral ore - in odd-numbered holds (1, 3, 5, etc.), with the remaining holds specifically designed and designated to be empty when the vessel is at maximum draught.

Cargo weight per laden hold is approximately double that of homogeneous load distribution, with alternate holds designed/reinforced accordingly.

Block Hold Loading/Part Loaded Conditions:

Block hold loading refers to stowage of cargo in a block of two or more adjoining holds - with holds adjacent to such blocks remaining empty.

The configuration is often adopted when the ship is only part loaded. However, to avoid over-stressing the hull structure in the part loaded condition, careful consideration must be given to the amount of cargo in each laden hold and the anticipated sailing draught.

There are additional service features for bulk carriers with a length of 150 m and above.

- BC-A: For bulk carriers designed to carry dry bulk cargoes of cargo density 1.0 t/m^3 and above with specified holds empty at maximum draught in addition to BC-B conditions.
- BC-B: For bulk carriers designed to carry dry bulk cargoes of cargo density of 1.0 t/m^3 and above with all cargo holds loaded in addition to BC-C conditions.
- BC-C: For bulk carriers designed to carry dry bulk cargoes of cargo density less than 1.0 t/m^3.

Other service features can also be applied which give further detailed description of the limitations to be observed during operation:

- {Maximum cargo density in t/m^3} for additional service features BC-A and BC-B if the maximum cargo density is less than 3.0 t/m^3
- {No MP} for all additional service features when the ship has not been designed for loading and unloading in multiple ports (“MP” stands for multiple ports).
- {Holds a, b, … may be empty} for additional service feature BC-A
- {Block loading} for additional service feature BC-A, when the ship is intended to operate in alternate block load condition.

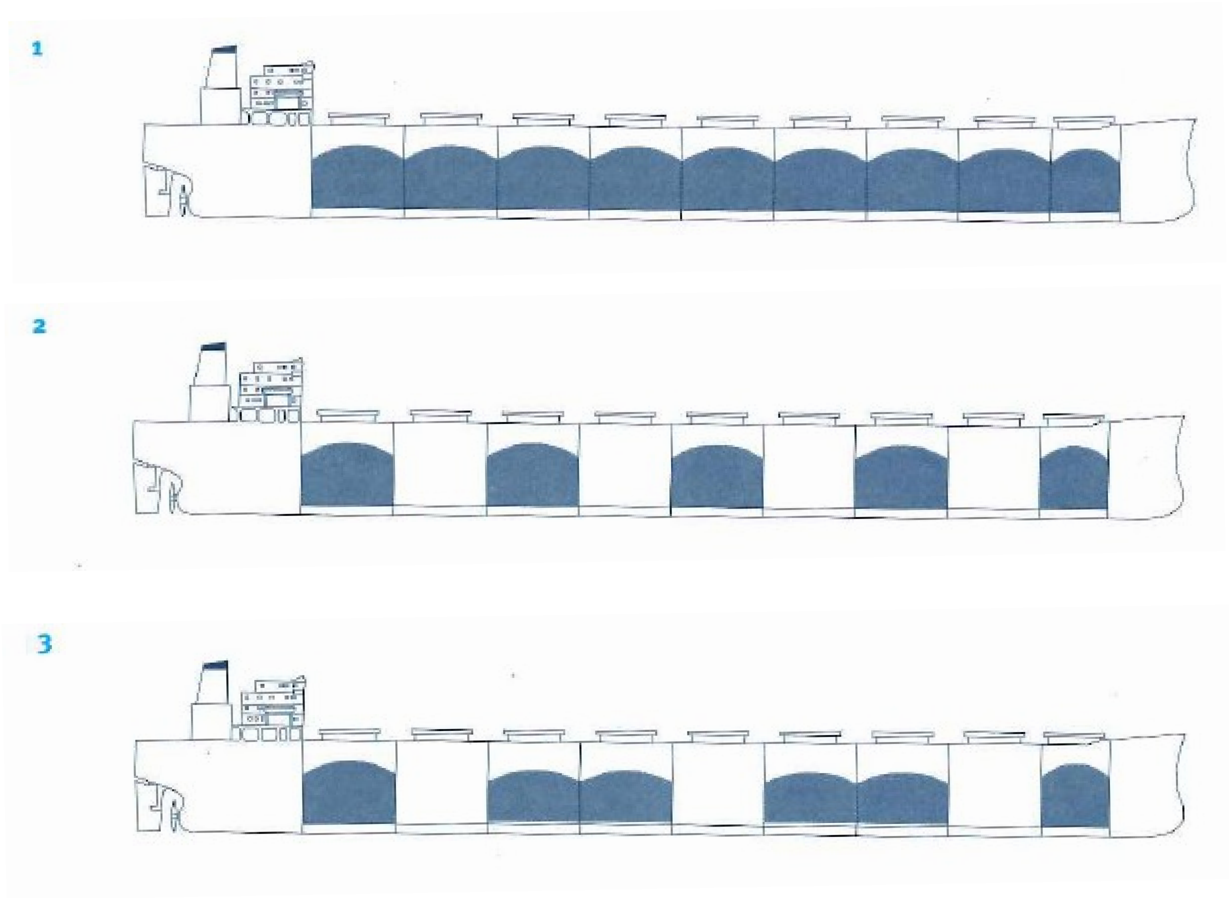


Figure 8: Loading Conditions

1. In HOMOGENEOUS hold loading, cargo is evenly distributed in all holds.
2. ALTERNATE hold loading, in odd-numbered holds, gives approximately double the cargo weight per hold of homogeneous loading – with holds designed or reinforced accordingly.
3. Cargo in two or more adjoining holds – BLOCK loading – is a frequent part-loaded configuration.

5 LOADING GUIDANCE INFORMATION

The International Load Line Convention requires information on board so that the Master can load and ballast his ship without creating unacceptable stresses in the ship's structure.

Under the requirements of SOLAS VI Part B, Regulation 7, the ship must have a booklet covering stability data; ballasting and de-ballasting rates; maximum allowable loads on the tank top and per hold; guidelines on loading and discharging; information designed to limit hull stresses; restrictions on operating conditions and means of carrying out any necessary strength calculations.

Loading Manual:

The ship's Approved Loading Manual is therefore an essential on-board document for planning cargo loading, stowage and discharging. It describes:

- Design loading conditions, including permissible Still Water Shear Forces and Bending Moments
- Maximum allowable and minimum required mass of cargo and double bottom contents of each hold and of any two adjacent holds
- Allowable local loading
- Ballasting requirements including the maximum rate of ballast change
- Operational limits

Loading Instrument:

Complements the Loading Manual as an invaluable shipboard calculation tool for:

- Planning/controlling cargo and ballasting operations
- Rapidly calculating SWSF and SWBM for any load condition
- Identifying the imposed structural limits which are not to be exceeded

According to SOLAS Ch. XII, Reg.11, bulk carriers of 150 m in length and above shall be fitted with a loading instrument capable of providing information on the hull girder shear forces and bending moments.

It is important to note that the loading instrument is not a substitute for the ship's loading manual. Therefore, the officer in charge should also refer to the loading manual when planning or controlling cargo operations.

6 PLANNING AND CONTROL OF CARGO HANDLING

Advance planning, exchange of information and continuous ship-to-shore communication are all critical. Key factors will include:

- **Terminal/cargo data for the ship**
- **Stowage and Loading/Unloading Plans**
- **Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code) with due regard to the provisions of the International Maritime Solid Bulk Cargoes Code (IMSBC Code) where applicable**
- **Communication before and during cargo operations**
- **Monitoring of stevedoring**
- **Monitoring the ship's condition and**
- **Checking for hull damage....**

6.1 PREPARATION FOR CARGO OPERATIONS:

Cargo and Port Information:

To plan stowing, loading and discharge, the cargo terminal should provide the ship's staff well in advance with:

- Cargo characteristics, amounts and properties
- Availability and any special sequence requirements
- Characteristics of loading/unloading equipment: number, range of movement and loading/unloading rates
- Depth of water alongside and in fairway.
- Water density at berth and any air draught restrictions
- Maximum sailing draught and minimum draught for safe manoeuvring
- Conveyor belt delivery amount beyond ship's stoppage signal
- Terminal requirements/procedures for moving ship
- Relevant local port restrictions (bunkering, de-ballasting etc.)

To minimise the risk of cargo shift, IACS recommends that the cargo in all holds be trimmed. The ship's Master should be aware of the possibly harmful effects of corrosive and high temperature cargoes, and cargoes which may liquefy if the moisture content exceeds a certain limit.

Cargo stowage and Loading/Unloading plans:

The amount and type of cargo and intended voyage will dictate the proposed cargo and/or ballast stowage plan for departure. The officer in charge should always refer to the ship's approved Loading Manual to determine a cargo load distribution consistent with the structural loading limits imposed.

- If cargo needs to be distributed differently from the Loading Manual, calculations must always be made to determine, for any part of the voyage, that SWSF, SWBM, block loaded cargo weights and local loading limits are not exceeded.
- Ballasting must be considered to ensure: correct synchronisation with cargo operations; rates consistent with loading rates and imposed structural/operational limits; simultaneous ballasting/de-ballasting of symmetrical port/starboard tanks.

- Stress and displacement calculations must be commensurate with the number of cargo pours and loading sequence to ensure that SWSF/SWBM, cargo weights and tank top/local loading limits remain within limits.

At all times, hull stress limits should be kept below permissible limits.

For each step of the cargo operation, the cargo Loading/Unloading Plan should give a clear indication of:

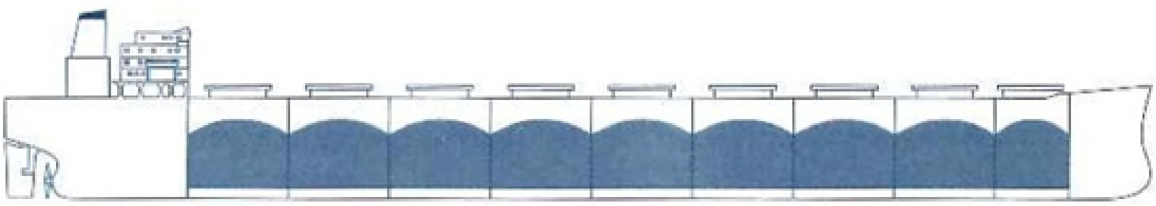
- Cargo quantity and corresponding hold numbers(s)
- Amount of water ballast and corresponding tank/hold to be discharged/loaded
- Ship's draught and trim at completion of each cargo stage
- Calculated SWSF and SWBM at completion of each cargo stage
- Estimated time for completion of each cargo loading/discharge stage
- Assumed rate(s) of loading/unloading equipment
- Assumed ballasting/de-ballasting rates
- Allowances for any necessary cargo loading/discharge stoppages

Ship-shore communication:

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. The ship's officers should be familiar with the IMO Ship/Shore Safety Checklist, developed in conjunction with the industry.

Effective communication must be established and maintained between the ship's deck officers and the terminal throughout cargo operations. The link should establish:

- Agreed procedure to STOP cargo operations
- Personnel responsible for terminal cargo operations
- Ship's officer responsible for Loading/Unloading Plan
- Ship's officer responsible for on-deck cargo operation
- Confirmation of information received in advance
- Agreed procedure for terminal to provide ship's officer in charge with loaded cargo weight at frequent intervals and at the end of each pour
- Agreed procedure for draught checking
- Reporting of any ship damage from cargo operations



The terminal should not commence cargo operations until the Loading/Unloading Plan and all relevant procedures are agreed, and the ship's Master has, where necessary, received a Certificate of Readiness issued by the respective maritime authorities.

Under the requirements of SOLAS VI Part B, Regulation 7, the Plan and any subsequent amendments should be lodged with the appropriate authority of the Port State. It is also mandatory for the ship's Master and terminal representative to ensure that cargo operations are conducted in accordance with the agreed Plan.

The Master have the right to suspend operations if he/she is not satisfied with the manner of working.

Before cargo operations are commenced, it should be determined that no structural damage exists and that, if noted, it is reported to the classification society. No cargo operations should be undertaken until the damage has been assessed and repairs carried out as found necessary - and that bilge and ballast systems determined to be in satisfactory working condition. Moisture content of the intended cargoes which may liquefy should be less than the transportable moisture limit.

6.2 MONITORING AND CONTROLLING CARGO OPERATIONS:

Monitoring of Stevedoring Operation:

The ship's officer in charge has responsibility for monitoring of the stevedoring operation and should ensure that:

- The terminal is following the agreed loading/unloading sequence
- Any damage to the ship is reported
- Where possible loading is symmetrical in each hold and, where necessary, the cargo is trimmed.
- Effective communication with the terminal is maintained
- Pour completions and movement of shoreside equipment in accordance with an agreed plan are advised by the terminal staff
- Loading rate is not increased beyond the agreed rate for the Loading Plan

Any changes to previously agreed plans should have the mutual agreement of both the terminal and the ship before implementation.

Monitoring the ship's Loaded Condition:

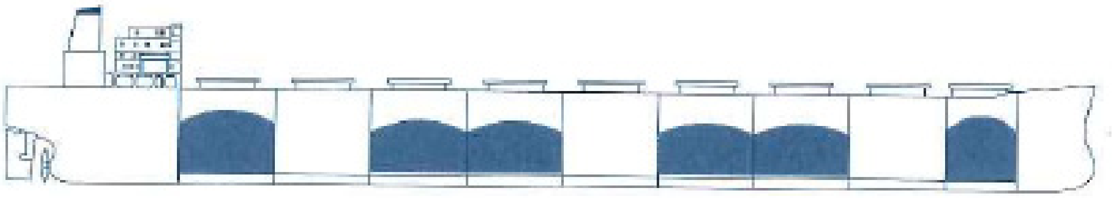
The officer in charge should closely monitor the ship's condition during cargo operations, to ensure that all cargo and ballast operations are STOPPED if there is any significant deviation from the agreed plan.

The officer in charge should ensure that:

- Cargo operations and ballast procedure are synchronised
- Draught surveys verify ship's loading condition versus the Loading Plan
- Ballast tanks sounded to verify content and ballasting/de-ballasting rate
- Cargo load agrees with terminal's figures
- The cargo is loaded/unloaded in compliance with the ship's approved Local Loading Diagram (Hold Max Mass Curve) for each cargo hold
- SWSF, SWBM and - where appropriate - hold cargo weight/draught calculations are performed at intermediate stages, and recorded on the Loading Plan

If there is deviation from the Loading Plan, the officer in charge should take corrective actions to:

- Restore the ship to the original Loading/Unloading Plan, or...
- Re-plan the balance of the loading/unloading operation - ensuring that the stress and operational limits of the ship are not exceeded at any intermediate stage



Cargo operations should not be resumed until the modified Loading/Unloading Plan is agreed between the ship's officer responsible and the terminal representative - **and the ship's officer has given a clear indication of his readiness to proceed.**

A typical Local Loading Diagram for a cargo hold (strengthened hold) of a BC-A ship not having {No-MP}, is shown below:

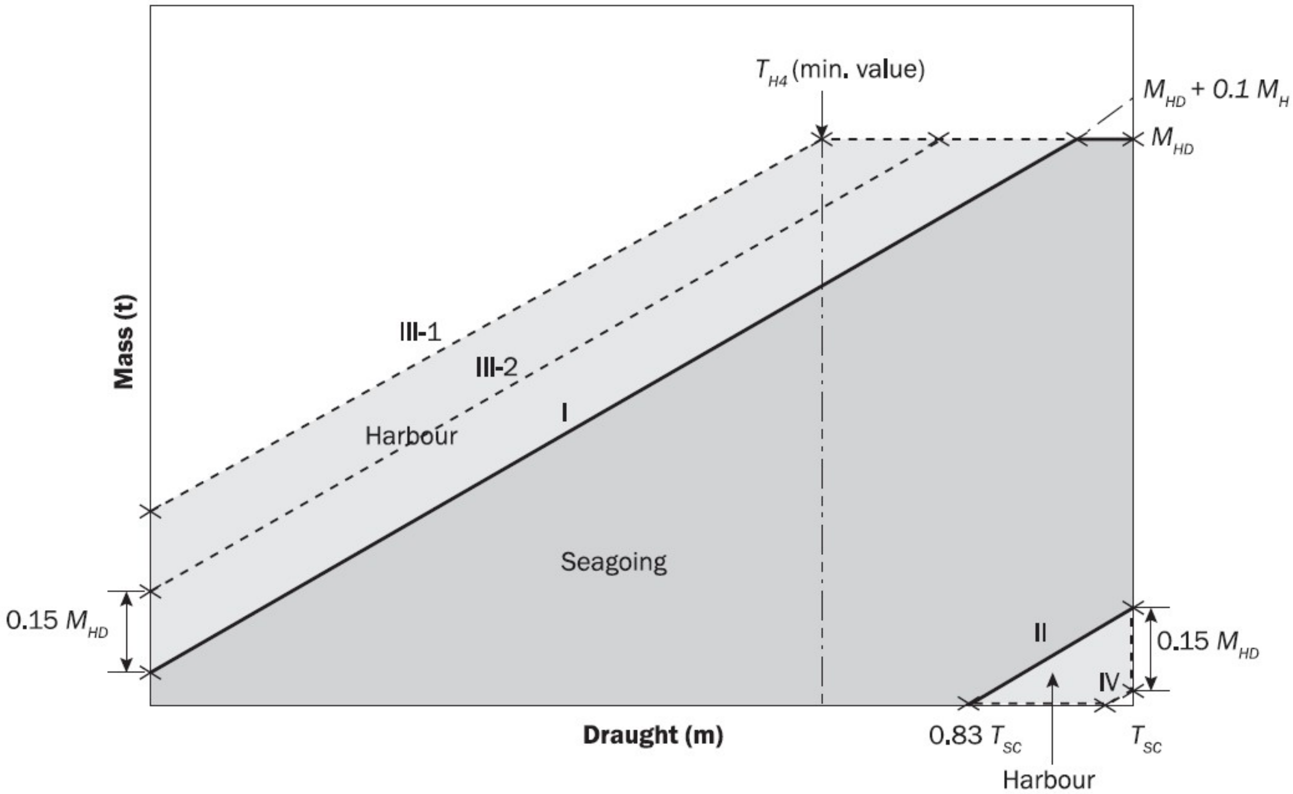


Figure 9: Example of a Local Loading Diagram for a BC-A ship not having {No-MP}

The important trend to note from the local loading diagram is that there is a reduction in the cargo carrying capacity of a hold with a reduction in the draught. To exceed these limits will impose high stresses in the ship's structure in way of the over-loaded cargo hold and most probably the adjacent empty hold as induced by increase of hull girder BM and/or SF due to over-loaded cargo. There are two sets of local loading criteria depending upon the cargo load distribution namely, individual hold loading or two adjacent hold loading.

The allowable cargo loads for each hold or combined cargo loads in two adjacent holds are usually provided in association with empty double bottom and hopper wing ballast tanks directly in way of the cargo hold. When water ballast is carried in the double bottom and hopper wing tanks, the maximum allowable cargo weight should be obtained by deducting the weight of water ballast being carried in the tanks in way of the cargo hold.

The maximum cargo loads given in the Local Loading Criteria should be considered in association with the mean draught in way of the cargo hold(s). In the case of a single cargo hold, the ship draught at the mid-length of the hold should be used. For two adjacent cargo holds, the average of the draught at the mid-length of each cargo hold should be used.

6.3 HULL DAMAGE FROM CARGO OPERATIONS

A general inspection of the cargo spaces, hatch covers, and deck is recommended. Any structural damage is to be reported to the classification society. In the event of major damage, cargo operations are not to be undertaken.

All damage is to be reported to the ship's Master. Where any hull damage is identified, which may affect the integrity of the hull, its machinery systems or equipment, the ship's owner and classification society must be informed.

Bad cargo handling practice can over-stress and damage a ship, lowering safety margins and increasing risk to the ship and its crew. By understanding bulk carrier design and operating limits - and working closely together - ship and shore personnel become key partners for safer shipping.

7 BALLAST WATER MANAGEMENT AT SEA

The International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, requires that ships engaged in international traffic are required to manage their ballast water and sediments in accordance with a ship-specific ballast water management plan.

Ships have to carry:

- A ballast water management plan - specific to each ship, the ballast water management plan includes a detailed description of the actions to be taken to implement the ballast water management requirements and supplemental ballast water management practices;
- A ballast water record book - to record when ballast water is taken on board; circulated or treated for ballast water management purposes; and discharged into the sea. It should also record when ballast water is discharged to a reception facility and accidental or other exceptional discharges of ballast water; and
- An International Ballast Water Management Certificate (ships of 400 gt and above) – this is issued by or on behalf of the Administration (flag State) and certifies that the ship carries out ballast water management in accordance with the BWM Convention and specifies which standard the ship is complying with, as well as the date of expiry of the Certificate.

As a minimum requirement until required to conduct ballast water treatment, ships are required to conduct ballast water exchange at a minimum distance from the nearest land and in waters having a minimum depth as specified in regulation B-4 of the BWM Convention. Major hazards when carrying out ballast water operations at sea are the sloshing of seawater in ballast holds, the potential loss of ship stability if the ballast water management plan is not followed properly and the high stress exerted on the ship's ballast tank structure and hull during the ballast operations in sea conditions.

The variability of the sea and swell conditions in a short period of time is an important factor in deciding whether to do ballast water operations at sea. Responsibility for deciding on whether to carry out such operations at sea must rest with the ship's Master, taking into account the permissible limits in respect of structural strength and stability and the sea and weather conditions prevailing at the time.

8 IACS AND BULK CARRIER SAFETY

IACS has a vital role in and commitment to the safety of the current and future bulk carrier fleet. It also has a unique understanding, backed by research, of bulk carrier operations and risks - and has led the industry with initiatives to improve bulk carrier safety.

To minimise the possibility of further casualties occurring on dry bulk carriers, a number of actions have already been implemented by the IACS Member Societies and ongoing work is being carried out which will bring further enhancements to the safety of these ships.

These have included the introduction of the corrosion protection requirements for ballast spaces, minimum thickness requirements for side shell web frames in cargo areas, a tough regime of Enhanced Surveys and most notably the introduction of the Common Structural Rules for Bulk Carriers in 2005 followed by the Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC & OT) in 2015.

The CSR BC & OT is the outcome of years of major research led by IACS into known or suspected structural failures amongst bulk carrier casualties together with the utilisation of advanced methods of determining loads and structural strength to better predict how a design will perform.

Produced by

IACS International Association of Classification Societies

IACS Limited
Permanent Secretariat
4 Matthew Parker Street
London SW1H 9NP
UNITED KINGDOM

TEL: +44 (0)20 7976 0660
Email: permsec@iacs.org.uk

In partnership with

International Maritime Organisation (IMO Secretariat)

International Association of Dry Cargo Shipowners (INTERCARGO)

International Chamber of Shipping (ICS)

Baltic and International Maritime Council (BIMCO)

International Association of Ports and Harbours (IAPH)

International Cargo Handling Coordination Association (ICHCA)