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# 1. BASIC OPERATIONS OF BULK-CARRIERS

## 1.1 Trade Service

### Tramp vessels

A number of tramp vessel bulk carriers have been constructed with special features to make them particularly suited for the carriage of **grain**, **ore** or **coal** – three most important ocean-borne bulk cargoes – but the average ocean going tramp is built along fairly standardized lines which experience has shown will make it suitable for the carriage of any of the bulk cargoes usually transported by this class of vessel.

The trading of the average tramp vessel is worldwide in extent. For example, a tramp may be chartered to load a cargo of wheat in the River Plate (Argentina) for discharge in one or more ports in the U.K., for North Sea continental ports, Scandinavia, or eastern ports of western Mediterranean. The ultimate port of discharge, which is often decided while the vessel is on its passage, will naturally have an important bearing on the Owner's decision about subsequent employment. If the vessel were ordered to discharge, say at Antwerp, the probability is that loading coal outward from the U.K. would be the next employment. If, on the other hand, the vessel were ordered to discharge at a Mediterranean port, it might be decided to load ore at Southern Spain for the Atlantic side of the United States. Hence, the vessel might be sent to New Orleans (NOLA) to load another grain of cargo.

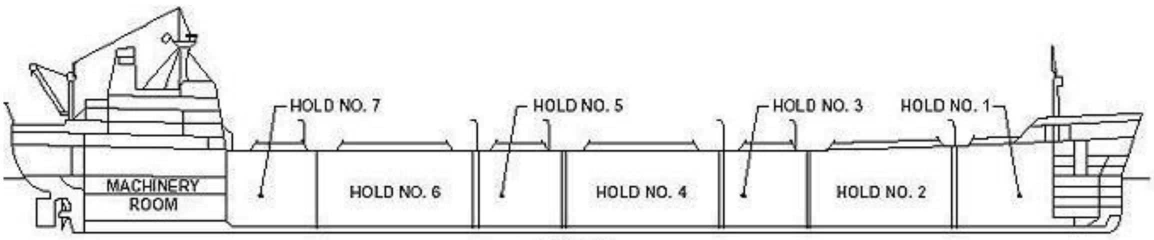
A general all-round design, rather than a specialized one which tends to restrict the kind of cargo that can be carried, is obviously the most suitable for the average tramp vessel, which during its lifetime will trade in all parts of the world and may carry numerous different kinds of bulk or homogenous cargo.

Owing to the nature of trade of tramp vessels, it has always been the general practice that maritime publications (i.e. Guide to Port Entry) are referred upon to obtain supplemental information regarding a specific port.

### Cargo Liners

Cargo Liners are vessels that carry cargo exclusively and operate over definite routes on fixed schedules. A noticeable tendency in the design of modern cargo liners has been to increase the number of holds to five, six or seven. Increasing the number of cargo holds in many instances makes for more rapid cargo handling and for shorter stay in port.

## 1.2 Typical construction of Bulk-carriers: cargo holds

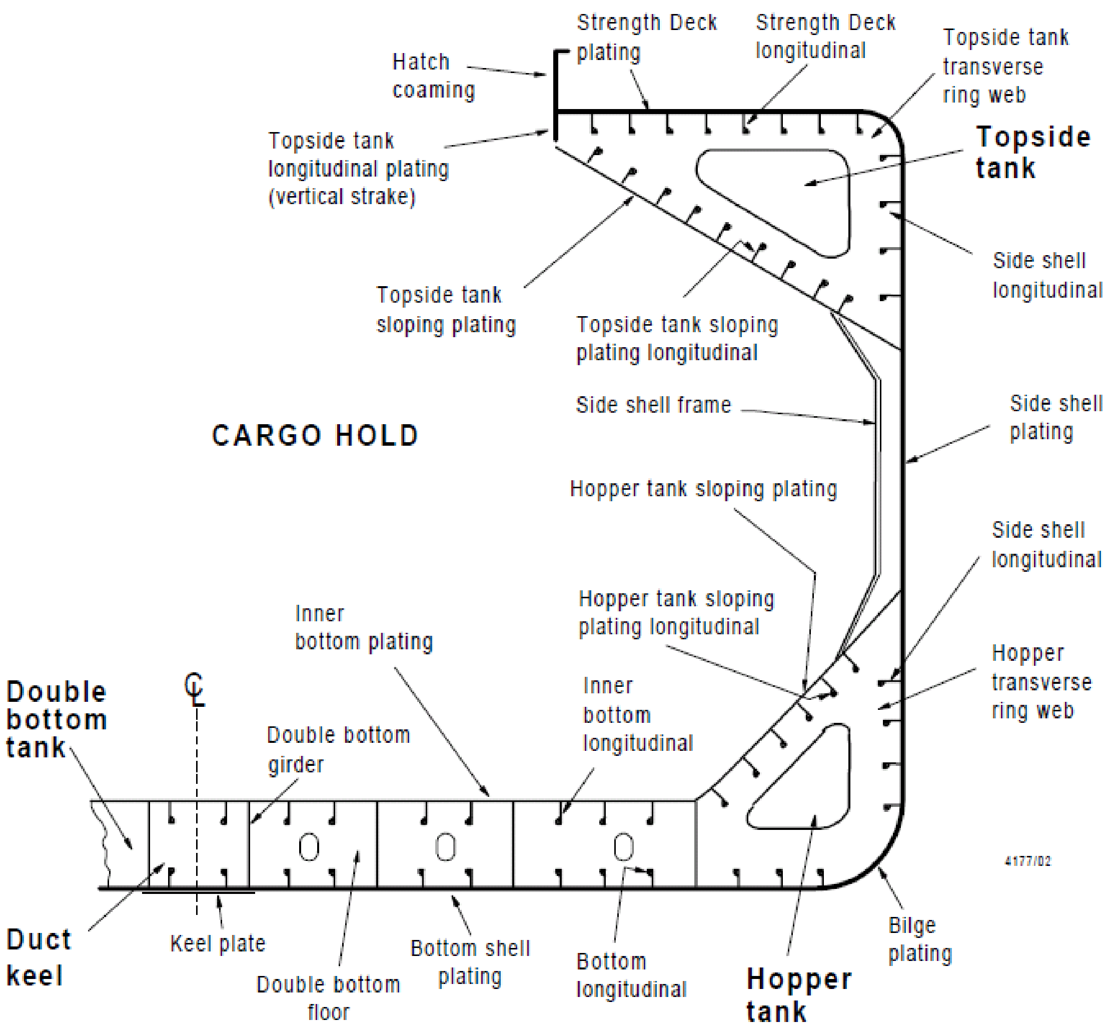



Single-purpose bulk carriers are generally designed as ore carriers, built to carry heavy cargoes stowing at 25 cubic feet per long ton or less, or dry bulk carriers, for grain and similar cargoes stowing at 45 to 50 cubic feet per ton.

The general arrangement of cargo spaces is dictated by the facts that the cargo is in the form of homogeneous particles of more or less uniform size, and can be transferred by blowers, conveyors, or grab buckets. Cargo spaces are divided into holds to meet structural and subdivision requirements, to restrain cargo movements and resulting upsetting moments, to permit the carrying of different cargoes simultaneously, and to provide for ballasting. Machinery is invariably aft, and the nonperishable nature of the cargoes leads to speeds in the 12- to 16-knot range.

Relatively small volumes of dense ores and similar cargoes will settle a ship to her summer load line. Holds on ore carriers are therefore quite small, bounded by broad wing tanks and deep double bottoms. The double bottom and longitudinal bulkheads are of heavy construction to carry the heavy ore load. The narrow hold breadth limits transverse weight shifts and the depth of the double bottom is sufficient to keep the center of gravity of the ore high enough to prevent stiff rolling in a seaway. Large volume wing tanks are used for ballast.

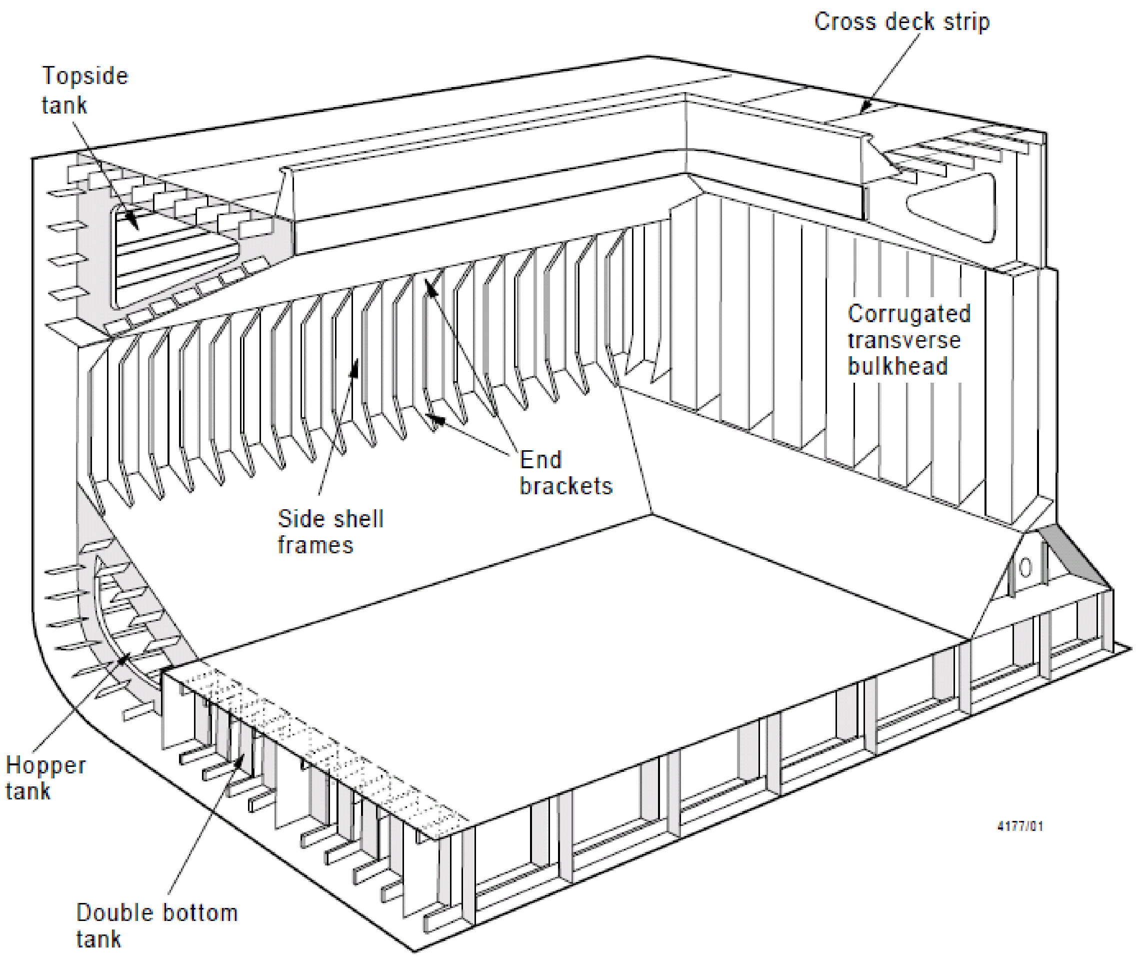
Designed for low-density cargoes, dry bulk carriers require much greater hold volume than ore carriers, and therefore have much shallower inner bottoms . In some designs the topside tanks are omitted or fitted with bolted plates in the sloping plating facing the hold. When very light cargoes are carried, the plates are removed and the tanks are filled along with the hold; the cargo in the tanks feeds into the hold by gravity when discharging. Larger carriers are sometimes built with an inner side shell, which eases hold cleaning and provides additional ballast space.




The most common structural arrangement is a single deck with a double-bottom, hopper tanks, single skin transverse framed side shell, topside tanks and deck hatchways.

Bulk-carrier design does not alter significantly with size: a 30,000 dwt bulk carrier has similar structural configuration comparing to an 80,000 dwt one.

In general, the plating comprising structural items provides local boundaries of the structure and carries static and dynamic pressure loads exerted by cargo, bunker, ballast, etc. and the sea. This plating is supported by secondary stiffening members such as frames or longitudinals. These secondary members transfer the loads to primary structural members such as the double-bottom floors and girders, or the transverse web frames in topside and hopper tanks.



The transverse bulkhead structures, including its upper and lower stools (see below Fig. 3)

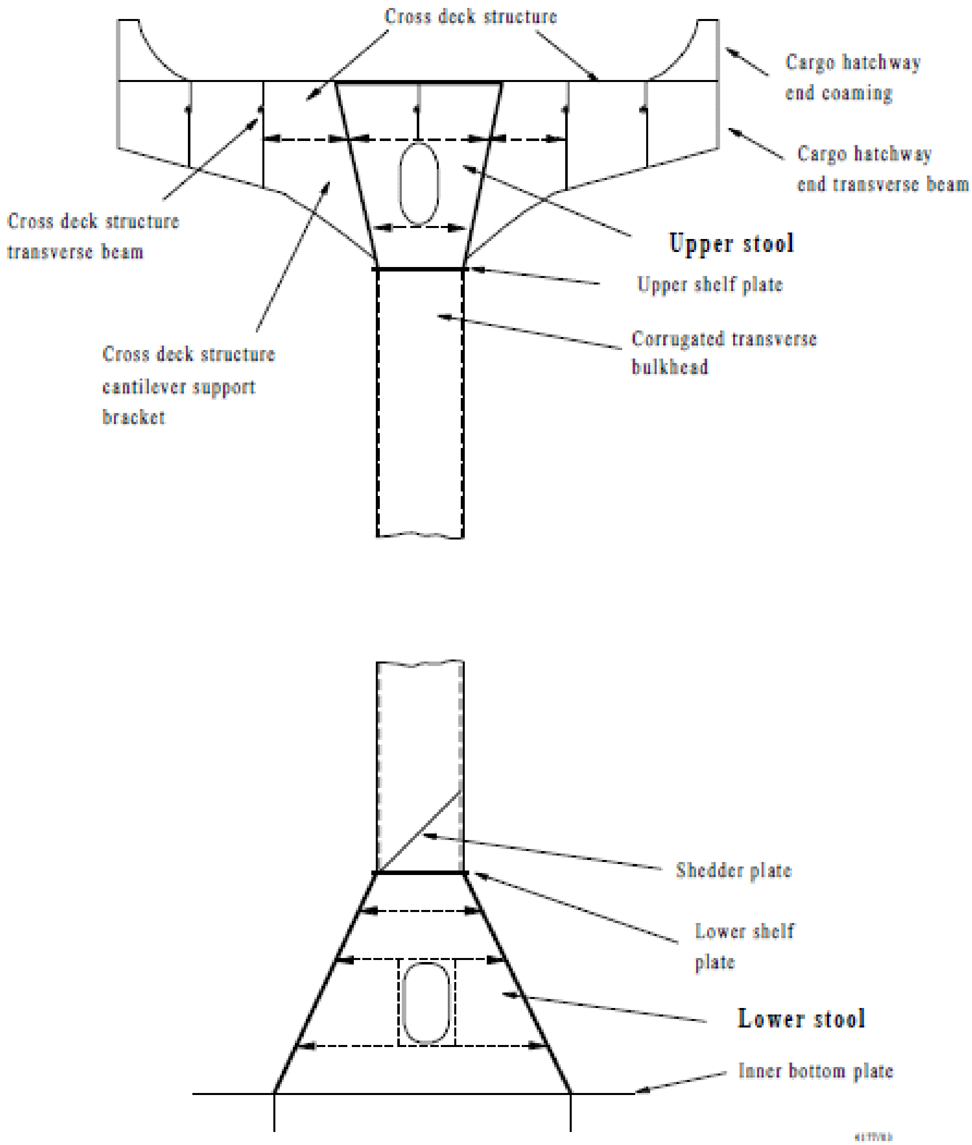



**Figure 3**
**Nomenclature for Typical Corrugated Transverse Watertight Bulkhead**

## 2. BULK-CARRIER CARGO OPERATIONS

### 2.1 Sailing Instruction

These are the prime communication between the operator and the ship. Although the instructions are written addressed to the Master, the ship managers should be fully aware of them, in order that he can support the ship to the fullest.

The instructions are usually in a letter form, although they may be issued by telex or e-mail and are supplemented as necessary throughout the voyage. They usually cover the following basic points, with additions to suit the particular trade.

❖ **Voyage orders:**

➢ **Owners' time charter voyage orders:**

- The owners' voyage orders for a time charter voyage will generally provide the following:
  - Name and address of the charterers
  - The charterparty date
  - Details of delivery
  - Laydays and cancelling dates
  - Details of the voyage
  - Date and place of redelivery
  - Instructions regarding speed of the vessel and fuel consumption
- Reference will be made to charterparty clauses relating to:
  - Lying aground
  - Cargo to be loaded under the supervision and direction of the master
  - Appointment of charterers' supercargo
  - Quantity of bunkering at redelivery and option of bunkering for owners' account
  - Authority for charterers to sign bills of lading in accordance with mate's or tally clerk's receipts
  - Action to be taken in the event of stevedores' damage.
- The orders may contain:
  - A reminder to the master to ensure that all invoices for the charterers' account are endorsed with a stamp stating: "The good and /or services being hereby ordered, acknowledged and/or receipted for, are being ordered and or accepted solely for the account of charterers of the mv……., and not for the account of said vessel or her owners. Accordingly no lien or other claim against said vessel can arise therefrom".

- Instructions to the master to report at the time of redelivery on hold condition, fuel remaining and costs incurred by charterers in respect of subsistence and gratuities.

➢ **Charterers' voyage orders:**

- The charterers voyage orders will provide for the following:
  - Name and address of the charterers
  - The charterparty date
  - Details of delivery
  - Laydays and cancelling dates
  - Details of the voyage
  - Date and place of redelivery
  - Instructions regarding speed of the vessel and fuel consumption
- In addition it will:
  - Provide details of the intended cargo
  - Ask the master to prepare and submit a stowage plan
  - State the requirements for ETA and tendering NOR
  - Provide details of the charterers agents
  - Advise proposed bunkering intentions
  - State the authority, if any, to be given by the master to charterers or their agents for the signing of bills of lading.
  - Describe the arrangements for using a weather routing service
  - State the requirements for reporting noon position, average daily consumption, speed, weather and ETA whilst at sea, and for providing an arrival report on completion of each passage.
- In the voyage orders or at some stage in the voyage the charterers will provide:
  - A list of discharge ports, maximum permitted drafts at each port and the cargo quantity to be discharged at each
  - Details of whether the quantity of cargo loaded and discharged is to be assessed by draft survey or shore scale, to determine bill of lading weight.

❖ **Failure to comply with items of the charterparty and the voyage instructions can prove expensive and the master should consult his documents and principals whenever he is doubt.**

Sample of Sailing Instruction – see Annex A

### 2.1.1 The voyage

The Master will be told where to proceed and when the ship is to be available to commence loading. Thereafter, he will be expected to follow the voyage schedule as described at the beginning of the chapter. This may include an itinerary if on a liner trade, and commencement and canceling dates if on a voyage charter.

### 2.1.2 The cargo

He will be advised of the prospective cargo and of any special requirements for pre-loading, loading, carriage, and discharge. He may also be instructed on the rejection of unsuitable cargo and in this respect the signing of mates' receipts. He may also be asked to authorize the agents to sign the Bills of Lading on his behalf.

In highly specialized trades in which the operators have a long experience, he may be issued with detailed instructions on the ports to be visited and their various customs and requirements.

### 2.1.3 The Agents

He will be advised of the operator's representative at each port at which the ship is expected to call and will be given full details on how to communicate with them. Prior arrival, it is prudent to ask the agent regarding latest port information including berthing prospect, mooring line requirements, Illegal activities like piracy, stowaway, robbery, etc.

### 2.1.4 Communications

He will be given full instructions on when, what and how to communicate with the operators and their representatives. The frequency and details of such communications are stated in the "Voyage instructions," thus, will vary with the trade and the operator's individual requirements most especially the Dep/Arrival report, Noon reports, ETA notices and tendering of notice of readiness (NOR).

Careful reading of the requirements for tendering notice of readiness (NOR) is essential. Little is gained by burning extra fuel only to find that NOR cannot be formally tendered until after the weekend.

### 2.1.5 Speed and bunkers

In the Voyage instructions, the operator/charterer will advise the Master of ship's speed at which they wish him to proceed on each sea passage, when and where they intend to supply/replenish fuel to the ship.

### 2.1.6 The contract of carriage

The Master's involvement in the contract of carriage of the cargo will depend upon the type of contract. In the liner trades he may never see the Bills of Lading, but, authorization to sign the Bills of lading, whereas on a voyage charter he will either have a copy of the Charter Party, or at least be advised on the salient features on which he is expected to act, such as giving notice of arrival and of readiness to load and discharge.

In some cases, Letter of Indemnity (LOI) will be required at the port of discharge due to short voyage where a copy of the Bills of lading is not yet available.
In some cases when the Original Bill of Lading may not be available at the discharge port, the Master may be authorized to Unload the cargo to the receiver on basis of a "Letter of Indemnity"- LOI. The owner receives this LOI from the Charterers Indemnifying the Owner and the Ship-Master from any claims which may arise due to unloading of cargo without proper presentation of Original Bill of Lading.

Similarly as is checked for the Bill of Lading the following details( but not limited to) are checked for in the LOI to be same as is on Bill of lading and in Sailing instructions of the Charterer.

Voyage Number,
Name of vessel
Name of Charterers and Owners if inserted.
Quantity of Cargo
Details of Cargo as is in the Bill of Lading
Port of unloading

The Master should contact Owners for advice and do not allow the cargo operations to start until the Master receives a "go signal" to start discharging from the Owners.

### 2.1.7 Warnings

In some trades warnings may be given to Masters about illegal practices, trickery and even such danger such as Piracy and stowaways, so that the Master can be on his guard against illegal practices (please refer to your Ship Security Plan).

These are the principal points to note which is included in most voyage instructions. As with all communications, their aims should be also to inform, guide and assist the Master. On the hand of the operators/charterers, need to take care that they do not instruct the Master to do anything that would conflict with his responsibilities to all parties involved in the voyage.

For his part, the Master should do everything he can to co-operate with the operators/charterers, bearing in mind these responsibilities. As an example, the operators should not arrange cargo unsuitable for carriage to the ship concerned. If they do, the Master should refuse to accept it and he will inform the Owner immediately. Fortunately, in most cases of experienced and professional operators, such cases rarely arise.

The same applies to speed: the operators should never word their instructions on the required speed in such a way that the Master could feel he must maintain that speed in all circumstances. Of course, it is the operator's/charterer's and the Master's job to try to avoid delays, but the Master must do so with safety, and the operators should always recognize this. Similarly the operators should not send a ship to unsafe port/ berth or in a dangerous area or port where there is a risk of war or other hazards. Apart from the fact that the ship may not be insured for such risks, it is not anyone's interests that the ship, cargo, and crew should be exposed to such dangers.

## 2.2 General Instruction to Master

A written instruction similar to the sailing instruction sent to the Master from the charterers/shippers/owners known as the General Instruction to Master in which details for the necessary precautions needed for the proper handling, stowage, and care of the cargo to be loaded are set forth.

Ship managers issue the General Instruction to Masters of their operating vessel. The manual contains the company policy and standard operating procedures on all matters to familiarize the Master relating to the agreement between the Owners and Charterers for safe ship operation of the vessel, including the issued circulars and memorandum as well as contingency plans from ship managers.

## 2.3 Cargo Operation

### 2.3.1 Hold Cleaning

Usually, the first step that must be taken in the actual process of stowing a bulk cargo is the preparation of the cargo holds. In some cases, this may consist of nothing more than removing the loose scales and cargo residues from previous cargo (by sweeping). Washing down the holds by high pressure water jet then rinse well with fresh water.

If the ship carried cargo, which emits a different odor that may damage or taint the next cargo, the holds must be scoured and cleaned with special care. Usually, when a cargo consists of such goods as flour or seeds, which are particularly susceptible to moisture damage, is to be carried, it maybe necessary (not in all cases) to cover metal parts inside the holds to prevent the drops of moisture that may condense on the metal from contacting the cargo. Some cargoes require the holds to be coated with lime to avoid corrosion, i.e., sulphur, salt, soda ash, etc.

However, normal practices nowadays consist of thorough hold washing and drying of tank tops and hold bilges.

*__FROM BULKER STARS – NYK LINE INSTRUCTIONS__*

*We have reviewed and revised the standards for cargo hold cleaning for dry-bulk carriers transporting coal / iron ore as follows:*

*1. Purpose:*

*1) Prevention of cargo contamination from previous cargo residual*
*2) Early grasp of damage and corrosion in hold.*

*2. Standard:*

*We have established a hold-cleaning standard for bulk carriers that transport coal and iron ore.*
*The standard is noted below. If attention beyond this standard is ever required, we will instruct you separately.*

*2-1. General Requirement*
*From COAL to COAL Shovel cleaning(*1)*
*From COAL to IRON ORE Sweeping*
*From IRON ORE to COAL Sweeping and Washing (* 2)*
*From IRON ORE to IRON ORE Shovel cleaning(*1)*

*Remarks:*

**1: ‘Shovel cleaning’ means shovel cleaned by shore labor in the discharge port, Cleaning the holds will be much more difficult if quantities of cargo sweepings have* *been left in the hold, particularly if the cargo is not soluble in water, so the ship's officers will do all that they can to compel or persuade the stevedores and trimmers to discharge all the sweepings. Even so, many quantities of cargo remaining, report it to the operator as soon as possible.*

**2: Washing refers to freshwater washing or freshwater rinsing after washing with seawater. When conducting a freshwater rinse, ensure a thorough rinse.*

*2-2. Vessels Assigned to Electric-Power Companies*
*Following hold-cleaning standard was applied for the bulk carrier assigned for Electric Power Company. If more attention beyond this standard is ever required, we will let you know.*

*From COAL to COAL Sweeping*
*From IRON ORE to COAL Sweeping and washing (*3)*

*Remarks:*

**3: 'Washing' refers to freshwater washing or freshwater rinsing after washing with seawater. When conducting a freshwater rinse, ensure a thorough rinse using the Combi-gun (Water Tobay) or such materials.*

*2-3. Special requirement*
*When special hold cleaning is required more than above criteria, we will instruct you separately.*
*3. Requirements as an Owner (for NYK-owned vessels)*
*Hold cleaning (Washing) for hull maintenance purposes on NYK-owned vessels which operated by Steaming Coal Group should be done in 6 months interval by freshwater or freshwater rinsing after washing with seawater. When above work was carried out, took the photograph and report it by the "Semi Annual Report" or other reports. Any other special requirement by Ship-management Company should be carried out based on the standards of the ship-management company.*
*You should take enough consideration about the MARPOL, local regulation and weather forecast, and if applicable, carried out freshwater rinsing for Ballast hold after de-ballasted.*

*4. Standards for Cargoes other than Coal / Iron Ore*
*Our requirement of hold cleaning/preparation for other cargo will be informed separately.*

*5. Hold cleaning mentioned on C/P*
*When agreed between a shipowner and charterer about cargo hold cleaning by charter party(C/P), we give priority to the C/P.*

- Cargo holds are always cleaned in preparation of the next cargo, except when the ship is engaged on a shuttle service carrying the same cargo.
- Instructions for hold cleaning are almost always mentioned in the voyage orders. The charterers will instruct whether the holds are to be swept only, or to be swept and washed and whether that is to be followed by painting or lime coating as for some cargoes. If in any doubt as to the method and extent of cleaning required the master must not hesitate to ask the Charterer.

For Hold cleaning to be quick and easy good Cargo watch plays an important part. During the unloading of cargo the watch keeper in conjunction with the shore representative or stevedore must ensure that all the cargo from along the frames is being cleared as the cargo level drops in the hold as these places will be difficult to reach after the cargo has been unloaded and the Ship staff will be required to clean the Hold for next cargo.

**Washing and Preparation of Ballast Hold**.

If the weather permits then the vessel departs the discharge port in the light ballast condition and the ballast hold is the first hold to be cleaned.
If the vessel departs in the heavy weather ballast condition then on the voyage, if the weather permits water from the hold is de-ballasted , cleaning is carried out and clean water is refilled into the hold..

On some vessels where Hand scrubbing is required the crew has been known to enter the hold when it is being de-ballasted, using rafts, life buoys and life line and the bulkheads are scrubbed as the water level falls. Water is discharge initially by gravity and the final Quantity is pumped out.. Though this process is convenient in the sense that all the areas of the hold can be covered by the crew without the use of ladders and stages it is exhausting and cumbersome particularly if the satins are stubborn. This operation also requires complete Risk assessment and effective, safe management of the work and crew.

If there is no opportunity to clean the hold at sea and a clean hold is required at the loading port, the crew can commence hosing down form the deck level as the hold is being deballasted and they can enter the hold when the level is about 30-40cms of water left in the hold.

After the hold has been cleaned with salt water, a fresh water rinse is carried out and the water is educted out through ballast line.

When the hold is drying out, the ballast wells are blanked out using cover plates whilst the covers on the bilge suction are removed, the bilges are checked for cleanliness and the perforated cover plates inserted after burlapping of the bilges is carried out.

**Cleaning in port:**

- Cleaning of the holds becomes more difficult and time consuming, if there are large quantities of cargo sweepings are left in the hold, on the tank top, along the frames etc and it becomes particularly more tedious if the cargo is insoluble in water. Cargo residues in the form of large particles will clog the suctions, non return valves and bilge lines.
- The Chief mate must compel or persuade the stevedores / trimmers to ensure that as much cargo is swept and discharged as possible.
- The level of sweeping carried out by the stevedores is generally not satisfactory and time permitting, the ship's crew should be sent down into the holds to carry out efficient sweeping from at least the bottom hoppers and tank top. A compressed air hose may be used for blowing the cargo down from the hoppers.
- The hold bilges must also be inspected for any cargo remains. Cargo tends to enter the hold bilges particularly when the hold bilge plate has been displaced by the bulldozers during discharge or if the burlap inserted under the plate is torn. The Chief mate needs to discuss the location / dimensions of all bilge wells so that the bilge plate is not damaged/uprooted when the tank top is being cleared of the cargo with a bulldozer.
- The sweepings are then collected in the centre of the hold and normally the stevedores are willing to return to the hold where the cargo has been swept by the crew, to grab discharge the sweepings.
- If the stevedores refuse, a note of protest with a photographic evidence should be given to the terminal in-charge. The sweepings are hoisted using a mucking winch. This is specially the case of the ballast hold which normally the first hold to be completed and cleaned by the crew, before ballast is taken in the hold. The sweepings of the ballast hold are stored in drums on deck which should be well covered to avoid spillage due to rain or wind/seas as invariably local regulations prohibit dumping of cargo sweepings overboard in port.
- For the other holds the sweepings are left in the hold for picking up later at sea, s generally the vessel will not have sufficient drums and leaving the cargo on the deck will result in it being blown about the ship as well as staining the deck and shipside.
- When discharging sticky cargoes such as grain, it is worthwhile to send crew members into the holds to clean positions high under the deck head during interruptions in discharging. By standing on the cargo during the early stages of discharging, they can reach places which later become inaccessible. This work must be properly supervised keeping in mind the safety of the crew.
- Hold washing is generally prohibited on port limits. On some ships fitted with dedicated dirty water tanks, the ballast hold is washed in port prior ballasting and the water is pumped into the tanks via the bilge system. There is generally a pair of these tanks and their capacities are about $600m^3$ each.

**Opening of hatch covers at sea for cleaning:**

- Hatch covers must never be opened at sea except special conditions.
- Hatches have been known to be lost overboard or dislodged from the track way whilst opening/closing in a seaway when vessel is rolling / pitching.
- Even when hatches are open it must be ensured that they are properly secured.

**Cleaning at sea:**

- If not complete in port, the process of sweeping the holds continues on departure from the discharge port, especially if the cargo is insoluble in water. (If the cargo is soluble, then sweeping will not generally be required in the first place.)
- If the weather is calm, geared bulkers use their cranes to lift out the sweepings. For rough weather and for gearless bulkers a mucking winch is invariably provided.
- The mucking winch is fixed to the hatch-coaming or davit or trimming hatch and can typically lift quantities such as a 200 ltr drum at a time. The container is filled in the hold and carried to a position below the mucking winch, where it is hooked on and raised to the deck level where it is tipped over the ship's side or on deck under a running hydrant. Crew members must be reminded to tip or wash the sweepings over the lee side.
- Once the sweeping of the holds is complete, the next step is the washing down of the holds.

**Washing of holds:**

- This involves washing with water drawn from the sea by hosing down every part of each hold with a water jet, whilst the water is drained from the hold by educators or bilge pumps and discharged overboard.
- Three methods of hosing down a hold include using:
  - Handheld hoses
  - Water cannon
  - Permanent installations
- Handheld hoses:

This requires a team of three seamen, with one standing on deck and two to handle the hose which is normally at full pressure.

On large bulkers, this method does not achieve good results in the more remote parts of the hold like under the deck head or on the top hopper or the shipside frames, and is generally used to hose down the hatch covers, hatch coaming, accesses, and the tank top. The other areas are wasted down using water cannon.

- Water cannon:

This comprises of a hose connected from the fire main, being led to a high pressure sea water cannon (Combi-gun) on a tripod in the hold, whereby the high pressure is provided by compressed air from the ship's deck air line.

The resultant powerful jet achieves better cleaning of the high extremities of the hold. It is of utmost importance that the deck water pressure and the deck air pressure are optimum to achieve the best results.

- Washing sequence:

The washing sequence starts at the top of the hold and works towards the bottom.
First hatch covers are wasted on all sides as far as possible.
Compression bars and rubbers may need scrubbing to remove any cargo stuck to them.
The temperature pipes are flushed with water from the deck level after ensuring that any thermometers attached to the cap by a rope are cleared.
Next the coamings hold accesses, upper stool spaces, ladders, hold deck heads and hold sides are washed paying particular attention to non vertical surfaces such as pipe guards, brackets.
Then the deck is washed, including under the cover plates of DB manholes, and the bilges are flushed.
As a final measure the hold bilge sounding pipe and the hold temperature pipes.

- **Requirements while washing:**

Maintain a good pressure on the deck water and deck air lines.
Input of Water for washing should be equal to water being educted out from the bilges..
Maintain good communication between the hold, deck, Ballast Control Room, Bridge, Engine room.
Maintain a good trim and slight list to enable water to flow to one bilge.
Ensure the perforated bilge cover plate is in place with any burlap wrapping inserted in the previous voyage having been removed.
Clear the cover plate of any larger lumps of cargo residue regularly.
Intermittently, direct a hose to the bilge which is being drained out, to avoid suction becoming blocked.

- **Clearing of blocked bilge suctions:**

  - If build up of water occurs, stop the washing and investigate the problem.
  - Directing a hose into the bilge will most likely clear the suction.
  - If the hold eductor suction is blocked, then flooding back by temporarily shutting back the eductor discharge so that the eductor drive is forced through the bilge suction in the hold, may be the quickest way to clear it (Backflush).
  - If tank top becomes flooded, list the ship towards the other suction and start pumping out from there.
  - To clear the blocked suction, water will have to be baled out with buckets, or a portable pump driven by compressed air will have to be used to speed up the process.

- One or more sections of the suction will have to be unbolted to locate and remove the blockage.
- If both the suctions get blocked ten the portable pump will have to be used or if this is not possible then the manhole cover to the DB tank may be opened as a last resort, provided the water in the DB is below the tank top level and the water drained does not contaminate it.

- **Fresh water rinsing:**

- When holds are wasted with sea water, traces of salt remain on all surfaces inside the hold.
- Salt traces must be removed from these surfaces because:

They encourage corrosion
They are unacceptable to hold inspectors
They are liable to contaminate cargoes such as steel and wood pulp

- Removal of salt traces is carried out by a fresh water rinse and this may be achieved in any one of the following ways depending on the design and configuration of the ballast, fresh water and deck water lines:

Load fresh water in a suitable tank, generally the after peak tank, (sometimes even the fresh water tank) and than pump the fresh water through the deck water line for use in hosing down the holds
Use a portable high pressure washing machine (KEW machine)
Use a normal FW hose connected from the deck water line

- Of the three methods above, the first is the fastest and most effective, especially if a combi-gun is used. When using this method ensure that:

Crew members understand that they are using FW and not sea water, so that water is used efficiently and with care.
All valves (overboard, cooling water for winches, anchor wash) except the hydrant/s where the hose is connected, are shut otherwise there will be loss for precious Fresh water and delay in preparation of cargo Holds. If there is excessive pressure on the line then the number of hoses used should be increased, which eventually reduces the rinsing time
Depending on the capacity of the fire pump, and the amount of FW available, the crew members are aware how much time they have to spend in each hold.

Rinsing with the KEW machine or the FW hose is more practical for lower areas of the hold, and though they consume less water, the time spent is much longer
If possible, fresh water should be obtained where it is cheap or free
FW picked up for cargo purposes is generally on charterers account.

**Cleaning of bilges:**

- After completion of hold washing bilges are to be cleaned to ensure that they continue to function properly and do not get blocked with residues.

- They must be meticulously cleaned with every trace of matter removed, especially if foodstuffs such as grain or sugar have to be carried.
- The strum boxes which are perforated and fitted to prevent large particles from entering the pump strainers, must be taken apart, cleaned and refitted.
- The final residue which is removed from the bilges is brought up on deck using the mucking winch, and during this process care must be taken to prevent the tank top from getting dirty again.

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

*In order to monitor safety of ship condition, cargo condition, and achieve smooth cargo operation, following guideline is to be followed:*

*(1) Sounding Hold Bilge is to be carried out twice a day.*
*(2) Discharging Hold Bilge is to be carried out as much as practical.*
*(Never leave bilge well full condition. If bilge water comes to more than half capacity of bilge well, bilge water is to be discharged.)*
*(3) If plenty quantity of Hold Bilge is come out and/or expected, sounding Bilge Well and discharging Hold Bilge are to be carried out as much as practical, at least more than twice a day.*
*(4) If Hold Bilge comes out more than half of Bilge Well capacity even after Hold Bilge is discharged twice on the same day, the fact is to be reported to NYK.*
*(5) Hold Bilge Sounding & Discharging Report is to be sent to NYK as per instruction.*
*(6) If water/moisture on/in cargo is observed/expected, the fact is to be informed to NYK immediately.*
*(7) If Hold Bilge Water cannot be discharged sufficiently before entering port, and plenty bilge water remain in hold in port, the fact is to be report to NYK immediately.*
*(8) If NYK received the report to inform plenty Hold Bilge water in cargo, NYK takes following actions.*
*(a) NYK reports the fact to the cargo owner and stevedore, and then discuss measure to be taken.*
*(b) If the vessel is required to shifting Hold Bilge Water from cargo hold according to above (a), NYK plans/arranges following measures.*
*(b)-1: Ship transfers hold bilge by ship's pump from cargo hold to slop tank or ballast water tank, if applicable.*
*(b)-2: NYK arranges portable pumps to the ship to transfer hold bilge from cargo hold to appropriate tank, if (a) is not applicable.*
**Following items are to be considered.*
*(a) It can happened that non-return valves on bilge line does not function and backwater of bilge water comes to cargo hold.*
*(b) Accuracy of sounding bilge well is limited. The way of sounding work to get accurate figure is to be considered.*

*Getting average figure after serial plural sounding works at the same bilge well can take out some of observation error.*
*(c) Information regarding weather condition, especially rainfall, before and/or during loading operation at loading port is helpful to estimate water content in cargo. Such kind of information is to be informed to NYK.*
*(d) If condition permitted, after disembarking pilot at loading port, put ballast water to the after peak tank and make stern trim for smooth bilge discharge.*

**Drying of holds:**

- The C/P frequently requires the holds to be presented 'Clean and Dry' prior to loading.
- All puddles of water which form in the depressions in the tank top when hold is washed, need to be mopped up.
- The hold bilges will have to be dried up.
- For ships fitted with cargo ventilation fans, effective ventilation can be carried out to dry up the holds or prevent the formation of sweat.
- If the weather is dry and the ship reaches smooth waters in the port approaches, hatches may be opened to dry up the hold using the flow of air over the ship.
- For grain loading in winter, when holds are sweating it may be possible to persuade the operator of the elevator to blow some grain dust into the hold, which will stick to the moisture and form a coating of sorts.

**Inspection of cargo holds:**

- After the holds have been washed, the Chief mate, whose responsibility it is to ensure that the cargo holds are ready for cargo will undertake a thorough inspection of the hold.

- The aspects he will be looking for are:
  - Cleanliness
  - Hold damage
  - Leakage from ballast tank or other sources
  - Insect Infestation

  - ➢ Cleanliness:

Inspect flat surfaces high in the hold, such as flanges of beams visible from the hold ladder, for signs of cargo residue.
At tank top level check whether the bulkheads, hopper sides and tank top are clean to touch and no residual dust of the previous cargo adheres to the hands. The same should be done whilst climbing down the ladder.
Look for residues beneath manhole cover plates and behind pipe casings.

Inspect bilge wells.
Inspect for loose rust (scale) or loose paint and have it removed by scraping.

- Hold damage:

Though the hold would have been checked for damage during discharge and after completion of cargo, it is still possible for damage to have been overlooked, due to the hold having been dirty.
Inspect for damaged hold ladders, air pipes, and thermometers pipes, sounding pipes and their casings, and piping for any hold smothering system that is fitted.
Inspect the frames, brackets and plating.
Check the cover plates for manholes or gratings for bilge wells.

- Leakage from ballast or fuel oil tanks:

Check for any leaks from tanks in way of the cargo holds.
Ensure all manhole cover nuts in the tank top are properly tightened.

- Insect infestation:

Any trace of insect infestation in the holds or bilges is unacceptable for edible cargo.
Favourite hiding place for insects is loose scale.
If found, consult owners for advice immediately.
Spraying with suitable spray may be sufficient or fumigation may have to be carried out.
If found, by inspectors, insect infestation can result in expenses, delay and off hire whilst the ship is being fumigated.
If undetected, cargo may be damaged and massive cargo claims may be experienced.

**Burlapping of bilges:**

- Bilge wells are provided with perforated robust steel plates set flush with the tank top.
- They are set flush so that they are not dislodged by the bulldozers which are used to push the cargo to the centre of the hold in the later stages of discharge, and they are perforated such that they allow water from the hold to be drained into the bilge whilst large particles of cargo from entering into the well.
- Smaller particles can still fall into the well and to prevent this the bilge cover plates are lined with burlap (gunnysack)
- The burlap is wrapped around the cover plate; the plate is replaced in its normal position.
- For fine cargo the edge of the plate may be sealed with cement, Ram-nek or linen tape.
- After the fitting of the burlap, the plate must be flush with the deck.
- For edible cargoes the burlapping is left until after the hold bilge inspection has been carried out by the inspectors at the loading port.

**Lime washing:**

- Though presence of hard rust is not a concern for most cargoes, there are some cargoes which are sensitive to rust.
- Salt used for the preservation of fish, when it comes in contact with rust will get discoloured.
- There are other cargoes like sulphur which are corrosive in nature.
- To prevent contact between these cargoes and the surfaces in the hold, lime washing (coating with lime) of the hold is carried out.
- Lime wash is made by mixing slaked lime (hydrated calcium hydroxide – $Ca(OH)_2$ and water in the ratio of 1:4 by weight.
- Mixing is carried out in a 200 Ltr. Drum inside the hold and the lime wash is applied with the hose of a portable pump.
- The bulkheads are lime washed to whatever height the cargo is expected to reach.
- Coating on bulkheads and tank top should be even and thick.
- It takes a few hours for the lime wash to dry up.

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

*We would like to request that the below information be used by all dry bulk carriers and chip carriers in port to conduct proper procedures to prevent polluted water contaminated with cargo residue (slop water) from being discharged overboard.*

***Background***
*Environmental-protection requirements continue to become more stringent. This tendency is especially so at electric power company discharging-berths for coal. Rainwater that collects on the upper deck is contaminated with coal on deck and should be treated as polluted water. Draining this polluted water overboard is prohibited at all discharging berths for coal.*

*Procedure*
*1. Confirm complete closure of all deck scuppers*
*Before vessels arrive, a leakage test should be conducted to confirm complete closure of all deck scuppers. If any leakage is discovered, conduct maintenance (e.g., change rubber packing, chip to adjust face, etc.) and perform the leakage test again. If the vessel does not have spare packing, the master should consider a substitute method of plugging (e.g., wood plugs, welding, etc.).*
*2. Establish path to collect polluted water*

*(a)* ***Ships that have a polluted-water collection device****:*
*(a-1) Spill manhole for topside bilge tank / slop tank*

*1) Open manhole of topside bilge tank / slop tank.*
*2) Install strainers on the topside bilge tank / slop tank manhole to prevent coal from falling off the deck with rainwater.*
*(a-2) Surface valve for topside bilge tank / slop tank*
*When raining, open surface valve to collect polluted water on deck in the topside bilge tank / slop tank.*



*(b)* ***Ships that do not have a polluted-water collection device****:*
*(b-1) Ships that have an air pump*

*Open the manhole of the ballast tank on the stern side, and used the air pump to shift polluted water on deck to the ballast tank. NYK recommends that all vessels possess at least two pumps.*

*(b-2) Ship that do not have an air pump:*

*Polluted water overflowing causes pollution. If ships do not have polluted water collection devices or air pumps, the master must prevent the pollution through use of the crew members and any other effective means.*

*The below picture shows a crew member collecting polluted water.*

*1) A crewman on deck uses a bucket to draw polluted water and then transfers it to drum cans.*
*2) The crewman transfers the polluted water to the ballast tank when the drum is filled with polluted water.*

***<u>SMS Requirement</u>***
*If a company's SMS or company instructions to handle polluted water has a stricter procedure, the required procedure should be followed.*

**Painting of holds:**

- The process of removing the coating of lime wash after completion of discharge is painstaking and time consuming and some owners prefer to apply a coating of paint instead.
- The fastest way is the use of a paint spray machine.

- It must be ensured that the holds are properly ventilated during painting and the crew is properly equipped with masks, goggles, etc.

Authorities in some countries require to see evidence in the form of a certificate; that the paint applied is not harmful to edible products

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

*We request all vessels that carry iron ore and coal to note the below-mentioned procedure in order to prevent cargo contamination from rust.*

***Background***

*We recently had to deal with cargo being contaminated by rust in one of our bulk carriers. Even though the holds of the vessel were heavily rusted, as pictured below, the cargo (coal) was loaded at Newcastle, Australia, and arrived at a Japanese port for discharging. When the hatch cover was opened at the second discharging port for this hatch, the stevedore discovered the surface of the cargo to be contaminated with a lot of rust. Not only was there rust on the surface of the cargo but there were also many loose rust scales on the bulkheads, and light shakes would easily cause these scales to fall off.*

*The stevedore recently had experienced the serious injury of a trimmer when rust fell from the bulkhead of a vessel operated by another shipping line, and mentioned the safety concerns to us. Our vessel's nomination was then regrettably canceled because of concerns about stevedore safety and cargo contamination.*

*This incident forced us to realize again the necessity of a system that will help us to better understand the rust condition on vessels in our operation. In order to prevent a similar trouble from occurring, we have established the below-mentioned guideline. The guideline requires:*

*(1) a judgment of the hold condition based on the attached samples and (2) the submission of a report to NYK when the vessel does not satisfy our standard and/or when our operator requests to obtain a much better understanding of hold conditions.*

*1. Purpose*
*1. Understand the hold condition of vessels in operation to prevent rust contamination, secure stevedore safety, and improve transportation quality.*
*2. Quickly realize the existence of a substandard vessel and take immediate action.*
*2. Procedure*
*2-1. Reporting standard*
*When the master is requested to submit current hold condition from the operator, refer to the "Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces" and check your condition and report it to the operator based on the reporting format.*
*2-2. Report*
*The report should be submitted as soon as possible after receiving a request from the operator. While on a voyage and when it is difficult to check the condition of the hold, report the condition in the range that you can confirm, and send a detailed report later. This also applies to cases in which photographs are difficult to take and transmit by e-mail.*

*2-3. Other standards and formats*
*If there is a standard or format established by your owner or ship-management company, please use that reporting format instead of ours. There is no need to do extra work.*

*3. Evaluating*
*An actual rusting surface may be a combination of various types of rust (spot rust, general rust, blister, etc.) and the degree of rusting may be difficult to determine. In such case, you should choose the grade that is most similar to the sample photograph while always considering potential cargo contamination from rust.*

*4. Danger level*
*Because the danger level changes by cargo and customer demands, NYK will determine the level of danger based on your report.*

### 2.3.2 Preparation for Loading - Cargo Planning and Monitoring

The holds will require cleaning to the highest standards. All traces of the previous cargo must be completely removed, and there should be no loose rust scale. The holds must be dry and be free of odors, infestation and anything else which could contaminate the cargo to be loaded. On completion of Hold cleaning to comply with the above requirements as discussed in 2.3.1- Hold Cleaning the Chief Officer moves on to Cargo Planning and Distribution.

The determination of an acceptable safe and proper cargo distribution is vital to effective and efficient cargo handling.

Conventionally, appropriate results are manually obtained through the process of preparing cargo plans. The modern approach is to utilize computerization. The former includes basic principles; the latter technological analysis.

Cargo Plans draw particular attention to the importance of compiling accurate loading or stowage plans, showing the distribution of weight and capacities, for all types of cargoes (if carrying more than two (2) types of cargoes).

The Chief Officer will devise a planned stowage for the cargo once he receives the cargo booking list (part of the sailing instructions). Correct cargo stowage of cargo will help to ensure that it reaches its destination undamaged. It is recommended that the OOW makes himself familiar with all the characteristics of the cargo before it is loaded. Prior knowledge of the hazards of spontaneous combustion, self-heating, vapors, fumes, moisture and odors is essential. Ventilation requirements and compatibility with other intended cargoes should be studied. For detailed guidance on individual commodities learners should consult a definitive cargo manual such as *THOMAS STOWAGE* and IMDG Code.

In general terms however, and in some trades, cargo plans are known as stowage plans.

Master should understand that ship owner and operator are in business to earn profit from the safe transportation of cargo. One of the main tasks of the ship's staff is to ensure that the cargo is delivered to the consignee or receiver in the same condition and quantity as it was received by the vessel from the shipper. The cargo owner has entrusted his goods to the carrier, and expects them to arrive at their destination undamaged with no part missing.

Prior arrival at load/disports, apart from the stability computations being prepared intended for the unloading/loading sequence, Ship and Shore safety checklist should be executed/completed prior loading or unloading. The Chief Officer and the foreman shall fill out the form and affix both their signatures.

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

## *Constant calculation*

*Each vessel has a constant to show unknown weight composed of materials adhering to the bottom, unmeasured quantity in tanks and stores, and ship weight changes due to repairs. And the value of the constant changes in accordance with a ship's age, before/after dock, and other factors.*
*On the other hand, the following miscellaneous weights, which are measurable and changeable, are provided together with the constant in some loading booklets:*

*- Quantity in small tanks*
*- Washing water tank*
*- Ballast water in pipes*
*- Others;*

*In some cases, the above miscellaneous items are mistakenly handled as if they are part of the constant. It is important that all measurable items be grasped as accurately as possible and used for calculations. Otherwise, correct cargo quantity cannot be found. Handling Constant and Miscellaneous Weights*
*Items categorized as constant and items categorized as miscellaneous items are not standardized, and itemization/categorization described in the loading booklet varies by shipyard. Constant as an unknown weight is used as a fixed value for a short period, and it can change as time passes, and so it must be reviewed periodically. In order to make an accurate calculation of the ship's constant,*
*the following should be done properly:*

*1) Confirm each item categorized as a constant, such as miscellaneous weight, ballast tanks, cargo weight, lightship, etc.*
*2) Confirm which items are fixed, which are variable and/or measurable, and which are unknown.*
*3) Measure/get exact values, as accurately as possible, each item that is measurable.*
*4) Minimize items categorized as constants, and recheck constant values at every opportunity, such as draft survey, dry docking, etc.*
*The categorization of a constant and the description of a constant vary according to each shipyard's standard. We recognize that some dockyards provide descriptions that might not clearly provide details and do not deduct some quantities that do not actually exist. However, there are a lot of ships that always use the same constant value including miscellaneous weight even though a different value can easily be determined by using the loading booklet.*

*In order to grasp accurate ship condition & cargo quantities, we would like you to confirm your constant again and confirm the breakdown of constant and miscellaneous weight, especially by taking into account the existence of ballast line water when the vessel enters or departs from port.*

***Bad Examples of Calculation of Constant:***

*The following is a sample calculation sheet (from a loading booklet) for constants and miscellaneous weights. In this case, the vessel had always used 723.1 MT as its constant.*
*1) The weight in small tanks in the E/R (466 ton) was calculated based almost on its full capacity.*
*2) The weight in the WW Tank (Washing Water Tank: 272 ton), where washing water does not normally exist, was calculated based on its full capacity.*
*=> The vessel lost 272 tons of cargo every voyage.*
*3) The 111.8 tons of ballast in pipes was not excluded from the final survey even though almost all ballast in pipes does not exist after eductor stripping. Ballast in pipes usually exists when vessels enter port (at initial survey).*
*=> The vessel lost 111.8 tons of cargo every voyage. The above-mentioned vessel might have lost approx. 400 MT of cargo every voyage.*

*<Sample calculation sheet (in loading booklet) for constants and miscellaneous weights >*

## 5.6 Constant & Misc. Weight In Loading Condition

| Constant & Misc. | Weight (Ton) | L.C.G (M) | L.Moment (MT-m) | V.C.G (M) | V.Moment (MT-m) | F.S.Mt (Ton-m) |
|---|---|---|---|---|---|---|
| Crew & their effects | 3.4 | -113.000 | -384.20 | 34.000 | 115.60 | 0 |
| Provision | 10 | -116.600 | -1166.00 | 26.400 | 264.00 | 0 |
| Engine room store | 18 | -112.200 | -2019.60 | 19.600 | 352.80 | 0 |
| Steering gear room store | 16 | -140.850 | -2253.60 | 19.600 | 313.60 | 0 |
| Deck store | 10 | 25.365 | 253.65 | 26.400 | 264.00 | 0 |
| Bosun store | 22 | 131.920 | 2902.24 | 20.200 | 444.40 | 0 |
| BALLAST IN PIPE | 111.8 | -1.27 | -141.99 | 0.87 | 97.27 | 0 |
| Small Tank in E/R | 466 | -115.659 | -53896.94 | 4.362 | 2032.84 | 0 |
| Miscellaneous Tanks | 65.9 | -18.252 | -1202.79 | 6.807 | 448.57 | |
| | 723.1 | -80.085 | -57909.22 | 5.992 | 4333.07 | 0 |

| Small Tanks in E/R | Weight (Ton) | L.C.G (M) | L.Moment (MT-m) | V.C.G (M) | V.Moment (MT-m) | F.S.Mt (Ton-m) |
|---|---|---|---|---|---|---|
| F.O. drain Tk. | 3 | -115 | -345.00 | 2.342 | 7.03 | 0 |
| F.O. sludge Tk. | 36 | -116.6 | -4197.60 | 17.7 | 637.20 | 0 |
| D.O. Tk for emergency genset | 1.3 | -123 | -159.90 | 29.11 | 37.84 | 0 |
| Incl.M.D.O.Tk. | 1 | -127.8 | -127.80 | 26.8 | 26.80 | 0 |
| L.O. Drain Tk. | 3 | -115 | -345.00 | 2.342 | 7.03 | 0 |
| L.O. sludge Tk. | 14.5 | -121.8 | -1766.10 | 17.7 | 256.65 | 0 |
| Cyl. Oil Measuring Tk. | 1.1 | -115 | -126.50 | 19.1 | 21.01 | 0 |
| S/T L.O. Drain Tk. | 1.3 | -123.8 | -160.94 | 2.342 | 3.04 | 0 |
| S/T L.O. Gravity Tk. (Low) | 0.4 | -129 | -51.60 | 19.6 | 7.84 | 0 |
| S/T L.O. Gravity Tk. (High) | 0.4 | -127 | -50.80 | 26.14 | 10.46 | 0 |
| FeedWater Filter Tk. | 2.5 | -123.4 | -308.50 | 13.5 | 33.75 | 0 |
| Bilge holding Tk. | 62 | -126.361 | -7834.38 | 1.577 | 97.77 | 0 |
| Oily bilge Tk. | 16.5 | -123.768 | -2042.17 | 1.631 | 26.91 | 0 |
| WWTK | 272 | -109.45 | -29770.40 | 1.707 | 464.30 | 0 |
| HT.F.W. Cooling Exp. Tk. | 1.5 | -115 | -172.50 | 22.1 | 33.15 | 0 |
| LT.F.W. Cooling Exp. Tk. | 1.5 | -127.4 | -191.10 | 29.61 | 44.42 | 0 |
| Composite boiler in E/R | 7.5 | -125 | -937.50 | 21.4 | 160.50 | 0 |
| CWT | 40.5 | -131.09 | -5309.15 | 3.88 | 157.14 | 0 |
| | 466 | -115.659 | -53896.94 | 4.362 | 2032.84 | |

*Even though the WW tank does not actually have water in it at the loading port, 272 tons of water is always included in the constant and miscellaneous weight. As a result, a freight loss always occurs.*

*Quantities of tanks in the engine room are considered to be at full capacity, not the actual amount. All weights are considered constant values.*

## 2.3.3 MAXIMUM LOADABLE CARGO

Prior fixing any Charter the Master may be requested by the Charterers to calculate the maximum amount of cargo a vessel can load for a succession of possible voyages. At other times the Charterers may fix the voyage and then send the loading orders to the vessel.

**Cargo Planning Example.**

" Ref next voyage , Intend loading 1,60,000MT10% MOLOO coal- SF 42cuft/LT at Vancouver- Canada for discharging at Mizushima- Japan. Kindly advise your Bunker requirements at Vancouver. Also pls advise soonest Hold wise stowage plan based on17mts SWAD Mizushima"

The vessel is loading a Single Cargo at a Single Berth for a Single Port.

Things to take note of in the above message.

**Next Voyage**
**160,000** base figure of Cargo to be carried.
**Cargo unit is MT** – ( sometimes it could be Long Tons- UK)
**10%MOLOO**- MOLOO is More Or Less Owners Option. It means that the owners or owners representative has the option to load cargo between 144,000MT and 176,000MT abiding with all requirements of draft restrictions that may be exist( Company UKC Policy, Canal Transit- Port requirement, Geographical Zone restriction etc).
**Type of Cargo** – Coal
**SF- 42cuft/LT**--- Kindly take note of the units of stowage factor.
**Load Port**- Vancouver
**Discharge Port**- Mizhushima
**Bunker** likely to be revcd at **Vancouver- Qty** to be ascertained.
17mtrs SWAD Mizhushima –------ **Salt Water Arrival Draft** . It means that vessels salt water draft at discharge port should not exceed 17mtrs.

**Approach to planning**

1. Identify the limiting point which will determine the quantity of cargo that can be carried.
2. Calculate the maximum amount of cargo that can be carried.
3. Decide on the disposition of cargo in the holds.
4. Prepare a loading plan/ Sequence
5. Prepare a discharge plan/ Sequence.

## Limiting point of the voyage.

At various points of the voyage, limits may restrict the amount of cargo a vessel can carry and these may depend on.

- Geographical Zone and time of the year- Confirm the zones through which the vessel will pass during the loaded passage.
- If the vessel is to pass the Winter zone then she will load only so much cargo such that when she arrives at the winter zone limit, her winter loadline is not submerged.
- Draft restriction at the loading port, discharging port or some intermediate port such as a canal or waterway.
- Requirements to carry a minimum qty of Fuel and Water
- Tonnage to be carried as stipulated in the C/P.

## Calculating the Maximum cargo the ship can carry.

On a particular voyage the amount of cargo that can be carried may be decided by the ships deadweight or the volume of her cargo spaces. A high density cargo will bring the ship down to the limiting draft before the holds are full, whilst with a low density cargo her holds may be full before the limiting draft can be reached.

To calculate maximum cargo the vessel can lift, following points need to be known for checking Draft limitation.

- ✓ Draft
- ✓ SW displacement for that draft
- ✓ Fuel Oil
- ✓ Diesel Oil
- ✓ Fresh water
- ✓ Ballast
- ✓ Constant
- ✓ Lightship
- ✓ Loadline Zone/s during Transit.
- ✓ Stowage Factor
- ✓ Permissible Load Density( PLD) of Tanktop.

*CONVERSION:*

*1 TON (METRIC TON) = 1000Kg = 0.98421 LT (LONG TONS U.K.) = 1.1023 ST (SHORT TONS U.S.A.) = 2,204.6 POUNDS.*

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

*We would like to request that the below information be used by all dry bulk carriers and chip carriers to prevent cargo loss in exchange for the ghost ballast.*

*We, NYK, recently investigated several dry-bulk carriers in which a lot of ballast water always remained when the vessels departed from loading ports. We found that, even though the crews regularly performed the proper de-ballasting operations, there was no "dipping table," "wedge table," or "sounding table with trim" (hereafter "dipping table") provided by the dockyard, and so it was impossible for the crews to grasp the actual remaining quantities of ballast. Thus, we recognized that many ships lost freight in exchange for "ghost ballast" (ballast water that does not actually exist).*

## ***Ghost Ballast***

*Stripping work is usually done when a vessel's trim measures 2 to 5 meters, so on an inclined vessel, and there may be no water on the bow side of the tank.*
*In principal, the quantity of remaining ballast is measured using a sounding table, and even when the sounding height shows 0 cm, about 10 or more metric tons of ballast water remain (according to the sounding table) because the sounding measurement, which is taken at the vessel condition trim zero, takes into account the thickness of the striking plate. The sounding table, like the one in fig below does not take into consideration a decrease in water volume from ship inclines when the remaining ballast quantity is a little. And on a stern trimmed vessel, there may be no water on the bow side of the tank. This area should be deducted for a proper measurement; however, the sounding table that does the trim correction using a sounding height adjustment cannot do this.*

*The sounding table therefore includes a ghost ballast (one that doesn't really exist), and as a result, we lose cargo every voyage in exchange for the ghost ballast. To correct this difference, shipyards usually provided a dipping table, and an accurate measurement of ballast remaining using this table had been done for many years. However, we have discovered that many shipyards are no longer providing a dipping table, and if a dipping table is provided, the crew does not know how to use it.*

***Sample calculation of differences****:*

*Please refer to the below sample of the remaining quantity of ballast between the sounding table corrected by the trim correction table and the dipping table. This is the difference of the remaining quantity of ballast of one ballast tank (No. 2 BWT(S)) of same vessel (Capesize bulk carriers.) The vessel has 2.0 meters of trim, and the final sounding is 4 cm of No. 2 BWT(S).*

*<By Sounding Table corrected using Trim Correction Table>*
*Please refer to the below sounding table and trim correction table. Using these tables, the correction value for a vessel with a sounding height of 4 cm at a trim of 2 m can be calculated to be minus 3 cm. This 3 cm is then subtracted from the 4 cm sounding to obtain a corrected height of 1 cm, from which we can obtain a ballast of 26.2 cbm.*

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NO.2 B.W.T. (P&S)

| S.H. METER | CAPACITY CUB.M. | CAPACITY KT | S.H. METER | CAPACITY CUB.M. | CAPACITY KT |
|---|---|---|---|---|---|
| 0.00 | 16.1 | 16.6 | 0.50 | 524.3 | 537.4 |
| .01 | 26.2 | 26.9 | .51 | 534.6 | 547.9 |
| .02 | 36.3 | 37.2 | .52 | 544.8 | 558.5 |
| .03 | 46.4 | 47.6 | .53 | 555.1 | 569.0 |
| .04 | 56.5 | 57.9 | .54 | 565.4 | 579.5 |
| .05 | 66.6 | 68.2 | .55 | 575.7 | 590.1 |
| .06 | 76.7 | 78.6 | .56 | 585.9 | 600.6 |
| .07 | 86.8 | 88.9 | .57 | 596.2 | 611.1 |
| .08 | 96.8 | 99.3 | .58 | 606.5 | 621.6 |
| .09 | 106.9 | 109.6 | .59 | 616.8 | 632.2 |

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NO.2 B.W.T. (P&S) TRIM CORRECTION TABLE

| SOUND. HEIGHT (METER) | EVEN KEEL | TRIM -1.0M. | TRIM 1.0M. | TRIM 2.0M. | TRIM 3.0M. | TRIM 4.0M. | TRIM 5.0M. | TRIM 6.0M. |
|---|---|---|---|---|---|---|---|---|
| | | | | ***CENT.M*** | | | | |
| 0.00 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| .10 | 0 | 8 | -6 | -8 | -9 | -10 | -10 | -10 |
| .20 | 0 | 8 | -8 | -14 | -16 | -17 | -18 | -18 |
| .30 | 0 | 8 | -8 | -16 | -20 | -23 | -25 | -25 |
| .40 | 0 | 8 | -8 | -16 | -23 | -27 | -30 | -32 |
| .50 | 0 | 8 | -8 | -17 | -25 | -31 | -34 | -37 |
| .60 | 0 | 9 | -8 | -17 | -25 | -32 | -37 | -41 |
| .70 | 0 | 9 | -8 | -17 | -25 | -33 | -40 | -45 |
| .80 | 0 | 8 | -8 | -17 | -25 | -33 | -41 | -47 |
| .90 | 0 | 8 | -8 | -17 | -25 | -33 | -41 | -48 |

*<By Dipping Table>*
*You can get 17.1 cbm of remaining ballast directly from the dipping table.*

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NO.2 B.W.T. (BOTT.) (P.S)

| SOUND. HEIGHT (METER) | EVEN KEEL | TRIM -2.0M. | TRIM -1.0M. | TRIM 1.0M. | TRIM 2.0M. | TRIM 3.0M. | TRIM 4.0M. | TRIM 5.0M. |
|---|---|---|---|---|---|---|---|---|
| | | | | ***CUB.M.*** | | | | |
| 0.00 | 16.1 | 184.1 | 99.3 | 8.7 | 6.3 | 4.9 | 4.2 | 3.8 |
| .01 | 26.2 | 194.2 | 109.5 | 13.1 | 9.0 | 6.7 | 5.6 | 4.9 |
| .02 | 36.3 | 204.3 | 119.6 | 17.5 | 11.7 | 8.5 | 7.0 | 6.0 |
| .03 | 46.4 | 214.5 | 129.7 | 21.9 | 14.4 | 10.3 | 8.3 | 7.1 |
| .04 | 56.5 | 224.6 | 139.9 | 26.3 | 17.1 | 12.2 | 9.7 | 8.2 |
| .05 | 66.6 | 234.7 | 150.0 | 30.7 | 19.8 | 14.0 | 11.1 | 9.3 |
| .06 | 76.7 | 244.8 | 160.1 | 35.1 | 22.4 | 15.8 | 12.4 | 10.4 |
| .07 | 86.8 | 255.0 | 170.3 | 39.5 | 25.1 | 17.6 | 13.8 | 11.5 |
| .08 | 96.8 | 265.1 | 180.4 | 43.9 | 27.8 | 19.4 | 15.2 | 12.6 |
| .09 | 106.9 | 275.2 | 190.5 | 48.3 | 30.5 | 21.2 | 16.5 | 13.7 |

*By sounding table with trim correction:* *26.2 cbm*
*By dipping table:* *17.1 cbm*
*Difference: 9.1 cbm (ghost ballast)*

***Variation of format of sounding table***

*Each dockyard has its own sounding table format, some of which include the function of a dipping table, and there is some variation in the formats of these sounding tables provided by different dockyards. Even if the vessel doesn't have a dipping table, but has a sounding table like that in fig-1, this sounding table can be used to determined the quantity of ballast directly based on the trim; in this case, the correction is already added into the table and it is not necessary to arrange for a separate dipping table. However, in a sounding table like that in fig 2, the correction value of the trim applies to the height of the sounding. An accurate quantity of ballast (ghost ballast is included) cannot be determined using the below tables in fig-2.*

NO.2 W.B.T. (P or S) (SOUNDING TABLE)

| SOUND. HEIGHT (METER) | EVEN KEEL | TRIM -1.0M. | TRIM 1.0M. | TRIM 2.0M. | TRIM 3.0M. | TRIM 4.0M. | TRIM 5.0M. |
|---|---|---|---|---|---|---|---|
| | | | | ***CUB.M.*** | | | |
| 0.00 | 9.4 | 29.7 | 3.2 | 1.7 | 1.8 | 1.8 | 1.8 |
| .02 | 16.4 | 36.4 | 5.6 | 2.9 | 3.0 | 3.0 | 3.0 |
| .04 | 23.4 | 43.6 | 7.9 | 4.1 | 4.2 | 4.2 | 4.3 |
| .06 | 30.5 | 50.8 | 12.4 | 6.6 | 5.4 | 5.4 | 5.5 |
| .08 | 37.6 | 58.0 | 18.9 | 10.1 | 6.6 | 6.7 | 6.7 |
| .10 | 44.8 | 65.2 | 25.4 | 13.7 | 7.9 | 7.9 | 7.9 |
| .12 | 51.9 | 72.5 | 31.9 | 17.2 | 9.1 | 9.1 | 9.2 |
| .14 | 59.1 | 79.7 | 38.9 | 22.4 | 12.5 | 10.5 | 10.4 |
| .16 | 66.4 | 87.0 | 46.0 | 28.4 | 17.4 | 11.9 | 11.7 |
| .18 | 73.6 | 94.3 | 53.2 | 34.5 | 22.2 | 13.3 | 12.9 |

Fig-1

NO.2 B.W.T.(S) (SOUNDING PIPE)

| S.H. METER | CAPACITY CUB.M. | CAPACITY KT | S.H. METER | CAPACITY CUB.M. | CAPACITY KT |
|---|---|---|---|---|---|
| 0.00 | 25.4 * | 26 | 5.00 | 3340.7 | 3424 |
| .10 | 122.9 | 126 | .10 | 3360.9 | 3445 |
| .20 | 222.2 | 228 | .20 | 3380.8 | 3465 |
| .30 | 322.4 | 330 | .30 | 3400.2 | 3485 |
| .40 | 423.8 | 434 | .40 | 3419.0 | 3504 |
| .50 | 525.9 | 539 | .50 | 3437.3 | 3523 |
| .60 | 628.8 | 644 | .60 | 3455.1 | 3541 |
| .70 | 732.3 | 751 | .70 | 3472.5 | 3559 |
| .80 | 836.2 | 857 | .80 | 3489.3 | 3577 |
| .90 | 940.7 | 964 | .90 | 3505.6 | 3593 |

NO.2 B.W.T.(S) (S.P.) TRIM CORRECTION TABLE

| SOUND. HEIGHT (METER) | EVEN KEEL | TRIM -1.0M. | TRIM 1.0M. | TRIM 2.0M. | TRIM 3.0M. | TRIM 4.0M. | TRIM 5.0M. | TRIM 6.0M. |
|---|---|---|---|---|---|---|---|---|
| | | | | ***CENT.M*** | | | | |
| 0.00 | 0 | 9 | -2 | -2 | -2 | -2 | -2 | -2 |
| .50 | 0 | 9 | -9 | -17 | -25 | -32 | -35 | -38 |
| 1.00 | 0 | 9 | -9 | -17 | -26 | -35 | -43 | -51 |
| .50 | 0 | 9 | -9 | -18 | -26 | -35 | -44 | -52 |
| 2.00 | 0 | 9 | -9 | -18 | -27 | -35 | -44 | -53 |
| .50 | 0 | 7 | -9 | -18 | -27 | -36 | -44 | -53 |
| 3.00 | 0 | 9 | -9 | -17 | -28 | -46 | -53 | -60 |
| .50 | 0 | 9 | -9 | -18 | -26 | -35 | -44 | -55 |
| 4.00 | 0 | 9 | -9 | -18 | -27 | -36 | -44 | -53 |
| .50 | 0 | 9 | -9 | -18 | -27 | -36 | -45 | -54 |

Fig 2

***Standard Procedure***

*In order to get accurate ballast water, we would like you to confirm the below-mentioned items, so that we can measure the actual quantity of ballast and prevent future cargo loss.*

*(1) If a dipping table has not been provided, request one from the shipowner.*
*(2) Carry out the final sounding while the vessel has enough stern trim so that the ballast can be minimized.*
*(3) Even though the surveyor requests to use the sounding recode when it's measured at the final draft survey that he attends the vessel trim is most likely near zero, prepare a sounding record for when the vessel was trimmed and measure by yourselves, and then compare the ballast quantity differences. When a large difference exists, discuss the existence of ghost ballast.*

*<Striking Plate>*

***EXAMPLE OF CALCULATION:***

*SAG allowance:-227MT

The limiting point as per in this condition is Arrival Mizushima Draft- 17mtrs Salt water.

Other Available Data to assist us in the calculations is:
ROB: FO:- 800MT, D.O:- 50MT , FW:- 100MT

Consumption at sea ( ballast): FO: 50MT/day.; DO: 1MT/day and FW: 10MT/day.
Consumption at sea (loaded): FO: 60 MT/day.; DO: 1MT/day and FW: 10MT/day.
Consumption in port : FO: 5 MT/day.; DO: 0.5MT/day and FW: 10MT/day.
Ballast ROB: 100MT
Constant:- 200MT
Lightship: 25,500MT, SW displacement for 17.00mtrs=169,000MT
Distances: Chiba- Vancouver:- 3401miles
Vancouver-Mizushima:-3800 miles
Vessel to arrive in port with at least 5 days of reserve fuel.
C/P speed :- 14kts in both loaded and ballast passage.
Time expected for loading: 48hrs turnaround
FW production on board: 15MT/day

*Sag allowance is a reduction in the deadweight capacity which results from the ships normal sag when loaded. It is prudent to include the sag allowance in deadweight calculations, so that the Charterer is aware from the beginning of the voyage of the cargo lift which can be realistically anticipated.

The value used for sag allowance could be the average of the capacity lost during the previous voyages due to SAG.
Some Masters prefer not to allow for Sag in the cargo calculation but to reflect same in a separate note in the reply to Charterers.

**2.3.4 Trim**

Cargo planning should so as to finish loading with the vessel at Even-keel so as to simplify the Final Cargo calculation process.

Depending on vessel type if possible a trim by stern is generally preferred in order to achieve speed as per Charterer Party.

Trimming of the vessel needs to be carried out to bring the vessel to her intended drafts- Fwd-midship and aft. Trimming pours are also required to compensate for few of the following factors:

- Inaccurate Quantities loaded
- Failure to load the cargo in exactly the positions intended.
- In accuracies in loading calculations
- Error in assumed position / figure of assumed Constant.
- The most important aspect of laying stress on Trimming is to reduce the possibility of Cargo Shift.

The volume of trimming should be large enough to absorb any error; typical trimming cargo tons are. As the trimming hold, do not use the end hold that would invite too great a trim variation. Also, do not use the midship holds whose trim variation is too small.

Cape Size:- 5,000 tons
Panamax Size: 3,000 tons
Handy Sized:- 1000tons
Trimming should be accomplished in two passes for better control, although in some cases it is done in one pass to save time. In the latter case, the minimum pour capacity of the loader should be taken into account when determining the trimming quantity.
Once the Trimming holds and trimming quantities are confirmed, then the proportion of trimming amount is to be decided depending upon the trimming moments of the respective holds.
The trimming pours are the incorporated into the loading sequence and checked to ensure that they provide acceptable draft, trim and stress.
The Loading plan should then be submitted to Ship managers for Approval. If any recommendations for your plan are received then the plan should be re-submitted with respective changes.
Once the cargo plan is approved then this should be sent to the agents who can forward the same to Loading Terminal and discussed in detail during the initial Ship-Shore meeting.

Similarly for Cargo Discharge, First Shore unloading plan should be received from the local agents. Basis this a discharge sequence and ballasting plan should be made by the Chief Officer. The Discharge plan should then be submitted to Ship managers for Approval. If any recommendations for your plan are received then the plan should be re-submitted with respective changes.

Once the cargo plan is approved then this should be sent to the agents who can forward the same to Terminal and discussed in detail during the initial Ship-Shore meeting.

**PLEASE SEE ANNEX CARGO TRIMMING 1, 2, 3 FROM NYK LINE / STARS.**

### 2.3.5 Stowage Plan

After the Total cargo to be loaded has been finalized then we need to decide the amount of Cargo that will be stowed in each hold. The following should be kept in mind.

1. Insert the known figures for Bunkers, Fresh water, Constant and Unpumpable Ballast as per the
   vessels experience(confirm density of every item is correctly entered).
2. Confirm the number of Holds to be loaded.
3. Enter the correct stowage factor for the holds.

*STOWAGE FACTOR is the number of cubic feet occupied by one long ton (2240Lbs) of cargo.*
*1 cubic meter = 35.3145 cubic feet*
*1 meter = 3.28 feet*
*1 feet = 0.3048 meters.*

4. Share the total cargo between holds decided. In doing so the following is to be emphasized upon.
   a) Minimize hogging and sagging
   b) Keep in mind that fore and aft holds have large broken spaces due to their location and vessels structure (narrowing toward the back of the coaming).
   c) In planning cargoes with high Stowage factor, careful attention should be paid for space in trimming holds so as to have some additional space to absorb any undue trim.
   d) When carrying more than one grade allocate loads such that one Hold will carry same grade of cargo so far as possible. Also try not to allocate the

same grade to adjoining holds ( refer ships stability booklet to check restrictions if any).

5. Check stability for departure Condition.
6. Check SF/BM for departure Condition.
7. Check that the tonnage allocated to each hold is within permissible limits.
8. If Alternate/Block loading is to be carried out then does the loading of individual holds remain within block loading limits.
9. Work the stowage plan through the entire voyage stages reflecting all consumables so as to ensure that the ships stability, SF/BM are all within permissible limits at every stage up to discharge port arrival.

**2.3.6 Cargo Planning - Loading / Discharging Sequence**

Once the stowage plan for the cargo has been approved the focus then shifts to Cargo Loading sequence. Efficient management of loading sequence will allow the vessel to load the cargo within least possible time, no undue stress on the cargo and ensure loading of complete parcel of cargo.
Factors that need to be taken into account when planning the loading sequence are as follows.
Max allowable safe draft at Berth.
Tidal range.
Limiting draft as was calculated earlier.
Air Draft restriction at berth.
Characteristics/ Limitations of loading equipment.
Maximum load rate
Number of Ship loaders.
Ships Characteristics.

Other practical aspects which need to be considered are as follows.

Taking into consideration the air draft restriction minimum trim requirement for de-ballasting loading should generally be started from the centre hold. In the event of the centre hold still having ballast then the adjacent hold aft can be considered. This will give bodily sinkage and less change of trim.

If there is restriction in Air Draft and there is a rise in tide after berthing then de-ballasting may be required to be stopped.

A “Pour” is the quantity of cargo poured into one hold as one step of loading programme.
A “Pass” is composed of a pour in each of the holds to be loaded.

Complete a Pass whereby each Pour consists of about half the total tonnage to be loaded into the compartment.

The end holds have a very large trimming moment and hence have the biggest effect on vessels trim. These holds should generally receive the last pours in the 1st pass and the 1st pours in the 2nd pass as the large changes in trim and raft are least inconvenient at such times.

The sequence of pours will also depend on the deballasting progress to allow sufficient trim.

Ballast holds should be lined up for loading as late as possible to allow sufficient time for Hold preparation.

Deballasting should be planned so that there are no starting and stopping of Ballast pump required.

Normal deballasting sequence starts from heavy Weather Ballast Hold, then, DB's followed by Top side tanks and lastly the peak tanks.

Ballast should normally be discharged from a position close to the one where Cargo is being loaded.

Try to maintain minimum load passes to complete the full loading of the entire consignment taking the Stresses into consideration.. Increasing the number of passes will increase the vessels Turn around time. Ore carriers experience high stresses and hence the number of Passes may increase.

Classification Society restrictions should be adhered to which may restrict the amount of cargo being poured during each pass.(e.g-No hold may be completely filled until the mean draft is at least 2/3 of the intended sailing draft.).

As a practice to increase the safety margin the complete planning should be carried out where the Stresses are calculated for Sea-going condition. This will maintain vessels preparedness even if she has to vacate berth in the event of sudden deterioration of weather to any other circumstances, halfway through the loading.

Plan the sequence in order to secure a large trim by the stern during the stripping work (usually 3.5 m to 6.0 m for Capesize, or 3.0 m to 5.0 m for Panamax). The rest of the cargo handling sequence after achieving this trim by the stern should be such that the state of trim by the stern is maintained by shifting the loading position from the stern to the midship and then to the stern to secure enough time for the stripping work. Therefore, before doing interim draft survey, the holds remained to be loaded with cargo should be the fore holds.

When carrying more than one cargo plan the sequence such that the Cargo constituting the bigger parcel is stowed last to ensure trim flexibility.

FROM BULKER STARS – NYK LINE INSTRUCTIONS

## Techniques for Planning Cargo Loading Sequence

*The cargo loading sequence can significantly impact cargo volume, cargo handling time and operational efficiency. In planning the sequence, factors including the ship's characteristics, cargo handling equipment and the port should be taken into account. Always make allowances for any changes in the sequence from shore side, as well as any problems that may happen.*

*The following are general rules, which may not be applicable for some ships and/or in some situations. Keep this in mind when mapping out your plan.*

***Knowledge on Allocating Loads to Hatches***

*1) Allocate loads in holds so as to minimize hogging and sagging if hold space and hull strength permit. (Load less cargoes in midship holds than in fore and aft holds.)*
*2) In planning loads with a high stowage factor (SF) or when it is expected that available space will be full volume-wise, keep in mind that fore and aft holds have large broken spaces due to the narrowing toward the back of the coaming.*
*3) If the space is expected to be full volume-wise, pay careful attention to space in the trimming holds, and allow extra space to absorb any undue trim.*
*4) When carrying more than one grades of cargo, allocate to load the hatches so that each hold can be filled with the same grade of cargo, unless absolutely impossible. Complete loading with same grade without introducing another grade of cargo.*
*5) When carrying more than one grade of cargo, try not to allocate the same grade to adjoining holds. Try to distribute the same grade in the holds at the fore and midship, aft and midship, or fore and aft. (When two loaders are being used for cargo handling at the port, they might not be able to work adjoining holds simultaneously. This separation of holds can also help reduce excessive trim and strength variations.)*

***Basic Knowledge on Planning Cargo Loading Sequence***

*1) Ballast holds should be loaded as late as is practicable. Drainage, Cleaning, Preparation and Dry-up may take longer time than expected.*
*2) Be sure that the sequence ensures sufficient trim by the stern when completing deballasting of hold so that smooth hold preparation can be facilitated.*
*3) Plan the sequence so that no repeated starting and stopping of ballast pumps is required. Be careful not to let the plan involve alternate deballasting on ballast tanks differing in the waterhead. Plan the sequence so that cargo loading starts at a midship hold, while letting the hull sink parallel, and the ballast is uniformly discharged by gravity (except where the hatch allocation for multiple grades or hull strength limitation forbids it).*
*4) Begin cargo handling from the midship hold, and in parallel with the discharging of hold ballast, maintain safe air draft by letting the hull sink parallel.*

*5) Save the aftmost ballast tanks until the last so as to secure sufficient trim by the stern. Give priority to discharge ballast starting from forward ballast tanks toward the stern ballast tanks from the beginning till the middle phase of cargo loading to facilitate efficient deballasting.*
*6) Do not increase unnecessarily the number of loading passes at each hatch. To reduce cargo handling time, fill every alternate hold in only one pour, unless there is a problem with hull strength or trim, and or cargo cannot be handled without strain, except the holds at fore and aft end, trimming holds, and the second holds from the forward and aft, respectively. (This does not apply to ore carriers.)*
*7) Plan the sequence in order to secure a large trim by the stern during the stripping work (usually 3.5 m to 6.0 m for Capesize, or 3.0 m to 5.0 m for Panamax). The rest of the cargo handling sequence after achieving this trim by the stern should be such that the state of trim by the stern is maintained by shifting the loading position from the stern to the midship and then to the stern to secure enough time for the stripping work. Therefore, before doing interim draft survey, the holds remained to be loaded with cargo should be the fore holds.*
*8) When carrying more than one grades of cargo, plan the sequence in such a way that the cargo constituting the most volume is stowed last to ensure trim flexibility. (A plan to last sequence with the grade having smallest-volume might not rectify an error of earlier loaded grade, resulting the need for more volume for trim correction).*
*9) As the trimming hold, do not use the end hold that would invite too great a trim variation. Also, do not use the midship holds whose trim variation is too small. The volume of trimming should be large enough to absorb any error; trimming volume in one attempt should be 3,000 tons to 5,000 tons for a Capesize, or 2,000 tons to 3,000 tons for a Panamax.*
*10) Although the current standard practice is to trim cargo in one round (in two holds) to reduce cargo-operating time, trimming can also be accomplished in two rounds by terminal procedure. In the latter case, the minimum pour capacity of the loader should be taken into account when determining the trimming quantity*

### 2.3.7 Hazards of Bulk Cargoes

The Chief Officer serving on bulk carriers should consult all relevant IMO publications for detailed guidance on:

1. Cargo distribution to avoid overstressing the ship's structure.
2. The safety of personnel.
3. Trimming procedures, and methods of determining the angle of repose.
4. Cargo which may liquefy.
5. Cargo which have chemical hazards

Potential hazards associated with bulk cargoes include:

1. Movement of the cargo during voyage.
2. High structural stresses, which can lead to structural failure.

3. Spontaneous heating, which may lead to fire.
4. Corrosion to the ship's structure.
5. Production of explosive to toxic gases.
6. Absorption of atmospheric oxygen.
7. Health hazards through the contact of the cargo.

**- Liquefying Of Cargoes**

Mineral cargoes can turn into muddy slush if the amount of moisture is too high. Bulk cargoes are not designed to carry liquid / semi liquid cargoes. When this process happens there are stability problems that have led to vessels capsizing or sinking.



Problem occurs in mineral cargoes of predominantly fine particles and stored is conditions suitable for soaking up large amounts of water with minimal drainage. Likely problem areas are places prone to heavy rainfall.- India, Philippines, Brazil etc. It is the charterers responsibility to ensure that cargo as per the agreed terms and conditions is delivered to the ship owners and with complete documentation. Vessel should not load if right documentation is not provided in advance( lab report-TML etc). Loading should not be undertaken if there is any doubt on the documentation. Loading should be stopped if there is a possible problem.

Competent surveyors should be employed at all times. Extra cost and time should not be a deterrent: consequences could be in loss of money and possible loss of life.

**- Cargo Shift- Grain Cargoes**

Check out the grain loading plans
Check out the stowage details for the grain
Find out the type of grain carried and see what (if any) gases it gives off
Find the total weight of the grain
Find out what draft and freeboard you have before loading and after loading
Make sure that the grain cannot shift by taking precautions using boards transversely and athwart ships to minimize F.S.E. (Free Surface Effect)

Watch for overheating (sweating though Cargo sweat or Ships sweat) both are dangerous and can ignite and explode by itself.

**- Chemical Hazards to ships structure due to Cargo**

- Cargoes like Coal which are self igniting could cause structural Damage.
- Similarly Sulphur or Industrial Salt loaded in bulk are highly corrosive and can cause weakening of the structure.
- Few types of Coal when mixed with water generate sulphuric acid which is highly corrosive.
- Ships which have just completed a Sulphur emitting Coal run and then loaded Iron ore have known to be lost out at sea due to structural loss.

**- Health hazards due to Bulk cargo**

- Hazards to personnel exist right from the Loading stage till the Hold cleaning after unloading.
- Many cargoes when loading due to the shortcoming of terminal facilities create a dust cloud around which is harmful.
- Use of appropriate PPE is required during Hold sweeping/cleaning.
- Adequate precautions should be taken if it is decided that man-entry into a loaded hold space is required for any emergency as some cargoes generate gases which deplete the O2 levels.
- Some cargoes are known to bring along dangerous insects/reptiles.
- Precautions should be taken to prevent sinking into the cargo, if for any reasons crew members need to walk on the cargo.

**- Hazards due to Dangerous Bulk Cargo and MHB (Materials Hazardous only in Bulk)**

- Group B cargoes are classified in two ways within the IMSBC Code: ‘Dangerous goods in solid form in bulk’ (under the IMDG Code); and ‘Materials hazardous only in bulk’ (MHB).
- Some of the Group B cargoes meet the IMDG Code’s dangerous goods hazard criteria.
- Materials that involve chemical hazards when transported in bulk but that do not meet the criteria for inclusion in the IMDG classes are classified as MHB Cargo.
- The above cargo’s present significant risks to health and safety when carried in bulk and require special precautions.
- Some of the hazards presented by the above cargo’s include:
    a) Fire and Explosion
    b) Release of Toxic gases
    c) Corrosion

   d) Damage to ship structure due to poor loading procedures
   e) Radiation Hazards
   f) Health Hazards such as skin contact, eye exposure, inhalation, ingestion, etc.

- Based on the hazards they present, the Dangerous goods in solid form in bulk are classed into various classes such as:
   a) Class 4.1: Flammable solids
   b) Class 4.2: Substances liable to spontaneous combustion
   c) Class 4.3: Substances which, in contact with water, emit flammable gases
   d) Class 5.1: Oxidizing substances
   e) Class 6.1: Toxic substances
   f) Class 7: Radioactive materials
   g) Class 8: Corrosive substances
   h) Class 9: Miscellaneous dangerous substances and articles.
- MHB Cargo's are classed as follows:
   a) Combustible solids: materials which are readily combustible or easily ignitable
   b) Self-heating solids: materials that self-heat
   c) Solids that evolve into flammable gas when wet: materials that emit flammable gases when in contact with water
   d) Solids that evolve toxic gas when wet: materials that emit toxic gases when in contact with water
   e) Toxic solids: materials that are acutely toxic to humans if inhaled or brought into contact with skin
   f) Corrosive solids: materials that are corrosive to skin, eyes, metals or respiratory sensitizers.
- Some of the precautions to be taken for the safe carriage of the above categories of Cargo's include but are not limited to:
   a) Cargo to be kept cool and dry
   b) Stowed away from all sources of heat or ignition
   c) Electrical fittings and cables to be in good condition and safeguarded against short circuits
   d) Cargoes liable to give off vapors or gases which can form an explosive mixture with air shall be stowed in a mechanically ventilated space
   e) No Smoking prohibition to be enforced.
   f) In case of Corrosive substances:
      i. A coating or barrier may need to be applied to the cargo space structures before loading
      ii. Prevent penetration of these materials into other cargo spaces, bilges, wells and between ceiling boards
      iii. Cleaning after discharging, hosing down followed by drying
      iv. Cargo spaces should be absolutely dry after the cleaning

   g) Precautions to be taken for entry into enclosed spaces that may contain oxygen-depleted, poisonous or flammable atmospheres as a result of carriage of above cargo.

- In the case of any emergencies or occurrence of any Health Hazards such as skin contact, eye exposure, inhalation, ingestion, etc., please refer to the following publications for Emergency procedures to be followed:
   a) IMSBC Code Appendix 1 Individual schedule of solid bulk cargoes for the cargo being carried (especially the information under the section titled “emergency procedures”)
   b) For medical first aid, refer to IMDG code supplement ‘Medical First Aid Guide’ (MFAG).
   c) Shipper’s declaration.
- Cargo Vessels which expect to carry IMDG cargoes in solid form in bulk are required to have a Document of Compliance for the Carriage of Dangerous Goods, supplied by the ship’s flag or classification society. The Master must have a special list, manifest or stowage plan identifying the cargo’s location, and there must be instructions on board for emergency response.
- Bulk carriers are required to have an IMSBC code certificate which will specify the class, UN numbers of permitted cargoes.
- Always ensure that the nominated IMDG/MHB cargo is allowed to be carried on board as per the vessel’s DOC/IMSBC Certificate
- IMSBC Code Segregation requirements are to be complied with. When segregating cargoes, crew should take into account any secondary risks the cargoes present.
- Always be aware of the precautions of carriage and cargo care during the voyage. Relevant information sharing with crew and a risk assessment is also recommended.

### 2.3.8 Transportable Moisture Limit (TML)

When a ship vibrates at sea, inherent moisture in the cargo rises to the top of the stow. If this part of the cargo liquefies, it can flow from side to side as the ship rolls. This free surface effect can result in a dangerous reduction in the ship’s stability, and has led to ship’s foundering. Ore concentrates are very prone to such liquefaction.

Such cargoes are allotted a Transportation Moisture Limit (TML) which represents the maximum moisture content considered safe for the carriage of that commodity on board ships. It is essential that the shippers provide evidence (cargo declaration) that the actual moisture content is well below the limit. However, it is a good practice for the ship to perform its own rough tests both before and at regular intervals throughout the loading operations. The OOW may be required to carry out such tests, the procedure for which is described in detail in the IMO *Code of Safe Practice for Bulk Cargoes* and will be discussed in detail during our lecture.

### 2.3.9 Bulk Cargo Separation

On bulk carriers, most separations are "natural" in that different holds are used for different grades or different commodities. Sometimes, the quality of cargo on offer does not match the capacity of the ship's holds and / or tanks available, so a physical separation is required.

If there are two (2) commodities to be separated, and the hold can be left slack, the first cargo in poured into one end of the hold, and a stout separation cloth is secured over the top of the peak, and draped down the free slope. The next cargo is then poured into the other end, and rest against the separation cloth. Slight mixing at the edges is reported when such simple systems are used.

At other times horizontal separations are made using tarpaulins, burlaps, plastic sheeting, dunnage or a combination of these. The OOW must ensure the first cargo is trimmed level, and that the separation material completely covers the stow, paying particular attention to around obstructions such as separations within the one hold and each consignment can be of any tonnage. In practice, very little mixing of commodities is found when using this system.

In grain trades from USA to Japan, this is known as a "Japanese" separation. The first cargo is bulldozed flat, then leveled by hand using shovels. The cargo is completely covered with one large sheet of burlap, which is itself covered with overlapping runners of plastic sheet. This is covered by plywood sheets with the overlaps nailed together. These are only suitable for gentle methods of discharge such as suction, and obviously re totally unsuitable if grabs are to be employed for discharge

It is suggested that the following measures should be taken:

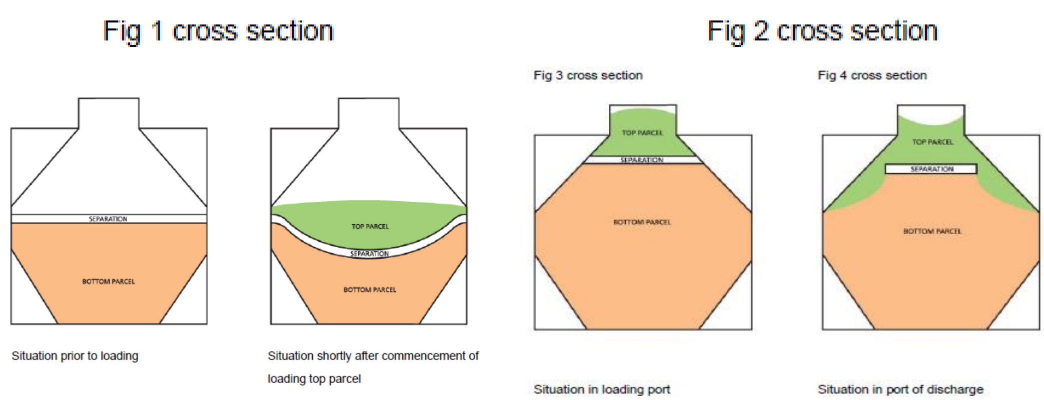
- Where it is intended to over-stow one bulk parcel with another,
- the lower parcel should be trimmed as flat as possible.
- If the surface is left uneven there is a risk that the separation material may be damaged either as the result of uneven stresses during the sea passage or as a result of contact with the grab or

elevator legs and bulldozers which may be used during the discharge of these commodities. Provided this procedure is followed, a single layer of separation material of good quality is considered adequate. Recommended materials include woven polypropylene, polythene sheets or burlap.

■ During loading operations it is essential that the distance between the separation material and either the top of the weather-deck hatch coamings or the deck head of the hold is measured and recorded. In this way it is possible to effectively locate the separations between the parcels during discharge and thus avoid any tearing or damage to the separation material.

■ The loading of second and third parcels may entail pouring cargo from a considerable height. As a result the surface of the lower stow inevitably becomes depressed; this can be seen clearly on Figs 1 and 2.
Because of the need to ensure a relatively even surface between any two parcels it may be wise to plan the stowage so that commodities with a high angle of repose, such as cereals and oil seed derivatives, are loaded below those with a low angle of repose such as canary seed or linseed.
Note: *Sitting the separation material at a level between the slant plating of the upper and lower hopper tanks (Figs 1 and 2) will eliminate any difficulties on account of settling of the cargo, (Figs 3 and 4).*

■ Ideally, the level of the separation between any two parcels should not be located in the vicinity of the upper ballast tank hoppers (as in Figs 3 and 4). This will ensure that when the inevitable settling of the cargo occurs, during the course of the voyage, the surface area of the separation material will remain
adequate, and prevent admixture; see Figs 1 and 2. This problem, of course, does not arise in the vicinity of the lower hopper tanks.




## 2.3.10 Trimming of Cargo

When the cargo is poured on the flat surface, such as the tank top in the bottom of a hold, it forms a conical heap. The angle between the slopping surface of the cargo and the horizontal tank top is called the angle of repose. If this angle is greater than 35°, then the cargo is likely to shift, and it is essential that such cargo is trimmed level.

Grain settling in the cargo hold.

Loading grain to all corners.

A cargo which is peaked may shift during the voyage. Even where the initial stability is satisfactory, shifting of cargo can cause a dangerous list, which may lead to the ship capsizing. Certain bulk cargoes are more liable to shift than others, but all are potentially dangerous, and should always be trimmed as level as practicable.

The IMO *BC Code* recommends that all bulk cargoes are trimmed level. Unfortunately, often times this advice is being ignored by many bulk loading terminals around the world. A peaked cargo may settle during the voyage which can produce a small list of it settles more to one side than the other. This could lead to problems if the ship has been loaded for a limiting arrival draft, or are draft restrictions on the voyage, such as canal transit.

If the bulk cargo is not trimmed so that its top surface is level, there is a risk that the weight of the peaks of the cargo may overload the tank top. This result in the dishing or set-down of the tank top plating, and may also cause structural damage. Further, a peaked cargo means that there is more surface area of cargo, which means that more air is in contact with more cargo. With some cargoes, this may mean there is more risk of spontaneous combustion due to absorption of oxygen by the cargo.

- **Methods of Trimming Cargo:**

1. MANUAL- highly labor-intensive and slow
2. MECHANICAL-use of bulldozers-quick and reasonably effective. There is a danger that cargo may be compressed and this may make it difficult to discharge.
3. SPOUT-the end of the loading spout is moved arthwartships and fore-and-aft in order to ensure the cargo fills the space and the surface is flat as the skill and attention of the operator permits.

4. CHUTE-a deflector plate or similar deice is used on the end of the spout to shoot the cargo into the far corners of the hold. These devices can be spun through 360°, and with a skilled operator can produce an extreme level stow.

All holds to be filled must be absolutely full without resulting in overloading. It is essential that the loading spout, or other mechanism, is directed to all corners, to avoid any void spaces. Time should be allowed for the grain to settle then refill any spaces (such as hatch corners)

### 2.3.11 Handling Cargo in the Rain

When loading or discharging cargo which is sensitive to moisture, the OOW should stop operations, and cover the holds, during all periods of rain, drizzle, snow, etc.

This standard instruction must be observed at all times, despite pressure from the stevedores or other shore officials to continue cargo operations in the rain. It should only be disregarded if the OOW receives clear authority from the Master.

If cargo is loaded to/from lighters alongside, it is good practice to plug the deck scuppers if rain is expected, to reduce risks of wetting the cargo in the lighters.

In areas such s the tropics, where rainfall is both sudden and intense, the OOW should run the radar to detect rain in advance, and plot its ETA at the ship. Precautions should be taken to enable the hatches to be closed rapidly, including having extra crew on stand-by, keep hydraulic motors continuously running, etc. These precautions should be recorded in the log book.

Before reopening the hatch covers after a period of rain, the OOW should ensure that any pools of water lying on the covers are swept off first. Squeegee is useful for this task. Sponges or other absorbent materials should be used for emptying any depressions where water collects, such as in container fitting set into the hatch covers.

### 2.3.12 Preparation for Discharging

Prior to discharging of cargoes, there are factors to be considered such as;

1. Preparation for arrival, including berthing
    - Arrival Draft
    - Trim
    - Depth of berth

- Tidal Range
- Air Draft
- Mooring lines required and location
- Whether mooring boat available
- Any specified requirements for positioning
- Fire wires ready (if necessary)

2. Safety requirements and pollution prevention.

- As per local port regulation
- Opening in superstructure are all closed
- No unauthorized person on deck
- Smoking in designated places only
- Personnel safety

3. Liaison between ship and shore.

- Quantities and order of discharging sequence preferred
- Discharging rate
- Ballast quantities and condition
- Ballasting requirements and rates

4. Cargo handling procedures

- Checklist to be completed to ensure preliminary inspection has been completed
- Agreed discharging plan
- Formal agreement that the ship and shore are ready to work
- Particular attention to moorings

5. Emergencies

- Telephone numbers to be used in case of emergencies
- Ship’s emergency plan prepared in the usual way
- Special instructions to ship’s personnel
- Communications between ship and shore or vice versa

Remember, the safety and efficiency of the ship’s operations in port rests in the first instance on the shoulders of the OOW. He has a most important function as the first point of contact between the ship and personnel from ashore. His initiative, dedication and professionalism can have a major impact on the safety, efficiency and commercial success of the operations.

## 2.4. Draft Survey and Displacement Calculation

### 2.4.1 Estimating for Cargo quantity

Each day it is customary on most piers not only to report cargo on hand on the dock and alongside in lighters but also to measure the ship to determine the weight of the cargo to be loaded to fill in the remaining space and put the ship down to its desired marks. The weight remaining is figured from the draft of the ship and its immersion scale.

(Explain draft survey form and use of hydrostatic table. Show sample calculation.)

**PLEASE SEE ANNEX FROM NYK LINE / STARS, P&I CLUB, etc.**

***DBCH 01-09 Draft Survey, DBCH 01-04 Stem and Stern Corrections, DBCH 01-06 Calculation of Displacement Correction, DBCH 01-03 Measurement of Seawater Specific Gravity, DBCH 01-07 Calculation of Weight of Consumables, AMSA Marine Notice 5/2006 The correct use of marine hydrometers, UK P&I Club May 2008 Measurement of bulk cargoes, Draft Survey Report (sample calculation) and Tank Sounding Table (sample).***

# M.V. QUEEN MARY E

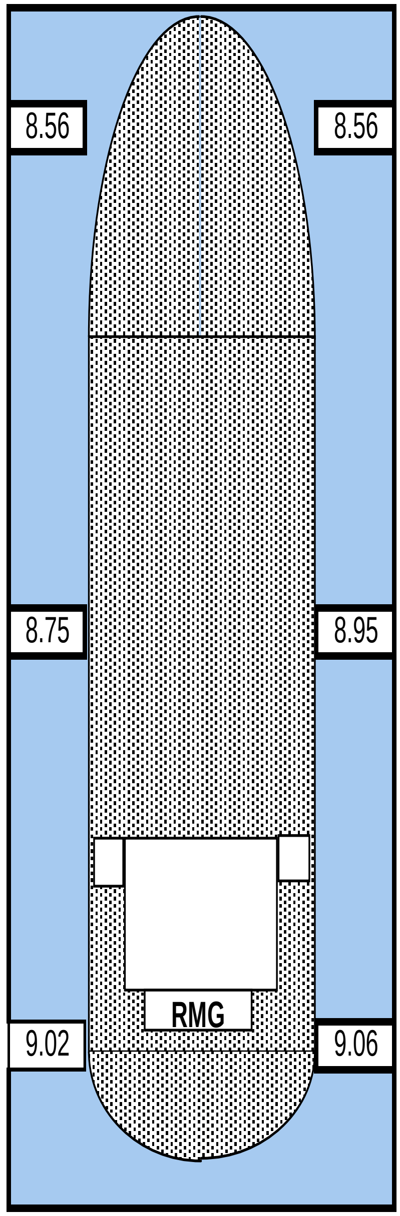
## PANAMA

## ***** DRAFT SURVEY *****

### Initial DRAFT SURVEY

### PORT: hachinohe

| DRAFT | | | CORR'N | |
|---|---|---|---|---|
| FWD P | 8.56 | | | |
| FWD S | 8.56 | 8.56 | 0.002688 | 8.56 |
| MID P | 8.75 | | | |
| MID S | 8.95 | 8.85 | | 8.81 |
| AFT P | 9.02 | | | |
| AFT S | 9.06 | 9.04 | 0.021499 | 9.06 |
| A/Trim | | 0.4800 | TTL Trim | 0.50 |
| M/Mean | | 8.83 | Deflection | 0.04 |
| M4 | | 8.824629 | S/G | 1.025 |
| D/COR'D | 8.83 | | SG/Corr'n | 0.00 |
| DISP | 40055.20 | | FO | 776.00 |
| TPC | 50.61 | | DO | 90.50 |
| LCF | -1.780 | | LO | 0.00 |
| MTCD | 32.40 | | FW | 69.00 |
| D/Diff. | -27.18 | | BW | 174.20 |
| 1st Corr'n | -23.72 | | L/S | 8559.00 |
| 2nd Corr'n | 2.15 | | CONST | 198.30 |
| DISP | 40006.45 | | TTL.Corr'n | 9867.00 |
| LQDS | 1109.70 | | CARGO | **30139.45** |
| F/DISP | **38896.75** | | I/DISP | 42634.08 |
| | | | F/DISP | 38896.75 |
| | | | TTL/Disch | 3737.33 |




| | |
|---|---|
| PORT | Hachinohe |
| DATE | 5/10/2002 |
| VOY NR. | 78 |

PREPARED BY:
C.OFF RAMON M. GUALDRAPA
M.V. QUEEN MARY E

Example 1: Let us assume that the cargo to load is grain 50,000 MT 10% MOLOO with a Stowage Factor of 55 CFT/LT (1.5328M³/MT). The vessel has 7 holds with the following capacity in M³: Hold 1= 9528, No.2= 12219, No.3= 12105, No.4= 12123, No.5= 12175, No.6= 12099, No.7= 11088. Find the following:

a. How many % of total hold capacity cargo will occupy?
b. How much cargo quantity is loadable?
c. Calculate the initial hold distribution.
d. Calculate the draft, stability and trim for initial pre-stowage.

**Solution**:

Given: S/Factor = 1.5328 M³/MT
Total Volume Available = 81,337 M³
Cargo Quantity per C/Party= 50,000 MT10%MOLOO or 55,000 MT

Volume of Cargo = Max. Cargo to load x S/Factor
= 55,000 x 1.5328
= 84,304 M³

*Note:* Since volume of cargo is greater than the volume available, we can not take the maximum contractual quantity, and then divide Volume Available by Stowage Factor to get Maximum Cargo loadable.

$$\text{Max. Cargo Loadable} = \frac{\text{Volume Available}}{\text{Stowage Factor}} = \frac{81{,}337}{1.5328} = 53{,}064 \text{ MT}$$

$$\text{Vol. cargo will occupy by \%} = \frac{(\text{Cargo to load x S/Factor})}{\text{Volume Available}} \times 100 = \frac{(53{,}064 \times 1.5328)}{81{,}337} \times 100 = 100\ \%$$

Holdwise Stowage:

Hold No.1 $= \dfrac{9528 \times 100}{1.5328} / 100 = 6{,}216$MT

Hold No.2 $= \dfrac{12219 \times 100}{1.5328} / 100 = 7{,}972$MT

Hold No.3 $= \dfrac{12105 \times 100}{1.5328} / 100 = 7{,}897$MT

Hold No.4 $= \dfrac{12123 \times 100}{1.5328} / 100 = 7{,}909$MT

Hold No.5 $= \dfrac{12175 \times 100}{1.5328} / 100 = 7{,}943$MT

Hold No.6 $= \dfrac{12099 \times 100}{1.5328} / 100 = 7{,}893$MT

Hold No.7 $= \dfrac{11088 \times 100}{1.5328} / 100 = 7{,}234$MT

Total = 53,064 MT

Using the Hydrostatic Particulars, check stability and trim by using stability calculation sheet in usual procedures as shown in Annex B.

See Loading Sequence Calculations (Sample) Appendix

Appendix: A3

M.V. " CUPID FEATHER " LOADER RATE: 4300 MT/HR

CONDITION: WEIPA-LOADING BAUXITE S/F 27.0 CFT/LT DATE: 22 JUL 94

| COMPARTMENT | 100 % CAPACITY m³ | ARVL | 1ST 1.16h | SEQ. | 2ND 1.16h | SEQ. | 3RD 1.16h | SEQ |
|---|---|---|---|---|---|---|---|---|
| ** CARGO ** | "K" | ‹201› | | ‹201› | | ‹201› | | ‹201› |
| NO. 1 CARGO HOLD | 9.528 | | | – | | – | | – |
| NO. 2 CARGO HOLD | 12.219 | | | – | 5000 | 5000 | | 5000 |
| NO. 3 CARGO HOLD | 12.105 | | | – | | – | | – |
| NO. 4 CARGO HOLD | 12.123 | | | – | | – | | – |
| NO. 5 CARGO HOLD | 12.175 | | 5000 | 5000 | | 5000 | | 5000 |
| NO. 6 CARGO HOLD | 12.099 | | | – | | – | | – |
| NO. 7 CARGO HOLD | 11.088 | | | – | | – | 5000 | 5000 |
| ( SUM ) | (81.337) | ‹0› | | ‹5000› | | ‹10000› | | ‹15000› |
| | | | | | | | | |
| * WATER BALLAST * | | | | | | | | |
| FORE PEAK TK | 1.556 | 638 | | 638 | | 638 | | 638 |
| NO. 1 T. S. TK (P&S) | 940 | 964 | | 964 | | 964 | | 964 |
| NO. 2 T. S. TK (P&S) | 1.432 | 1468 | | 1468 | | 1468 | | 1468 |
| NO. 3 T. S. TK (P&S) | 2.648 | 0 | | 0 | | 0 | | 0 |
| NO. 4 T. S. TK (P&S) | 2.640 | 2706 | | 2706 | | 2706 | | 2706 |
| NO. 5 T. S. TK (P&S) | 1.312 | 552 | | 552 | | 552 | | 552 |
| NO. 1 W. B. TK (P&S) | 1.411 | 1446 | | 1446 | | 1446 | | 1446 |
| NO. 2 W. B. TK (P&S) | 1.899 | 1946 | | 1946 | | 1946 | | 1946 |
| NO. 3 W. B. TK (P&S) | 3.294 | 0 | | 0 | | 0 | | 0 |
| NO. 4 W. B. TK (P&S) | 2.916 | 2989 | | 2989 | | 2989 | | 2989 |
| NO. 5 W. B. TK (P&S) | 1.314 | 1346 | | 1346 | | 1346 | | 1346 |
| AFT PEAK TK | 654 | 0 | | 0 | | 0 | | 0 |
| ( SUM ) 4 C.H. | (22.016) | 12000 | -3000 | 9000 | -3000 | 6000 | -3000 | 3000 |
| | | ‹26055› | | ‹23055› | | ‹20055› | | ‹17055› |
| ** FUEL OIL ** | | | | | | | | |
| NO. 1 F. O. TK | 646 | 5 | | 5 | | 5 | | 5 |
| NO. 2 F. O. TK | 509 | 208 | | 208 | | 208 | | 208 |
| NO. 3 F. O. TK | 551 | 324 | | 324 | | 324 | | 324 |
| F. O. W. TK (P) | 190 | 6 | | 6 | | 6 | | 6 |
| F. O. W. TK (S) | 173 | 6 | | 6 | | 6 | | 6 |
| ( SUM ) | ( 2.069) | ‹549› | | ‹549› | | ‹549› | | ‹549› |
| | | | | | | | | |
| ** DIESEL OIL ** | | | | | | | | |
| NO. 1 D. O. TK | 90 | 65 | | 65 | | 65 | | 65 |
| ( SUM ) | ( 90) | ‹65› | | ‹65› | | ‹65› | | ‹65› |
| | | | | | | | | |
| ** FRESH WATER ** | | | | | | | | |
| FRESH WATER TK | 154 | 60 | | 60 | | 60 | | 60 |
| DRINK. WATER TK | 154 | 85 | | 85 | | 85 | | 85 |
| ( SUM ) | ( 308) | ‹145› | | ‹145› | | ‹145› | | ‹145› |
| DISPL | | 36774 | | 38774 | | 40774 | | 42774 |
| dc | | 6.67 | | 7.04 | | 7.28 | | 7.73 |
| dF / dA | | 5.79/7.55 | | 5.41/8.67 | | 7.30/7.25 | | 5.46/10.00 |
| Trim | | 1.76 | | 3.25 | | -0.05 | | 4.54 |
| BM / SF | | -45/81 | | -51/79 | | 37/-60 | | 82/-97 |
| TOTAL | | OK | | OK | | OK | | OK |

Appendix: A4

M.V. " CUPID FEATHER "

CONDITION: WEIPA-LOADING BAUXITE

DATE: 22 JUL 94

| COMPARTMENT | 100 % CAPACITY m³ | 4TH SEQ. 1.16h | | 5TH SEQ 1.16h | | 6TH SEQ 1.16h | |
|---|---|---|---|---|---|---|---|
| ** CARGO ** | "K" | ⟨201⟩ | | | ⟨201⟩ | | ⟨201⟩ |
| NO. 1 CARGO HOLD | 9.528 | | — | | — | | — |
| NO. 2 CARGO HOLD | 12.219 | | 5000 | | 5000 | | 5000 |
| NO. 3 CARGO HOLD | 12.105 | 5000 | 5000 | | 5000 | | 5000 |
| NO. 4 CARGO HOLD | 12.123 | | — | | — | 5000 | 5000 |
| NO. 5 CARGO HOLD | 12.175 | | 5000 | | 5000 | | 5000 |
| NO. 6 CARGO HOLD | 12.099 | | — | 5000 | 5000 | | 5000 |
| NO. 7 CARGO HOLD | 11.088 | | 5000 | | 5000 | | 5000 |
| ( SUM ) | (81.337) | | ⟨20000⟩ | | ⟨25000⟩ | | ⟨30000⟩ |
| | | | | | | | |
| * WATER BALLAST * | | | | | | | |
| FORE PEAK TK | 1.556 | | 638 | | 638 | | 638 |
| NO. T.S.TK (P&S) | 940 | | 964 | | 964 | | 964 |
| NO. 2 T.S.TK (P&S) | 1.432 | | 1468 | | 1468 | | 1468 |
| NO. 3 T.S.TK (P&S) | 2.648 | | 0 | | 0 | | 0 |
| NO. 4 T.S.TK (P&S) | 2.640 | | 2706 | | 2706 | -2706 | 0 |
| NO. 5 T.S.TK (P&S) | 1.312 | | 552 | -552 | 0 | | 0 |
| NO. 1 W.B.TK (P&S) | 1.411 | | 1446 | | 1446 | | 1446 |
| NO. 2 W.B.TK (P&S) | 1.899 | | 1946 | | 1946 | | 1946 |
| NO. 3 W.B.TK (P&S) | 3.294 | | 0 | | 0 | | 0 |
| NO. 4 W.B.TK (P&S) | 2.916 | | 2989 | | 2989 | | 2989 |
| NO. 5 W.B.TK (P&S) | 1.314 | | 1346 | | 1346 | | 1346 |
| AFT PEAK TK | 654 | | 0 | | 0 | | 0 |
| ( SUM ) 4.CH. | (22.016) | -2500 | 500 | -500 | 0 | | 0 |
| | | | ⟨14555⟩ | | ⟨13503⟩ | | ⟨10797⟩ |
| ** FUEL OIL ** | | | | | | | |
| NO. 1 F.O.TK | 646 | | 5 | | 5 | | 5 |
| NO. 2 F.O.TK | 509 | | 208 | | 208 | | 208 |
| NO F.O.TK | 551 | | 324 | | 324 | | 324 |
| F.O.W.TK (P) | 190 | | 6 | | 6 | | 6 |
| F.O.W.TK (S) | 173 | | 6 | | 6 | | 6 |
| ( SUM ) | ( 2.069) | | ⟨549⟩ | | ⟨549⟩ | | ⟨549⟩ |
| | | | | | | | |
| ** DIESEL OIL ** | | | | | | | |
| NO. 1 D.O.TK | 90 | | 65 | | 65 | | 65 |
| ( SUM ) | ( 90) | | ⟨65⟩ | | ⟨65⟩ | | ⟨65⟩ |
| | | | | | | | |
| ** FRESH WATER ** | | | | | | | |
| FRESH WATER TK | 154 | | 60 | | 60 | | 60 |
| DRINK. WATER TK | 154 | -3 | 82 | | 82 | | 82 |
| ( SUM ) | ( 308) | | ⟨142⟩ | | ⟨142⟩ | | ⟨142⟩ |
| DISPL | MT | | 45271 | | 49220 | | 51514 |
| dc | M | | 8.09 | | 8.77 | | 9.11 |
| dF/dA | M | | 6.70/9.48 | | 6.28/11.26 | | 7.35/10.87 |
| Trim | M | | 2.78 | | 4.98 | | 3.52 |
| BM/SF | % | | 79/-64 | | 82/-67 | | 36/-38 |
| TOTAL | | | OK | | OK | | OK |

Appendix: A5

M.V. " CUPID FEATHER "

CONDITION: WEIPA - LOADING BAUXITE

DATE: 22 JUL 94

| COMPARTMENT | 100 % CAPACITY m³ | 7TH SEQ 1.16 h | | 8TH SEQ 0.65 h | | 9TH SEQ 0.93 h | | |
|---|---|---|---|---|---|---|---|---|
| ** CARGO ** | " K " | | <201> | | <201> | | <201> | |
| NO. 1 CARGO HOLD | 9.528 | 5000 | 5000 | | 5000 | | 5000 | |
| NO. 2 CARGO HOLD | 12.219 | | 5000 | | 5000 | | 5000 | |
| NO. 3 CARGO HOLD | 12.105 | | 5000 | | 5000 | | 5000 | |
| NO. 4 CARGO HOLD | 12.123 | | 5000 | | 5000 | | 5000 | |
| NO. 5 CARGO HOLD | 12.175 | | 5000 | | 5000 | 4000 | 9000 | |
| NO. 6 CARGO HOLD | 12.099 | | 5000 | | 5000 | | 5000 | |
| NO. 7 CARGO HOLD | 11.088 | | 5000 | 2800 | 7800 | | 7800 | |
| ( SUM ) | (81.337) | | <35000> | | <37800> | | <41800> | |
| | | | | | | | | |
| * WATER BALLAST * | | | | | | | | |
| FORE PEAK TK | 1.556 | - 638 | 0 | | 0 | | 0 | |
| NO . S. TK (P&S) | 940 | - 964 | 0 | | 0 | | 0 | |
| NO. 2 T. S. TK (P&S) | 1.432 | | 1468 | | 1468 | | 1468 | |
| NO. 3 T. S. TK (P&S) | 2.648 | | 0 | | 0 | | 0 | |
| NO. 4 T. S. TK (P&S) | 2.640 | | 0 | | 0 | | 0 | |
| NO. 5 T. S. TK (P&S) | 1.312 | | 0 | | 0 | | 0 | |
| NO. 1 W. B. TK (P&S) | 1.411 | | 1446 | | 1446 | | 1446 | |
| NO. 2 W. B. TK (P&S) | 1.899 | | 1946 | | 1946 | | 1946 | |
| NO. 3 W. B. TK (P&S) | 3.294 | | 0 | | 0 | | 0 | |
| NO. 4 W. B. TK (P&S) | 2.916 | | 2989 | | 2989 | - 2418 | 571 | |
| NO. 5 W. B. TK (P&S) | 1.314 | | 1346 | - 1346 | 0 | | 0 | |
| AFT PEAK TK | 654 | | 0 | | 0 | | 0 | |
| ( SUM ) | (22.016) | | <9195> | | <7849> | | <5432> | |
| | | | | | | | | |
| ** FUEL OIL ** | | | | | | | | |
| NO. 1 F. O. TK | 646 | | 5 | | 5 | | 5 | |
| NO. 2 F. O. TK | 509 | | 208 | | 208 | | 208 | |
| N . . O. TK | 551 | | 324 | | 324 | | 324 | |
| F. O. W. TK (P) | 190 | | 6 | | 6 | | 6 | |
| F. O. W. TK (S) | 173 | | 6 | | 6 | | 6 | |
| ( SUM ) | ( 2.069) | | <549> | | <549> | | <549> | |
| | | | | | | | | |
| ** DIESEL OIL ** | | | | | | | | |
| NO. 1 D. O. TK | 90 | | 65 | | 65 | | 65 | |
| ( SUM ) | ( 90) | | <65> | | <65> | | <65> | |
| | | | | | | | | |
| ** FRESH WATER ** | | | | | | | | |
| FRESH WATER TK | 154 | | 60 | | 60 | | 60 | |
| DRINK. WATER TK | 154 | | 78 | | 78 | | 76 | |
| ( SUM ) | ( 308) | | <138> | | <138> | | <136> | |
| DISPL | | | 54908 | | 56361 | | 57942 | |
| dc | | | 9,60 | | 9.84 | | 10,09 | |
| dF/dA | | | 9.40/9.79 | | 9.08/10.60 | | 9.37/10.81 | |
| Trim | | | 0.39 | | 1.52 | | 1.44 | |
| BM/SF | | | 63/-58 | | 71/-62 | | 51/-53 | |
| TOTAL | | | OK | | OK | | OK | |

Appendix: A6

M.V. " CUPID FEATHER "

CONDITION: WEIPA- LOADING BAUXITE

DATE: 22 JUL 94

| COMPARTMENT | 100 % CAPACITY m³ | 10TH SEQ | | 11TH SEQ | | 12TH SEQ | |
|---|---|---|---|---|---|---|---|
| | | 0.93h | | 0.47h | | 0.80h | |
| ** CARGO ** | | | <201> | | <201> | | |
| NO. 1 CARGO HOLD | 9.528 | | 5000 | 2000 | 7000 | | 7000 |
| NO. 2 CARGO HOLD | 12.219 | | 5000 | | 5000 | | 5000 |
| NO. 3 CARGO HOLD | 12.105 | 4000 | 9000 | | 9000 | | 9000 |
| NO. 4 CARGO HOLD | 12.123 | | 5000 | | 5000 | 3450 | 8450 |
| NO. 5 CARGO HOLD | 12.175 | | 9000 | | 9000 | | 9000 |
| NO. 6 CARGO HOLD | 12.099 | | 5000 | | 5000 | | 5000 |
| NO. 7 CARGO HOLD | 11.088 | | 7800 | | 7800 | | 7800 |
| ( SUM ) | (81.337) | | <45800> | | <47800> | | <51250> |
| | | | | | | | |
| * WATER BALLAST * | | | | | | | |
| FORE PEAK TK | 1.556 | | 0 | | 0 | | 0 |
| NC T. S. TK (P&S) | 940 | | 0 | | 0 | | 0 |
| NO. 2 T. S. TK (P&S) | 1.432 | -1468 | 0 | | 0 | | 0 |
| NO. 3 T. S. TK (P&S) | 2.648 | | 0 | | 0 | | 0 |
| NO. 4 T. S. TK (P&S) | 2.640 | | 0 | | 0 | | 0 |
| NO. 5 T. S. TK (P&S) | 1.312 | | 0 | | 0 | | 0 |
| NO. 1 W. B. TK (P&S) | 1.411 | | 1446 | -1210 | 236 | -236 | 0 |
| NO. 2 W. B. TK (P&S) | 1.899 | | 1946 | | 1946 | -1844 | 102 |
| NO. 3 W. B. TK (P&S) | 3.294 | | 0 | | 0 | | 0 |
| NO. 4 W. B. TK (P&S) | 2.916 | -571 | 0 | | 0 | | 0 |
| NO. 5 W. B. TK (P&S) | 1.314 | | 0 | | 0 | | 0 |
| AFT PEAK TK | 654 | | 0 | | 0 | | 0 |
| ( SUM ) | (22.016) | | <3393> | | <2182> | | <102> |
| | | | | | | | |
| ** FUEL OIL ** | | | | | | | |
| NO. 1 F. O. TK | 646 | | 5 | | 5 | | 5 |
| NO. 2 F. O. TK | 509 | | 208 | | 208 | | 208 |
| N( F. O. TK | 551 | | 324 | | 324 | | 324 |
| F. O. W. TK (P) | 190 | | 6 | | 6 | | 6 |
| F. O. W. TK (S) | 173 | | 6 | | 6 | | 6 |
| ( SUM ) | ( 2.069) | | <549> | | <549> | | <549> |
| | | | | | | | |
| ** DIESEL OIL ** | | | | | | | |
| NO. 1 D. O. TK | 90 | | 65 | | 65 | | 65 |
| ( SUM ) | ( 90) | | <65> | | <65> | | <65> |
| | | | | | | | |
| ** FRESH WATER ** | | | | | | | |
| FRESH WATER TK | 154 | | 60 | | 60 | | 60 |
| DRINK. WATER TK | 154 | | 76 | | 76 | | 76 |
| ( SUM ) | ( 308) | | <136> | | <136> | | <136> |
| DISPL | | | 59903 | | 60692 | | 62062 |
| dc | | | 10.40 | | 10.52 | | 10.74 |
| dF/dA | | | 10.05/10.74 | | 10.54/10.49 | | 10.24/11.24 |
| Trim | | | 0.69 | | -0.05 | | 1.00 |
| BM/SF | | | -29/-30 | | 36/31 | | -29/32 |
| TOTAL | | | OK | | OK | | OK |

Appendix: A7

M.V. " CUPID FEATHER "

CONDITION: WEIPA – LOADING BAUXITE

DATE: 22 JUL 94

| COMPARTMENT | 100 % CAPACITY m³ | 13TH SEQ 0.53h | | 14TH SEQ 0.58h | | DRAFT CHECK | TRIMMING (3,000 MT) | |
|---|---|---|---|---|---|---|---|---|
| ** CARGO ** | | | ‹ 201 › | | ‹ 201 › | (INTERMEDIATE DRAFT SURVEY) | | ‹ 201 › |
| NO. 1 CARGO HOLD | 9.528 | | 7000 | | 7000 | | | 7000 |
| NO. 2 CARGO HOLD | 12.219 | | 5000 | 2500 | 7500 | | 1495 | 8995 |
| NO. 3 CARGO HOLD | 12.105 | | 9000 | | 9000 | | | 9000 |
| NO. 4 CARGO HOLD | 12.123 | | 8450 | | 8450 | | | 8450 |
| NO. 5 CARGO HOLD | 12.175 | | 9000 | | 9000 | | | 9000 |
| NO. 6 CARGO HOLD | 12.099 | 2300 | 7300 | | 7300 | | 1505 | 8805 |
| NO. 7 CARGO HOLD | 11.088 | | 7800 | | 7800 | | | 7800 |
| ( SUM ) | (81.337) | | ‹53550› | | ‹56050› | | | ‹59050› |
| | | | | | | | | |
| * WATER BALLAST * | | | | | | | | |
| FORE PEAK TK | 1.556 | | 0 | | 0 | | | 0 |
| NO. 1 T.S. TK (P&S) | 940 | | 0 | | 0 | | | 0 |
| NO. 2 T.S. TK (P&S) | 1.432 | | 0 | | 0 | | | 0 |
| NO. 3 T.S. TK (P&S) | 2.648 | | 0 | | 0 | | | 0 |
| NO. 4 T.S. TK (P&S) | 2.640 | | 0 | | 0 | | | 0 |
| NO. 5 T.S. TK (P&S) | 1.312 | | 0 | | 0 | | | 0 |
| NO. 1 W.B. TK (P&S) | 1.411 | | 0 | | 0 | | | 0 |
| NO. 2 W.B. TK (P&S) | 1.899 | –102 | 0 | | 0 | | | 0 |
| NO. 3 W.B. TK (P&S) | 3.294 | | 0 | | 0 | | | 0 |
| NO. 4 W.B. TK (P&S) | 2.916 | | 0 | | 0 | | | 0 |
| NO. 5 W.B. TK (P&S) | 1.314 | | 0 | | 0 | | | 0 |
| AFT PEAK TK | 654 | | 0 | | 0 | | | 0 |
| ( SUM ) | (22.016) | | ‹ 0 › | | ‹ 0 › | | | ‹ 0 › |
| | | | | | | | | |
| ** FUEL OIL ** | | | | | | | | |
| NO. 1 F.O. TK | 646 | | 5 | | 5 | | | 5 |
| NO. 2 F.O. TK | 509 | – 3 | 205 | | 205 | | | 205 |
| NO. 3 F.O. TK | 551 | | 324 | | 324 | | | 324 |
| F.O.W. TK (P) | 190 | | 6 | | 6 | | | 6 |
| F.O.W. TK (S) | 173 | | 6 | | 6 | | | 6 |
| ( SUM ) | ( 2.069) | | ‹ 546 › | | ‹ 546 › | | | ‹ 546 › |
| | | | | | | | | |
| ** DIESEL OIL ** | | | | | | | | 65 |
| NO. 1 D.O. TK | 90 | | 65 | | 65 | | | 65 |
| ( SUM ) | ( 90) | | ‹ 65 › | | ‹ 65 › | | | ‹ 65 › |
| | | | | | | | | |
| ** FRESH WATER ** | | | | | | | | |
| FRESH WATER TK | 154 | | 60 | | 60 | | | 60 |
| DRINK. WATER TK | 154 | – 2 | 74 | | 74 | | | 74 |
| ( SUM ) | ( 308) | | ‹134› | | ‹ 134 › | | | ‹ 134 › |
| DSPL | | | 64255 | | 66755 | | | 69755 |
| dc | | | 11.09 | | 11.48 | | | 11.95 |
| dF/dA | | | 10.04/12.13 | | 11.26/11.69 | | | 11.90/12.00 |
| Trim | | | 2.09 | | 0.43 | | | 0.10 |
| BM/SF | | | -28/33 | | -31/-17 | | | -32/-22 |
| TOTAL | | | OK | | OK | | | OK |

### 2.4.2 Ballasting/ Deballasting Operation

**- Monitoring cargo and ballast operations**

Cargo planning is very important in all vessels where the longitudinal stability and stress plays the most important factor during loading or discharging. Loads must be carefully distributed through the holds to minimize the shear and bending stresses on the hull. A vessel steel hull will bend with remarkable elasticity, but if bend too far, will break. An improperly distributed load greatly augments this tendency.

Cargo being discharged must be replaced by ballast water to achieve the desired draft, trim and stresses of the vessel, and during loading the ballast water must be discharged to achieve the desired draft, trim and stresses of the vessel. However, it does not mean that ballasting/ deballasting will begin simultaneous with the operation.

In some ports (Loading/Discharging ports), cargo is poured on board at rates in excess of 10,000 tons per hour. The International Association of Classification Societies (IACS) has confirmed that these high loading rates in themselves do not cause structural damage to the ship. However, high loading rates mean that extra vigilance is required to ensure that proper distribution of the cargo is achieved.

On bulk carriers large quantity of ballast water has to be pumped quickly to compensate for the rapid loading or discharge of cargo. With the use of ballast plan, it will ensure that the sequence of pumping ballast correspond to the sequence for loading or discharging of the cargo, in order that the bending moments and shear force are kept within acceptable limits.

It is essential that the OOW monitors the loading/discharging operation closely, to ensure that it complies with the pre-plan. The Chief Officer and OOW should know the quantity of ballast in each tanks at al times. It is his duty to ensure that the ballast plan is adhered to strictly, to avoid excessive stress being placed on the ship's structure. He must also ensure that the cargo and ballast operations are coordinated; if they get out of step with each other; the OOW must inform Chief Officer immediately. Ships have broken their backs when insufficient attention has been paid to cargo and ballast distribution.

With rapid loading and high ballast-pump rates, there is little time available for correcting errors. Shore handling equipment often cannot be stopped immediately, and there may be a considerable quantity of cargo which may have to be run off the belts once the decision to stop loading has been made. Most loading terminals are in isolated locations and have no facilities for discharging cargo. If any overloading occurs, cargo which took only a few minutes to load may take several days to unload. Definitely the operation will incur considerable extra costs.

Generally, the cargo discharge rates are not as high as the loading rates. However, the Chief Officer will still produce a plan to ensure that the ship is not overstressed by an incorrect combination of cargo and ballast.

Correct loading and cargo distribution enables the required draft and trim to be obtained without the use of extra ballast. On ships which are provided with optimum trim/displacement/speed tables, a small amount of extra ballast may be used to achieve the required minimum fuel consumption.

Correct loading and cargo distribution enables the required draft and trim to be obtained without the use of extra ballast. On ships which are provided with optimum trim/displacement/speed tables, a small amount of extra ballast may be used to achieve the required minimum fuel consumption.

**- Safety Measures**

Onboard bulk carriers, some factors should be considered during ballasting/ deballasting operation, such as:

1. Loading/ discharging rates
2. Loading/ discharging sequence
3. Status of sea chest valve and ballast pumps
4. Ballasting/ deballasting rates
5. Ballasting/ deballasting sequence
6. Terminal or port regulations (overflow of ballast)

**- Pumping Order**

When it comes to the ballasting/ deballasting operations, the Chief Officer should ensure that his Officers (including deck crew and engine personnel) correctly respond to the intended lined-up arrangement sequence paying particular attention the opening and closing of valves. It is vital that prior arrival loading port all valves are being checked (open/close) and maintained.

On some ships, the OOW will have little involvement with the ballast operations, while on larger ships OOW plays a major role in such operations.  It is the responsibilities of the Chief Officer and OOW to control the ballast operation, sometimes he will be required to operate the pumps and valves.

Because the ballast has to be used to ensure optimum performance, the ballast sequence has to be managed carefully. The role of the Chief Officer and OOW is most important because the consequences of not controlling the operation effectively can be catastrophic, causing both damage and delay.

Some examples of faults which have led to serious incidents, sometimes with loss of life are:

1. Vessel capsized-insufficient ballast or pumped at the wrong time.
2. Vessel broke in two-Incorrect combination of cargo and ballast.
3. Vessel grounding at the berth due to ballast being pumped out much slower than planned, combined with high loading rate and inattention.
4. Lighters alongside sunk being filled with discharging ballast.
5. Cargo damaged by flooding from ballast.
6. Cargo and or/ ballast contaminated due to operating valves in the wrong sequence.
7. Tanks ruptured due to pressure or vacuum build up.
8. Pump burnt out due to poor maintenance or unattended.
9. Less cargo loaded due to inability to pump out all ballast.

Therefore, it is vital to check all ballast lines and valves settings every operation, and to have an agreed safe setting for all valves to which they must be restored on completion of every ballast operation.

It is essential for the OOW to monitor closely the ACTUAL movement of ballast at all times, so that he always knows the quantity (tons) of ballast water is on each specific tank. This goes hand-in-hand with his monitoring of cargo operation, and checking the ship's draft regularly.

The purpose of minimizing the amount of ballast is to earn money from cargo, so the Chief Officer will be constantly alert to that need. Excess ballast means a higher displacement, therefore, more fuel is burnt to propel the ship through the water, and the speed may be reduced. Also if there is a draft limitation at any stage of the voyage, excess ballast will mean less cargo is being carried. In these circumstances, it should be remembered that every ton of ballast that remains on board on completion of deballasting is equivalent of one ton of freight sacrificed if cargo has to be shut out.

FROM BULKER STARS – NYK LINE INSTRUCTIONS

**Knowledge on Ballasting/Deballasting**

*1. Ballasting at Discharging Port:*

*1) Make sure that the ventilation is "open" before commencement of ballasting.*
*2) Keep a close eye on water levels in the tanks during ballasting; never allow the ballast water to overflow when vessel at the berth.*
*3) In the initial stage of ballasting, no ballast pump is required because filling by gravity is generally faster than pumping. The line arrangement for ballasting by gravity should have strainers to prevent foreign objects from entering ballast tanks and, conversely, the line arrangement for deballasting should have no strainer.*
*4) Ballasting at the discharging port should be somewhat slower than the progress of cargo handling to facilitate adaptation to any sudden change in the discharging plan or any similar unexpected development. Also pay attention to the draft and trim, and make plans always readily adaptable to emergency un-berthing.*
*5) Plan your ballasting so as not to make trim by the head.*
*6) Pay constant attention to the water head. When it is necessary to fill the ballast tanks up to the planned water head, disengage the ballast pumps from parallel operation and operate them independently a little before top-off or keep one of them in circulation, and reduce a delivery quantity to allow for extra time to determine to stop it. If there is a difference in water heads between the top-off tank and other tanks, ballast may shift or flow back as a consequence of the water head difference, possibly inviting line blockage or an abrupt change in the load on pumps.*
*7) Equalize the water heads of the ballast tanks on both port/starboard sides to eliminate heel imbalance due to inappropriate ballasting. Precaution is particularly required for ballast-attributable heel imbalance, as it would lead unbalanced cargo discharging. If there is an excessive heel due to unbalanced cargo, ask the stevedore to change the cargo discharging side. (Take into account of the consequence of not achieving the planned capacity if the heel and/or the trim are excessive.)*
*8) Avoid repeated starting and stopping of the pumps. When the required ballast capacity varies substantially in a short period, either keep one of the pumps in circulation, top off one of the tanks and resume parallel operation when ballasting is restarted with the next pump, or fill many of tanks at the same time in the top-off operation to allow extra time for ballasting.*
*9) If there is a ballast tank topped off in a trim-less or a excessive heel toward the other side, or if cargo handling invites an excessive trim or the heel returns to the upright, achieve topping-off with some water head allowance in anticipation of a possible overflow of the ballast. When in port, it is usually advised not to fill any of the ballast tanks to its full capacity.*
*10) If limitations of the hull's strength require complete filling of every ballast tank to its capacity while the vessel is to be unloaded at multiple ports, pay attention to the progress of cargo handling and subsequent changes in trim, along with other factors,*

*and fill the ballast tanks somewhat behind cargo handling schedule not to let the ballast overflow from the tanks. Also ask the stevedore to keep watch over the impact of cargo handling on the heel.*

*11) When the ballast holds are to be topped off by operating the ballast pumps in parallel, keep track of the filling rate and the expected top-off time to prevent overflow. It is easier to estimate topping-off time by gauging it with ladder rungs to the escape hatch.*

*12) When ballast is to be replaced after leaving the port, if the hull stresses are within limit and the propeller is immersed in water more than required relative to weather conditions, it is not absolutely necessary to completely fill the ballast tanks. As an increase in remaining ballast volume could invite increased fuel consumption. Be sure not to keep more ballast than needed.*

*13) Before filling the ballast holds with water, remove all cargo residuals as thoroughly as possible. It is also necessary to install silk hat strainers to ensure that no cargo residuals enter into the ballast line and damage seat rings or cause any other problems. If any manhole stud has been bent in the course of cargo handling, fit a nut on the stud and lightly hit the nut to straighten the bend. Be careful not to break the bolt thread by accidentally hitting the stud directly.*

2. Deballasting at Loading Port:

1) Make sure that the ventilation is open before commencement of deballasting.
2) When discharging the hold ballast, be sure to open the air vents of the hold and escape hatches or hatch covers beforehand.
3) During deballasting operation, pay attention to the water heads in not only the tank being worked on but also the other tanks to make sure that the work is done exactly in the planned sequence.
4) When the ballast tanks have sufficient water heads, usually no ballast pump is required for deballasting, because deballasting by gravity is generally faster than deballasting by pump. The line arrangement for deballasting by gravity should have no strainer if possible.
5) Deballasting at the loading port should always be somewhat faster than the progress of cargo handling; and be careful not to fall behind the schedule of each sequence even if the loading rate is increased.
6) Plan deballasting so as not to develop trim by the head except when it becomes inevitable due to circumstances of cargo handling. Keep trim by the stern at all times to secure a sufficient suction head.
7) Be careful not to allow a difference in water heads between port and starboard tanks during deballasting work, and ensure that there is no heel due to uneven deballasting. If cargo handling causes excessive heel, ask the foreman to adjust the heel by loading cargo accordingly.
8) If both pumps trap air when in parallel operation while stripping, the operation may be hampered. Therefore, keep one of the pumps in standby keeping in circulation, and perform deballasting with the other. Also, pick up as much of remaining water as possible

*with the main pump to minimize the time taken for stripping by Eductor. To avoid repeated starting and stopping of the pumps, when stripping has to be done more than once during parallel operation of two pumps, keep one of them in circulation or, when the ballast lines are arranged in a ring main, keep the starboard and port side lines independent of each other in stripping operation.*
*9) Give top priority to discharge the hold ballast so that the holds can be ready to receive the cargo. In preparing the stowage plan, be sure that a sufficient trim by the stern can be secured at the time of stripping the ballast holds, so as to prevent taking extra time for their stripping.*
*10) When tanks with a large difference in water heads are to be deballasted at the same time, equalize the tanks before deballasting; otherwise, ballast may flow back from the tank with a higher water head to that tank with a lower water head, resulting in deballasting of only the former.*
*11) Even if any pump begins drawing air at the final stage of deballasting, don't stop the pump immediately; make every effort to continue deballasting with the main pump by priming the pump from another tank or deballasting the tank on the other side of inclination by utilizing the heel of the hull, and thereby reducing the time taken for deballasting with the eductor.*
*12) Keep a sufficient trim by the stern when stripping with the main pump, and make every effort to achieve thorough deballasting with the main pump.*
*13) Also while stripping with the eductor, keep a sufficient trim by the stern. Keep close watch on the hull inclination during cargo loading and, conversely, utilize the hull inclination to strip the tank efficiently taking into account the bell-mouth position of the tanks.*
*14) Upon completion of the final stripping, measure the remaining water by maintaining a state in which the trim is kept by the stern. In this case, use a Dipping Table (Wedge Table) for precise measurement of the remaining water. When there is a trim and the water head is very low, do not measure the ballast with the Sounding Table, which adjusts the trim correction with the water head, as it would inevitably lead to an error and consequently cause a reduction of the apparent cargo load.*

***PLEASE SEE ANNEX FROM NYK LINE / STARS: DBCH 05-02 Ballast Pump and DBCH 05-03 Valves.***

**- Air vents during Ballasting / Deballasting Operations**

It should always be remembered that during the entire operation whether ballasting or deballasting, the air vents should be opened to prevent imploding or exploding of tanks. In the same way when a cargo hold is use to put in ballast water, Chief Officer or the OOW shall ensure that lids should be opened without fail. (Please refer to manual for hold ballasting)

### 2.4.3 Hold wise Stowage

Stowage is generally understood to mean the placing and securing of cargo in the hold of a vessel. It is truly an art and can be learned by the stevedore or ship's officer only through long experience in the handling of many types of commodities.

The principal objectives that those responsible for the stowage of the cargo must aim to carry out the following:

- stowage to protect the ship and crew from damage or injury;
- stowage to protect the cargo from damage and tainting;
- stowage to make the best use of the cargo space so the vessel will carry the maximum load of cargo and obtain the maximum cargo freight;
- the handling of the stowage operation with the maximum possible speed in order to save time and reduce stevedoring costs by keeping overtime to a minimum; and
- stowage arranged so that cargo from different ports can be promptly and readily unloaded upon arrival.

**- Factors that Complicate Planning of Stowage**

There are still innumerable problems to be dealt with in the stowage of any ship, despite the more efficient construction of the modern vessel. Stowage nowadays is frequently complicated, for example, by the fact that many vessels load cargo at a number of ports with several discharging ports, as well. Obviously, this makes it more difficult to load all the cargo so that it will be immediately available when the ship arrive the port of destination. (Refer to ship's cargo manual)

**- Even Distribution**

A general rule that should be followed, unless circumstances absolutely prevent, is to stow the cargo so that there is fair or even distribution for each port over the different holds of the ship during the entire discharging operation. This rule assures that the ship structure is not stressed once part or all of the cargo has

been discharged. Therefore, it is essential that the OOW should closely monitor the loading/discharging operations, to ensure that it complies with the pre-plan. He must also ensure that the cargo and ballast operations are well co-ordinated; if they get out of step with each other; the OOW must inform Chief Officer immediately.

### 2.4.4 Finding Hatch Stow by Percentage of Shore Scale

The importance of conducting accurate draft surveys during completion of each loading sequence cannot be over-emphasized. Shore scale meters or weight-o-meters vary in accuracy. The amount of cargo stowed on each hold by percentage of shore scale is found by using the formula:

$$\frac{\text{Shore figure by hatch}}{\text{Total shore figure}} \times \text{Total draft survey figure}$$

Example:

A bulk carrier was loaded 28,200 Tonnes of cargo according to shore figures. Cargoes are stowed as follows: hatch no.1: 5,750 tonnes; hatch no.2: 5,500 tonnes; hatch no.3: 5,750 tonnes; hatch no.4: 5,500 tonnes; and hatch no.5: 5,750 tonnes. A draft survey conducted however reveal a total cargo of 27,600 tonnes. Find the actual cargo loaded per hatch:

| Hatch no. | Holdwise stow by shore figure | % of Total shore figure | Total draft survey figure | Holdwise stow by draft survey |
|---|---|---|---|---|
| 1 | 5,750 tonnes | 20.4 % | 27,600 tonnes | 5,630.4 tonnes |
| 2 | 5,500 tonnes | 19.5 % | 27,600 tonnes | 5,382.0 tonnes |
| 3 | 5,750 tonnes | 20.2 % | 27,600 tonnes | 5,575.2 tonnes |
| 4 | 5,500 tonnes | 19.5 % | 27,600 tonnes | 5,382.0 tonnes |
| 5 | 5,750 tonnes | 20.4 % | 27,600 tonnes | 5,630.4 tonnes |
| Total: | 28,200 tonnes | 100 % | | 27,600 tonnes |

There are several cases where cargo disputes occur at the discharging ports due to “Cargo shortage” – possible reasons of the case is that during the Final draft survey at loadport, sea swell reaches up to 2-4 meters. Reading of hygrometer was not accurate and was not done only one time not three times.

Therefore, it is important to thoroughly check the above items.

## 2.5 Cargo Care (Ventilation)

### Ventilation and Sweat

Most cargoes, particularly those of raw nature, are liable to suffer considerable damage if they are subjected to extreme ranges or fluctuations of temperature.

It is easy to appreciate that cargo is loaded at the temperature prevailing at the port of loading and, during its transit, may experience climates and temperatures varying considerably from the original, with consequent effects due to heating and cooling.

Excessive overheating of cargo leads to severe deterioration; rapid cooling leads to the presence of much condensation in the holds and a consequent effect on the cargo, while sweat or condensation may also result when passing from cold to warmer climates. Warmer outside air, by the process of through ventilation will in all probability, deposit its moisture on the cooler cargo within the ship. In such cases, it might be advisable to prohibit through ventilation.

Condensation can also occur when passing from cold to warmer climates, for if the temperature of the cargo is below the dew point of the external atmosphere, and air is admitted to the holds – condensation on the cargo will result.

Under these conditions, it would be better to keep the ventilators closed and this practice is employed by a number of cargo vessels that load in U.K. ports during winter months and proceed directly into the latitude of the trades.

It should be the aim of every Deck Officer to arrange the ventilation of the holds in such a way that the original temperature of loading is changed slowly as the ship passes into other climates, so that there is little or no difference between the temperatures inside the holds and that of the outside air.

Another important factor that must not be overlooked is the evolution of gasses and odors by the cargo, if not dispersed into the open air, may be absorbed by other cargo within the hold. Even though deterioration may not occur to a very large extent, a cargo may suffer depreciation in market value as a result of a "foreign smell."

If it can be shown that inefficient ventilation is the cause of damage to cargo, the ship is held absolutely responsible and the claims can be very heavy.

In modern ship construction, many elaborate system of ventilation are introduced but the main point is that there should be constant circulation through or over the cargo according to its nature.

**- Air Circulation to Ventilation**

Warm air, like any other gas that has been heated, tends to expand and rise. Cool air is heavier than warm air and therefore, tends to fall and take the place of lighter rising warm air. This difference in the densities of air at different temperatures produces a circulation within a cargo hold. The air in the lower portions of the space is relatively warmer than in higher portions and will rise in conformity with the natural laws of air circulation.

The air in a ship's hold will move in a direction contrary to that of the outside air. The establishment of a circulatory system of air ventilation can be achieved by leading to the lower parts of the hold, those ventilator shafts that serve as "intakes." The cool air entering will dilute the warm air rising through the cargo and disperse it via the upper ventilators (uptakes) into the outer atmosphere.

**- Sweat, trades on which it is likely to occur and the usual procedure adopted to counteract it:**

**Sweat** – Is condensation that forms on all surfaces and on all goods in a compartment or holds due to inability of cooled air to hold in suspension as much water vapor as warm air.

It will be appreciated that the air in all compartments of a cargo vessel loading in tropical climates is warm, and that the cargoes loaded are also warm. This warm air contains much water vapor that is not visible to the eye. On passing into temperate latitudes, the colder seawater and air cools the structure of the vessel, which in turn causes a drop of temperature within the cargo spaces. This cooling, particularly if sudden, causes much condensation and water drops will be observed forming on the deck heads and frames, while all goods within the spaces will be subject to considerable moisture deposit. This deposit is termed "sweat." The possibility of this condition will arise, irrespective of trade, with cargoes, which by virtue of their nature, are damp and moist and so give rise to moisture saturated air in their vicinity.

**Ship's sweat**

Condensation on the ship's structure - Ship's sweat takes place when the dew point in a cargo space exceeds the temperature of the structural parts of the ship. It is minimized or eradicated, by passing adequate volumes of outside air over

the cargo, more particularly necessary in a vessel passing from warm to colder atmospheric conditions.

**Cargo sweat**

Condensation directly to the cargo - Cargo sweat can arise when passing from cold to warmer climatic condition since the cause is from the warmer moisture-laden air condensing on the cargo. Its prevention is by sealing off the ventilating facilities, although extraction fans will be necessary to offset any moisture effects emanating from the cargo itself, or its dunnage materials.

**- Ventilation for Specific Cargoes**

The ventilation of cargoes is a matter of very special significance. Natural and artificial products are legion, and it is certain that sooner or later each one will have to be transported as a ship's cargo.

With some cargoes chemical reactions are constantly proceeding; sometimes slowly – but in other cases rapidly – and where these occur, there will be inevitable products of reaction. These products if allowed to remain unchecked may constitute a source of danger from fire and explosion, contaminate, or deteriorate other susceptible cargo.

Even though chemical reactions maybe so slow that the reaction products are regarded as producing no obvious risk, there is still a question of variable. Content of water vapor in air – a quantity dependent upon temperature. This latter point links up with the "sweating" of cargoes and condensation of moisture in cargo spaces and on metal structures. Obviously, all reaction products must be removed by the only practical method – ventilation.

**Grain Cargoes** – Grain cargoes are subject to germination that will depend upon the temperature and the presence of moisture. Through ventilation will therefore be important.

When loading grains, all the provisions of the *IMO International Grain Code* must be obeyed. The OOW should study this document thoroughly before reaching the port of loading. Leading grain exporting countries have their own forms, copies of which are usually kept on board most bulk carriers. These forms require the compilation of grain shift moments, and comparing the actual values to maximum limits given in the ship's Grain Stability Manual

The air between the grains will be saturated with water vapor that can only be removed by a through current of drier air. Should a sudden fall of temperature take place, and then condensation will take place. If care is not taken, the water will lead to germination of the grain, and this will be accompanied by a rise of temperature and evolution of gas.

In ventilation, therefore, it will be more important to adjust the hold temperature to that of outside air.

**Rice** – Rice is particularly likely to suffer from moisture effects. It heats up quickly and evolves odors likely to affect other cargo. Under ordinary conditions,
it gives off carbon dioxide. With matured grain, less ventilation is required.

**Coal Cargoes** – Coal cargoes evolve methane gas, which when mixed with certain proportions of air will ignite. Methane, which is set free, rises up owing to its density, and is then diluted with continuous air current at the surface, being finally swept out via the weather uptake.

Bulk coal is also subject to spontaneous combustion, a reaction due to contact with excess oxygen. Avoiding ventilation will therefore reduce the risk of spontaneous combustion.

It is vital that the Master and Chief Officer should make sure to obtain "Cargo Declaration" from the shipper or agent prior the start of loading.

While underway, the Chief Officer should monitor and record cargo temperature and on daily basis to ensure the cargo is in no risk of any such problem.

*FROM BULKER STARS – NYK LINE INSTRUCTIONS*

*Coal is one of the cargo items listed in Appendix B (cargoes possessing chemical hazards) of the Code of Safe Practice for Solid Bulk Cargoes (BC Code), and should be stowed and carried in accordance with the provisions of the Code.*
*Although the BC Code at the moment is a recommendation and therefore is not enforceable, there has been a decision to make it enforceable as the IMSBC Code from January 1, 2011. Please keep in mind that the requirements for coal transportation may be revised in the near future.*

***1. Classification of Coal***

*1-1. Classification by Degree of Coalification:*
*Coal is created by the decay of plants into a carbonized material like peat, which is further pressurized and dry-distilled. This process of alteration into coal is known as coalification, and the degree of coalification means how much the process has progressed.*
*Coal can be classified in the descending order of the degree of coalification into anthracite, bituminous coal, sub-bituminous coal, brown coal, lignite and peat, and the classes from anthracite to brown coal are commonly referred to as coal.*

*1-2. Classification by Use:*
*Coal is classified by use into coking coal, steaming coal and anthracite coal.*
*(a) Coking Coal*
*Coal used as a raw material for coke or gas generation is coking coal. In Japan, a great majority of coking coal is used for the production of coke to be put into blast furnaces for iron making.*
*(b) Steaming Coal*

*Steaming coal is mainly used as fuel for boilers in power stations. More recently, the demand for steaming coal is increasing from cement plants and paper mills to replace petroleum as fuel.*

*(c) （Anthracite Coal）*

*Anthracite coal is far smaller in consumption volume than coking coal and steaming coal. It finds its main uses in the production of ammunition, briquettes and small egg-shaped briquettes.*

## ***2. Properties of Coal***

*2-1. Generation of Methane Gas*

*Coal has many minute cavities, which absorb gases (of which methane gas accounts for 90%) generated in the process of coal generation under the ground. As long as coal lies underground, the adsorbed gases remain within the coal because they are in equilibrium with the surrounding gas pressure. But once coal is excavated and exposed, the pressure becomes lower and accordingly gases lighter than air are discharged into the atmosphere. Furthermore, when coal pieces are broken when they are transshipped or while they are in transit, gases are discharged from their new surface. The amount of such gases that would pose problems in transportation and storage depends on the environment in which they are generated, but their generation itself is a phenomenon common to all kinds of coal, and the following can be generally said.*

*1) The formation of minute cavities in coal itself decreases with the extent of coalification, namely the least in anthracite, which emits the smallest volume of gas.*

*2) Open-cut coal often emits no gas because it was exposed to the atmosphere.*

*3) The smaller the lump size of coal, the more forceful the generation of gas in a shorter period of time. Conversely, the greater the lump size, the more modest the generation of gas, though it extends over a longer period.*

*Limits of Explosiveness (Ignitability) of Methane: Methane has limits of explosive (ignitable) concentration, which range from 5% to 16% in terms of concentration (Vol %) in air. The minimum concentration needed for explosion (5%) is referred to as the lower explosive limit (LEL), and the concentration of inflammable gas is usually expressed in percentage of LEL (LEL %).*

*2-2. Self Heating*

*Coal has a property to heat itself by reacting with oxygen in air (oxidation). In an environment in which heat generation is greater than heat radiation, as oxidation is stimulated by the accumulation of heat within coal, the coal's own temperature rapidly rises to invite self ignition. The temperature at which coal ignites itself, varying with the qualities of coal, is generally considered to range from 250 C to 350 C. The following conditions are regarded as stimulative to self heating.*

*1) The lower the degree of coalification, the more likely the self heating or self ignition.*

*2) Moisture, which stimulates oxidation of coal, facilitates self heating. However, when too much adherent water is observed on stored coal, air between coal pieces is*

*driven away, and therefore the oxidation of coal is believed to be suppressed to prevent self heating.*
*3) The risk of self heating increases with the temperatures of the atmosphere and seawater while in transit, that of coal itself when it was loaded aboard and the duration of transit.*
*2-3. Water Content of Coal*
*The water content of coal comprises the intrinsic water content and the adherent water content (moisture), the sum of which is referred to as the total water content. The intrinsic water content is what coal itself adsorbs in a state of equilibrium with moisture in the atmosphere, and is generally said to be 3% to 6%. On the other hand, rainwater and other external water that adhere to the coal surface are called the adherent water content (moisture).*
*Where the adherent water content is great in quantity, it will accelerate oxidation to increase the risk of self heating and also more hold bilge will be generated, necessitating attention to the internal state of holds while in transit.*
*Coal Brand and Water Content: Although the guaranteed grade of coal imported to Japan is generally around 8% in total water content for coking coal, that of steaming coal is uneven, ranging from 8% to 16%.*

## ***3. Conditions of Coal While in Transit***

*3-1. Oxygen Concentration*
*The oxygen concentration in holds when coal is being carried is made lower than the usual level in the atmosphere by the effect of the oxidation of coal, but the degree of the drop in this concentration greatly varies depending on whether or not there is ventilation. (a) When Coal is carried with Ventilators Open. Although the oxygen concentration is observed to somewhat drop during the first three days or so after the holds are loaded with cargo, the concentration stays around 20% from then onward. During the first few days after the cargo loading, methane gas freed from coal transiently brings down the oxygen concentration in the holds.*
*(b) When Coal is carried with Ventilators Closed*
*Depending on the degree of oxidation and the extent of methane emission, the oxygen concentration significantly drops during the first week, followed by a trend of gradual decline. The trend in the decline of concentration differs with not only the qualities of loaded coal but also other factors, including the dead space in the hold and the water tightness level of the hatch cover. According to one record, the oxygen concentration fell to 1% or even less during two weeks of transit.*

*3-2. Methane Gas Concentration*
*Although methane gas is freed from any type of coal, the quantity of generated gas significantly varies with the condition of mining and the length of time that has passed since the mining, and therefore in some cases no methane generation is observed after the coal is loaded on board. Since the level of methane gas generation may greatly vary from one hold to another of the ship*

*even if coal of the same type is loaded on the same day, it is impossible at the moment to identify which coal type is more likely than others to generate methane gas. The concentration of methane gas generated obviously varies with the state of ventilators, manifesting the following tendencies:*
*(a) When Carried with Ventilators Open*
*Methane gas is scarcely detected throughout the period of transit.*
*(b) When Carried with Ventilators closed*
*Depending on the level of methane gas freed from the loaded coal, the records of methane gas concentration manifest one of the following three tendencies:*
*①If methane releasing from coal has almost ended, methane will be scarcely detected in the hold.*
*②A hold loaded with a coal type that is slow in freeing methane would manifest a gradual rising tendency of methane gas concentration with the lapse of time in transit, because the generation of gas is small in quantity but continues for a long period. In such a case, as the generation of gas is not so rapid, the gas concentration is at most 30% to 50% (LEL) if the duration of transit is only about two weeks.*
*③A hold is loaded with a coal type that is rapid in freeing methane, gas is generated rapidly in a short period of time, and the maximum concentration is reached within five days after loading. The gas concentration may surpass 100% (LEL) in rare cases, but records taken aboard actual ships indicate a gradual decline in gas concentration after that, with a tendency of settling down to 50% (LEL) or below in two weeks.*

*3-3. Concentration of Carbon Monoxide*
*What serves as an indicator of possible self-heating is the concentration of carbon monoxide (CO). It is recommended in the BC Code to look upon any detected rise in CO concentration as a sign of self-heating, and to keep the duration of top layer ventilation in cargo holds to the required minimum for discharging stagnant methane so that the supply of oxygen can be minimized.*
*According to records reported from ships engaged in the transportation of coal from North America, the concentration of CO in any reported case began to decline within a few days though in some cases a high level was registered during the first week of the voyage (with the ventilators closed).*
*The CO concentration is lower in coal from Australia, Indonesia and South America than in North American coal, recording a maximum of only about 30 ppm even on the day after departure.*

*3-4. Cargo Temperature*
*Whether self-heating is likely or not can be more easily judged by the CO concentration than by the cargo temperature (temperature in the hold). But it is important to keep track of the cargo temperature, too. The cargo temperature while in transit varies with other factors in each particular case of transportation, including the temperature of coal at the time of loading, atmospheric temperature, seawater temperature, as well as the measuring position and whether or not the fuel tanks are heated. But comparison with past data would make it possible to evaluate the current*

*load condition to some extent. Although the cargo temperature during the early part of the voyage is greatly influenced by that at the time of loading aboard, later it tends to be zero degrees Celsius to 15 C higher than the temperature of seawater or air, whichever is greater. This temperature difference is greater in winter. Accidental fires in holds adjoining the engine room are reported. In one particular case, there was an accident in a bulker where the F.O. service tank was in contact with the engine room bulkhead. Coal in the inner part of an adjoining compartment had ignited. The heating temperature in the F.O. service tank then was from 95 C to 100 C. Attention should especially be paid aboard bulkers with engine room bulkheads where the F.O. service tank and the F.O. settling tank adjoin cargo holds. The temperature of heating these tanks may be transmitted to coal to cause it to ignite.*

*Method of Measuring Cargo Temperature:*

*In a bulker designed to permit loading with coal, thermometric piping for measuring the cargo temperature is laid, and the temperature is measured by using a thermometer installed on this piping. Where no thermometric piping is laid, a thermometer may be hung on the bilge sounding pipe to measure the cargo temperature, but the timing of measurement should be carefully selected because the external air is inhaled into the piping immediately after bilge discharging and the temperature then falls steeply. In some reported cases, the gas temperature on the surface layer is measured by using the thermometric function of the gas detector, but this cannot be an accurate measurement because the top layer gas may vary in temperature depending on the condition of ventilation or some other factor.*

## ***4. Measures to be Taken on Coal Carrying Voyage***

*4-1. Hold Ventilation While at Sea*
*The BC Code recommends that hold ventilators should be open for 24 hours after leaving the port where coal was loaded and be closed afterwards when the methane concentration is stabilized at an acceptable level from the viewpoint of safety.*

*4-2. Measures to Prevent Accidents*
*In view of the recommendation of the BC Code cited above, the following risks should be guarded against when carrying coal.*
*(a) Seawater Damage*
*When a storm is anticipated, immediately close the ventilators. While sailing in ballast, check the water tightness of hatch covers and provide any necessary maintenance.*
*(b) Self-Heating of Coal*
*If any sign of self-heating is found, immediately close the ventilators. Measure the CO concentration, temperatures in holds and methane gas concentration at*

*least once a day.*
*(c) Explosion of Methane Gas*
*If the methane gas concentration rises while in transit, open the ventilators to ventilate the top layer. No forced ventilation shall be done. When near any cargo hold in which the methane gas concentration is high, any work using fire should be strictly prohibited.*
*(d) Generation of Hold Bilge*
*Check and record the state of hold bilge every day and, if the generation or an increase of bilge is noticed, discharge the bilge after measuring its pH. If the hull conditions permit, fill the APT with water to achieve a trim by the stern so as to facilitate bilge discharging. Forgetting to close any manhole, wrong operation of any valve or some other mishandling may allow ballast water filling the tank to leak into a cargo hold to cause seawater damage to the cargo therein. For early detection of any abnormality, measure the bilge even during cargo discharging.*
*(e) Oxygen Deficiency*
*When entering any sealed compartment (such as a stool, void space or store), check the oxygen concentration within the compartment and ventilate it if required. If ventilation is impossible, consider the use of a self-contained respiratory aid.*

***General Principles***
*In the early phase of a coal-carrying voyage, both CO and methane are often in high concentrations. Keep the ventilators open during this phase (for 24 hours after departure) unless in a storm. After that, keep them closed with the following in mind.*

- *To prevent seawater damage to cargo (in stormy weather) : Ventilators closed*
- *To provide against self-heating, actual or feared : Ventilators closed*
- *To ventilate top layer when methane gas is generated : Ventilators open;*

***Transportation of North American or Canadian Coal***
*The ventilators should be kept open for at least 24 hours after departure, but when a storm is anticipated in winter, the ventilators may have to be kept closed to prevent seawater damage.*

*4-3. Prevention of Seawater Damage*
*Many seawater damage accidents occur when the deck is being washed or the ship runs into stormy weather, and the frequently reported causes include having forgotten to close any hold ventilator in such weather, as well as the aging of hatch cover packing and locator wear. In particular, seawater damage due to locator wear begins in the fifth year of the ship's service life.*
*Also, many accidents of seawater damage to ballast holds due to such faults as the deterioration of manhole packing of ballast water-filled holds, inadequate tightening, mishandling of valves and deterioration of seat rings are reported. Please take thorough precautions.*

*4-4. Prevention of Oxygen Deficiency*
*Since coal has an oxidizing action in itself and has a property to free methane, thorough precautions should be taken, including measurement of the oxygen concentration and ventilation, when entering not only a coal-loaded hold but also a sealed compartment adjacent to it.*

*4-5. Actions to be taken when Hold Bilge Has Occurred*
*When coal is being carried, a large quantity of hold bilge sometimes occurs. In such a case, the efficiency of cargo discharging may be seriously deteriorated, and therefore utmost care must be taken to discharge hold bilge all the time whether at sea or at anchor.*

## 5. Contact with NYK

*In any of the following events, the operator should be informed without delay.*
・ *The concentration of methane has surpassed 50% LEL and is continuing to rise.*
・ *The concentration of CO has surpassed 50 ppm.*
・ *The temperature in the hold is above 55 C.*
・ *Even if hold bilge is discharged twice a day, the bilge well is found to be at least half way filled at every discharging.*
・ *Any other case in which the operator has given specific instruction.*

## 6. Key Check Points of Coal Transportation

*The following items are intended as supplementary reference for preventing accidents on coal carrying voyages. Please make good use of them to supplement instructions from the company and the specific circumstances of each vessel.*

*<**Preparatory Check Points Before Entering into Service**>*
*① Is the operation of gas detectors regularly checked?*
*② Are the required numbers of spare batteries, other spare parts, and test gas, among others, for gas detectors ready for use?*
*③ Are hatch covers regularly tested against water leaks to ensure their water tightness?*
*④ Is cargo holds equipped with thermometers for temperature checking?*
*⑤ Are there a ready supply of pH paper and other supplies?*
*⑥ Are the personnel responsible for testing sufficiently aware of and trained to check for gas, measure temperature, as well as to sound and measure the bilge and its pH?*

*<**Preparatory Check Points before Cargo Loading**>*
*① Are the holds and bilge wells adequately cleaned and dried?*

*② Has the consignor-issued Cargo Declaration been received and checked for accuracy of contents?*

*<**Preparatory Check Points before Departure**>*
*① Are cargo surfaces adequately trimmed?*
*② Are the hatch covers and other openings closed?*
*③ Are the ventilators provided on hatch covers open (unless a storm is anticipated)?*

*<**Daily Measurement**>*
*① Is methane concentration within the permissible limit?*
*② Isn't the CO concentration rising?*
*③ Isn't the hold temperature above 55 C?*
*④ Are the bilge quantity and pH measured and appropriately detected?*
*⑤ If any abnormal value has been detected, has it been made known to the operator?*
*⑥ In the absence of any abnormality, are the ventilators provided on hatch covers securely closed?*

### 2.6 Damage Report

Damage to cargo, caused by some form of improper handling or stowage, is of many different types. All are relatively common, however, and all are in some measure preventable if those in charge of the work are experienced in methods of preventing such damage.

Cargo may be damaged in a number of ways during the process of loading and unloading. It has been frequently been asserted that in many instances more damage is caused by rough or careless handling on the dock than by any other factor involved in ocean transportation.

Damages to cargo and ship due to rough handling of the stevedores should be noted and the vessel should have a specific form for this. If, as is usual under a voyage charter party, the charterer employs stevedores, it is advisable to ascertain, when in port, who are authorize to sign reports of any damage, done by stevedores to the vessel or cargo. When such damage is discovered, or soon

thereafter as possible, the stevedore in charge (usually the foreman) should be notified in writing, and copies sent to the charterer or his agent and to the vessel's home office. If the damage is not discovered until the cargo has been put out but was apparently sustained during cargo operations, the same procedures should be followed. Every effort should be made to obtain a signature from those who caused the damage, to show they have accepted the facts in the report. Frequently, this is difficult to obtain, in which case the ship should try to obtain a signature "*for receipt only*" of the report. If this proves impossible, a useful tactics to have the agent deliver the report, obtaining a signature from him for receipt of the report to forward to the party concerned. This practice will enable the ship to prove the report was written and available at that time.

The document will be more valuable, if it is accompanied by dated photos(digital photos) or videos of the damage, particularly if this is broken or has been mishandled. Views of the surroundings may assist in identifying hazards.

In either case, a full accounting is made on a stevedore damage report. If no printed forms are onboard, a typewritten form is acceptable. Generally, this is not a standard form, each company printing each own, but the information is practically the same on all versions. Copies, as complete as possible, are given to the stevedore and to the charterer or his agent, and the required numbers are sent to the vessels office.

The OOW must always report any new damage he notices to the Chief Officer,
even he does not actually see it occur. On some vessels, the OOW will be required to complete the damage certificate, on other vessels, this is the sole responsibility of the Chief Officer. Even in this latter case, it is a good training for the OOW to complete similar form as the basis of his report to the Chief Officer.

Many charter parties contain a clause which states that the ship must give a written notice of liability to the stevedore for all damage caused within 24 hours of the incident, otherwise the charterer will not be liable. The idea is to establish clear responsibility for any damage done, but its effect is to encourage the direct settlement of claims between ship and the stevedore, and not involve the charterer. Same time limits often apply for notifying the charterer. That Master must fulfill this requirement by faxing a copy of the damage certificate to the charterer, or notifying him of the circumstances by telex/e-mail. It is of vital importance that the damage is reported within this time frame/limit, otherwise the charterer may reject the claim. This is why the OOW's reports are so important, and have to be completed urgently.

If there is any dispute over the facts stated in these reports, including who is responsible, it may be useful for the Master to call for assistance of the local correspondent of P & I Club. If damage may affect the vessel's class, the Master should immediately notify the local representative of the relevant classification society, and the vessel's owners.

**- Letters of protest**

A letter of protest is a document used to provide a written record of events. They are issued by the Master to draw the attention of some third party to some facts or incidents which the Master believes may affect either the performance of the operations or the condition of the cargo. The circumstances are usually outside the control of the ship. If the OOW sees any of these, such as in examples which are stated below, he should report the facts immediately to the Chief Officer.

***Hidden Damage***

When cargo is loaded very fast, it is sometimes suspected that damage has been caused to this or other cargo or to the ship, but the damage is now covered by the latest cargo loaded. Such hidden damage will be revealed upon discharge. An example is heavy cargo allowed to fall from a substantial height on to an unprotected tank top by opening the grab as soon as it passes the coaming. It is preferable to persuade the stevedore to lower the grab to the bottom of the hold first, but if they will not obey, then a letter of protest will be issued.

***Suspected inherent vice***

If a cargo is observed to be in poor condition, this must be described in the bill of lading. But if the Master cannot prove the poor condition, but has reasonable grounds to suspect it, he may issue a letter protesting his fears. Also, it may be that the Master suspects the condition of the cargo will cause damage to the ship. Example: Wet coal cargo, where the moisture may drain off as mild sulfuric acid which can attack the steel structure of the vessel. In an extreme example, this acid has corroded completely through the tank top plating of a new ship.

***Cargo quantity in dispute***

If the amount of cargo unloaded is short from the amount cargo loaded. Example: due to weather loss-bulk cargo blown away by the wind during/after discharge; Errors in recording the quantity of cargo loaded or discharged; Inaccuracies in establishing the quantity of cargo loaded or discharged; cargo discharged at an earlier port, or left onboard, and perhaps discharged at a later port.

## 3. STRESS AND STABILITY

Compliance with the required minimum stability criteria does not insure immunity against capsizing, regardless of the circumstances, or absolve the Master from his responsibilities.

**- Importance of stress and stability**

If insufficient attention is paid to the ship's strength and stability during cargo and ballast operations, the results can be catastrophic- for example:

1. A ship with insufficient stability may list excessively during cargo operations, resulting in damage to the ship and to shore installations.
2. A ship with insufficient stability could be swamped by heavy seas.
3. On a ship with excessive stability, the cargo could shift, and there is a risk of structural damage, due to heavy and violent rolling. Either of these may lead to the ship capsizing.
4. A ship which has adequate stability bat the start of the voyage may become unstable during the voyage as bunkers are consumed. This needs to be taken into account when planning the cargo stowage.
5. A ship which is stressed and strained by excessive bending moments or shear force may suffer structural failure. This can occur immediately, but more likely a long term build up may result in sudden failure on future voyages when there may be excessive stress.
6. In correct calculation of drafts may leads to the ship's grounding, or being refused permission to sail of her load line is submerged.

Master should therefore exercise prudence and good seamanship, having regard to the season of the year, weather forecasts, the navigational zone, and should take appropriate action as to speed and course warranted by the prevailing circumstances.

Care should be taken to ensure that cargo, allocated to the ship is capable of being stowed, so that compliance with the stability criteria can be achieved. If necessary, the amount of cargo should be limited to the extent that ballast weight may be required.

In determining the sequence of tanks from which fuel oil and fresh water is to be consumed and those into which water ballast may be admitted during the voyage, the Master must ensure that prior to departure, that the required minimum stability criteria will be maintained throughout the voyage after making due allowance for free surface effect as may be appropriate.

Before a voyage commences, care should be taken to ensure that the cargo and sizeable pieces of equipment have been properly stowed or lashed so as to minimize the possibilities of both longitudinal and lateral shifting at sea, under the effect of acceleration caused by rolling and pitching.

### 3.1 Stability basics

A ship is HEELED when she is inclined by an <u>external</u> force –e.g., wind.

A ship is LISTED when she is inclined by an <u>internal</u> force –e.g., cargo shifting.

The **Center of Gravity** (G) is the point through which the total weight of the ship, and all weights on board, may be considered to act vertically down. Its vertical position (VCG or KG) is calculated by arithmetically summing the moments about the keel of all known weights and then dividing by the displacement. Its horizontal (or longitudinal) position (LCG) is calculated by arithmetically summing the moments of all known weights about either the aft perpendicular, or more usually nowadays, about amidships- see section 11.4.1.

The **Center of Bouyancy** (‘B) is the point through which is the point through which the total force of buoyancy may be considered to act vertically up. It is the center of gravity of the underwater volume of the ship, and both its vertical position (KB) and horizontal position (LCB) are listed for a range of drafts in ship’s stability manual or hydrostatic particulars- which may be tables or curves.

**ARCHIMEDES PRINCIPLE** states that when a vessel floats in water, she displaces her own weight of water. To remain at rest, the center pf gravity must be in the same vertical line as the center of buoyancy.

The **Metacentre** (M) is the intersection of the vertical lines through the centers of buoyancy in the initial and inclined positions. It is a function of he underwater shape of the ship, the larger the beam the higher the metacentre. Its vertical position (KM) and horizontal position (LCM) are listed for a range of drafts in the ship’s stability manual or hydrostatic particulars. The transverse metacentre governs the transverse stability and the ship’s rolling; the longitudinal metacentre governs the longitudinal stability and the ship’s pitching.

The **Metacentric height** (GM) is the vertical distance between the metacentre and the centre of gravity. It is often used as a measure to the ship’s stability. International regulations provide that a vessel can put to sea only if her metacetric height exceeds certain minimum values.

A ship has **POSITIVE STABILITY** if she tends to return in the initial position when inclined; this occurs when M is above G.

The ship has **NEGATIVE STABILITY** if she tends to heel over further when inclined; this occurs when G is above M.

The **Righting Lever** (GZ) is the horizontal separation of the forces of gravity and buoyancy when the ship is inclined.

$$GZ=GM \times \mathrm{Sin}\ (\mathrm{Heel})$$

The **Moment of Statical Stability** is the moment which acts to return the ship to the upright position when it is inclined. It is the mathematical product of GZ x displacement.

### 3.2 Behavior of a ship at sea

The period of roll is the time taken by the ship to roll from one side to the other and back again to the original position. It is a function of both the GM and the ship's beam. The ship may have tables which tabulate the rolling period for different values of GM.

**A ship with a large GM is called STIFF**; she will try to return to the upright position quickly when inclined. Her period of roll is quite short. This results in a rapid and jerky roll, perhaps rather violent, which may cause the cargo to shift or structural damage.

**A ship with a small GM is called TENDER**; she is sluggish returning to the upright position when inclined. This results in a long, slow roll which may lead to large volumes of water being shipped on deck. Any changes in weights have a marked effect, and could cause the ship to become unstable.

As the OOW has no control over the position of M, the major factor determining the ship's stability is the position of G. This is governed by the vertical distribution of the cargo, and by the contents of the tanks:

- ⇨ Additional weights stowed lower in the ship, and weights removed from higher in the ship, both increase the ship's stability. This ship takes on bunkers during the voyage, or discharges her deck cargo at an intermediate port.

- ⇨ Additional weights stowed higher in the ship, and weights removed from lower in the ship, such consuming bunkers from double bottom tanks during the voyage, both reduce the ship's stability.

This is important on container ships which carry a large proportion of their cargo on deck, which may lead to a high KG. It is vital that the weights of the containers on the top tiers are efficiently monitored in order to ensure that the GM does not fall below any required minimum value. It is also important on ships carrying timber on deck, which may absorb moisture from rain and seas on the voyage, thus increasing the weight on deck and so the KG, and consequently reducing the GM.

On ships which are likely to have critical GMs, it is essential that the value of the GM is known, and so should be recalculated regularly throughout the cargo and/ or operations.

### 3.3 Stability calculations

The calculations listed below relating to the ship's stability are usually made by the Chief Officer. It is both good practice and good training for the OOW to make these calculations too. If he is not sure of the theory, the OOW should consult a textbook on ship's stability, such a s Ship *Stability for Masters and Mates* by D.R. Derrett. If he is not sure of the procedures, the OOW should ask a senior officer to explain the calculations, and show him how they are made on board his ship. He should know where to obtain the required information, and should make himself, familiar with the contents and layout of the ship's stability manual and hydrostatic particulars/tables.

1. The effect of loading/discharging fixed amounts, say 100 tonnes on small ships and 1,000 tonnes on larger ships, at each hold, deck, tier or tank on:

(a) KG
(b) GM
(c) Draft. REMINDER: $\text{Sinkage} = \dfrac{\text{weight added}}{\text{TPC}}$
(d) Trim

REMINDER: (for small weights)

$$\text{Change of trim} = \frac{\text{weight added x distance for center of floatation}}{\text{MTCT 1 cm*}}$$

*Obtained from the ship's stability tables, for the initial draft.

*For large weights, the full calculation must be performed.*

2. The effect on KG, GM, drafts and trim of filling or emptying each of the tanks onboard- ballast, cargo, fuel and water, including their free surface effects when partially filled.

3. The correction of observed draft for density.

Although the fresh water allowance (FWA) is given on the load line certificate for the summer displacement, at all other drafts it should be calculated using:

$$FWA = \frac{Displacement}{(4 \times TPG)}$$

REMINDER: $$DWA = \frac{FWA \times (1025 - density)}{25}$$

The Officer should be able to calculate both the CHANGE OF DRAFT and the CHANGE OF TRIM when there is a change of density.

REMINDER: $$\text{Change of Trim} = \frac{\text{Displacement} \times \text{Shift of LGB}}{\text{MTCT 1 cm}}$$

(If LCB moves aft, trim is by the head)

4. The transverse movement of the ship's centre of gravity due to leading or discharging cargo away from the centerline. It should be remembered that for a given off centre weight, the list will be greater the lighter the ship is. The OOW should be alert to pairs of port and starboard tanks having unequal contents. When the ship is deep, it may appear to be upright, but as disharging continues, a list appears.

5. The calculations produce a mean draft and trim, which must be proportioned to obtain the fore and aft drafts.

REMINDER:

TRIM FWD = (TRIM / LBP) x (Distance fore peak to centre of floatation)

TRIM AFT = (TRIM / LBP) x (Distance Aft peak to center of floatation)

### 3.3.1 Procedure for calculating the ship's stability

1. List all the compartments on board the ship, with the values of their vertical centre of gravity (VCG), longitudinal center of gravity (LCG) and free surface moment, which are obtained from the ship's stability manual. Then, enter the weights of cargo or liquids contained in each one, including lightship, stores and constant. The LCG may be measured from the after peak (always positive), or from amidships (usually positive if forward, negative if aft- but check the ship's tables as differences do occur).

2. Multiply the value of each weight by its centre of gravity to calculate the horizontal and vertical moment for each compartment.

3. Add up all the weights to calculate the chip's DISPLACEMENT.

4. Add up all the vertical moments to calculate their sum. Add up all the horizontal moments to calculate their sum. (Pay close attention to signs if distances are measured from amidships). Add up all the free surface moments to calculate their sum.

5. KG = (Sum of vertical moments) / displacement.

6. Obtain the following values from the ship's hydrostatic tables, by looking up their value against the displacement:
   - KM (height of the metaceter above the keel)
   - LCB (position of the longitudinal center of buoyancy)
   - LCF (position of the longitudinal center of floatation)
     (LCB and LCF are tabulated either from midships or the aft perpendicular)
   - MTCT 1 cm. (the moment to change trim one centimeter)
   - Draft (this is draft at the LCF)

7. The Metacentric height GM = KM – KG
8. The virtual rise in the center of gravity due to the free surface effect of partially filled tanks is referred to as GG" (see sec 11.5)

$$GG" = \frac{\text{(Sum of free moments)}}{\text{Displacement}}$$

9. G"M = GM – GG"

   Where G"M is the Metacentric height corrected for free surface, often known as the virtual Metacentric height.

10. $\text{LCG} = \dfrac{\text{(Sum of free surface moments)}}{\text{Displacement}}$

11. $\text{TRIM} = \dfrac{\text{(LCG – LCB) x Displacement}}{\text{MTC 1cm}}$

12. The fore and aft drafts are calculated from the trim and the draft at the center of floatation by the method shown in step 5 in 11.4 above.
    A worked example of this calculation is provided below and in appendix 3

### 3.3.2 Stability, Draft & Trim Calculation

| SYMBOL | DEFINITION | UNIT |
|---|---|---|
| df | Draft at fore mark | m |
| d¤ | Draft at midship draft mark | m |
| da | Draft at aft mark | m |
| dF | Draft at F.P. | m |
| d¤ | Draft at midship | m |
| dA | Draft at A.P | m |
| dm | Mean of fore and aft draft, (1/2 (dF + dA)) | m |
| dM | Mean draft after corr. of deflection (dm + ¾ def) | m |
| t | Trim (dA – dF) | m |
| def | Deflection of hull (d¤ – dm) | m |
| ∆m | Displacement at S.W. ρ = 1.025 corresponding to dM | mt |
| ∆t | Displacement correction due to trim | mt |
| ∆ | Actual displacement | mt |
| dc | Corresponding draft to displacement or draft at LCF | m |
| ¤G, LCG, MG | Center of gravity from midship | m |
| ¤B, LCB, MB | Center of buoyancy from midship | m |
| ¤F, LCF, MF | Center of floatation from midship | m |
| BG | Distance between ¤B and ¤G | m |
| CLG | Center of gravity off center line of ship | m |
| KG, VCG | Center of gravity above base line | m |

| | | |
|---|---|---|
| TKM | Trans. Metacenter above base line | m |
| GM | Metacentric height (TKM – KG) | m |
| GGo | Apparent rise of VCG = Total p x I / displ. | m |
| GoM | Apparent metacentric height (GM – GGo) | m |
| KGo | Apparent VCG (KG + GGo) | m |
| ρ | Specific gravity of liquid | m |
| I | Trans. Moment of inertia of free surface in tank | $m^4$ |
| KN | Righting lever with KGo (KN – KGo x Sin θ) | m |

| | | |
|---|---|---|
| GoZ | Righting lever with KGo (KN – KGo x Sin θ) | m |
| θ | Heel angle | deg. |
| TPC | Tons per 1 cm immersion | mt |
| MTC | Moment to change trim 1 cm | mt $^{-m}$ |

### 3.3.3 Displacement Calculation from Draft Reading

- Calculate the mean of the drafts on both sides at fore, midship and aft draft respectively (df, d¤, da)
  df : mean of fore drafts
  d¤ : mean of midship drafts
  da : mean of aft drafts

- Correct the drafts df and da to the drafts at F.P and A.P. using “correction table for fore and aft draft marks and fore, middle, and aft drafts”

  dF : draft at fore perpendicular (F.P.)
  d¤ : draft at midship
  dA : draft at aft perpendicular (A.P.)

  dF = df + corr. df
  d¤ = d¤ + corr. d¤
  dA = da + corr. da

- Trim (t), mean draft (dm) and deflection (def) are calculated as follows:

  t = dA – dF
  dm = (dF + dA) / 2
  def = d¤ - dm ; if def < 0 : Hogging, def > 0 : Sagging

- Find the displacement (Δm) corresponding to dM from “Hydrostatic Tables”
  dM = dm + ¾ x def

- The correction due to trim (Δt) are made to the above displacement (Δm) by using “correction table of displacement by trim” at dM and t

- Actual displacement (Δ) is calculated by the following formula.

  Δ = (Δm + Δt) x ρ/ 1.025
  ρ : actual specific gravity

- Calculation of LCG

MG = MB + 100 x MTC x t / Δ x ρ / 1.025

If MB, MG positive after midship
MB, MG negative forward midship

**Blank Sheet Sample for Displacement Calculation from Draft Reading ( Draft Survey )**

| Draft | Port | Starboard | Mean |
|---|---|---|---|
| Fore (df) | m | m | m |
| Midship (d¤) | m | m | m |
| Aft (da) | m | m | m |

Specific gravity of sea water (ρ) : ______________

Trim between draft marks (da – df) _________________m
Correction of fore draft mark (corr. df) _________________m
Fore draft at perpendicular (dF) _________________m
Correction of midship draft mark (corr. d¤) _________________m
Midship draft (d¤) _________________m
Correction of aft draft mark (corr. da) _________________m
Aft draft at perpendicular (dA) _________________m
Trim (t) t = dA – dF _________________m
Mean draft (dm) dm = ½ (dF + dA) _________________m
Deflection (def) def = d¤ - dm _________________m
Corrected mean draft dM = dm + ¾ def _________________m
Displacement at dM (Δm) _________________m
Correction due to trim (Δt) _________________m
Actual displacement (Δ) Δ = (Δm + Δt) + ρ / 1.025 _________________m

### 3.3.4 Free surface effect

Whenever a liquid can move in a tank, there is a reduction in the ship's stability. This free surface effect is caused by liquids sloshing around in partially filled tanks, known as slack tanks. The wider the tank, the greater the effect- it is a function of the cube of the tank's beam. This effect occurs irrespective of the position of the tank in the ship. It is convenient to regard this loss of stability as a virtual rise in the ship's effective center of gravity, and hence a virtual reduction in the ship's metacentric height GM.

As the ship heels, the level of the liquid in the tank changes as shown, and its center of gravity moves from g to g'. The ship's center of gravity moves from G to G' (note

GG' is parallel to gg'). The new righting lever is G'Z', which is equal to G"Z", so the ship's effective metacentric height is G"M.
It is usual to refer to GG" as the virtual loss of stability due to the free surface effect.

Whilst it is possible to calculate the value of this reduction in GM, many ships will have the values tabulated for each tank in their stability tables. This is the maximum value, in practice this figure is used whenever the contents of the tank is between 5% and 95% of their maximum capacity. It is a safe figure to use as
no matter what the actual level of liquid in the tank, the resultant reduction in GM will never be more than this maximum figure. Outside of this range, i.e. when the content of the tank is less than 5% or more than 95% of its maximum capacity, it is usual to ignore the free surface effect.

On the other ships, the free surface correction is given as a "Free Surface Inertia moment". Once again, only the maximum figure is tabulated. The sum of these moments for all slack tanks, divided by the ship's displacement, gives the virtual reduction of GM. The OOW should make himself familiar with the method used in his own ship's stability booklet.

### 3.4 Effects of fire-fighting on ship's stability

A substantial quantity of water may be pumped into the ship during a fire-fighting operation. This can have a considerable effect on the ship and its stability due to:

1. Change of the ship's center of gravity, and associated change of the ship's metacentric height.
2. Free surface effect of the added water further reducing the stability.
3. Increase in the ship's draft.
4. Change of trim, and/or list.
5. Overloading decks.
6. Overstressing the ship's structure.

These effects will be governed by the quantity of water added, and the position and dimensions of the compartments concerned.

When considering holds which are loaded with cargo, the permeability of the cargo will have to be estimated. This is the percentage of the loaded compartment not occupied by solid cargo, and hence which can be occupied by water. Consideration should be given also to water which may be absorbed by the cargo. The adverse effect of free surface is reduced if the compartment contains large blocks of impervious cargo.

### 3.5 Investigating Vessel's Lists

Throughout cargo and ballast operations, it is usual to arrange for the ship to remain upright. If the ship develops any unexpected list, the OOW must investigate, and identify the cause. This may be due to:

1. Cargo not loaded evenly about the centerline
2. Cargo shifted in a non-working compartment.
3. Ballast pumping at uneven rates in pairs of port and starboard tanks.
4. A valve leaking on a tank not in use,
5. A compartment flooded due to structural failure or some other accident.
6. The ship grounding on the inshore side.

During loading, particularly on bulk carriers, it is important that the stevedore is informed about any list which is not due to cargo; otherwise he may try to correct the list with cargo subsequently loaded. This could result in the ship being subjected to twisting stresses, which can weaken the ship, and in extreme cases can lead to structural failure. Some ships have flashing lights on the bridge front to indicate list.

The list is obtained by reading the clinometers, the longer the pendulum arm the greater the accuracy. Some ships construct their own instrument by pinning a line to the top of an athwart ship bulkhead, and suspending a weight from the line near the deck. A scale is drawn on the bulkhead using simple geometrical calculations. The most accurate indication of list is obtained by comparing the port and starboard drafts amidships.

**- Reminder of strength and stress basics**

The dimensions and configuration of the components of the ship's structure determine its strength. The item of most concern to the OOW will be the load on each deck or tank top. This is expressed as so many tones per square meter, and maximum limiting values are stated in the ship's approved stability book. The Chief Officer will have considered these figures when planning the stow. The OOW should be aware of these limitations, in order that he remains alert to the possibilities of overloading the ship's structure if the cargo is not stowed exactly according to the preplan.

The strength of the ship's structure will govern the maximum forces of stress it is able to absorb in safety. The two forces which concern the OOW are those of SHEAR STRESS and BENDING MOMENTS. These can arise from the uneven distribution of weights throughout the ship, or the uneven distribution of buoyancy of the ship in large waves.

The shear stress at any point is that force within a material which tends to break (shear) the material across, it is equal and opposite to the load applied at that point. It is expressed in tones. (Diagram A on appendix 6).

The bending moment at any point is the total moment tending to alter the shape of the structure, it is equal to the algebraic sum of the moments of all the loads acting between that point and one end of the structure. Bending moments tend to cause the vessel to bend along its length, producing a HOG or SAG. They are expressed in tones-meters. (Diagram B on appendix 7).

The bending moments and shear forces are normally calculated on the ship's stability computer. They may also be calculated longhand using data and a preforma which are to be found in the ship's stability manual. It is both good practice and good training for junior officers to be able to perform such calculations. Worked examples are given in appendix 3.

When a ship is subjected to uneven forces along its length, the hull takes the shape of a complicated curve. It is a convenient common practice to consider this shape as a simple smooth curve, where the midship draft is greater or less than the mean of the forward and aft drafts.

If the mean of the forward and aft drafts is LESS than the midships draft, the ship is said to be HOGGED. This occurs when most of the weight of the cargo is placed near the ends of the vessel. When loaded to her marks, a ship which is hogged will lift a greater tonnage than indicated by her deadweight, because she displaces more water at her fore and aft ends.

Also, a ship is subjected to hogging forces at sea when a crest of a wave supports amidships and each end is in a trough. (Diagram C).

The degree of hogging or sagging is dependent upon the bending moments, though there is no exact relationship which can be readily calculated onboard. Once a ship is hogged or sagged by a certain loading condition, it may take some time for the hull to change to the hog or sag corresponding to a subsequent loading condition. Thus during rapid cargo operations, the hog or sag at any time may bear no relation to the actual loading condition at the instant
of time. It is not unusual for a ship to sail from one port with one hog/sag, and arrive at its destination with a very different hog/sag.

### 3.6 Stability Computer

If the ship has a machine to assist with stability calculations, then the OOW must be proficient in its use and operation. He should read the manuals, and ask senior officers for guidance. In learning to use such machines, it is important that the OOW

does not disturb information which the Chief Officer may have entered in readiness for cargo or ballast operations. The OOW must always ask the Chief Officer if it is convenient before he practices using these machines. During cargo operations, he should be guided by the system in use on that ship,- if the relevant data are to be updated by the OOW or only by the Chief Officer:
The OOW should be able to:

1. Switch on and set up the machine.
2. If it is a general purpose computer rather than a dedicated stability machine.
    a. Understand the operating system.
    b. Load the stress/ stability programs.
    c. User the help system.
3. Enter the data for ballast, cargo, fuel, fresh water, stores and dock water density.
4. Understand which units are used.
5. Appreciate the method of assessing the center of gravity of partially filled compartments.
6. Appreciate how the free surface effects are allowed for.
7. Obtain the results for:
    a. Draft and trim
    b. Stability:
        i. GM
        ii. The area under the GZ curve
        iii. Grain shift moments
    c. Shear forces
    d. Bending moments
8. Understand the difference between IN PORT and AT SEA conditions.
9. Appreciate the limitations of the system
10. Use the test cases to check its performance
11. Save and retrieve data
12. Predict the effects of filling/emptying all ballast tanks
13. Predict the effect of filling/emptying cargo compartments

**- Leveling bulk cargoes**

In order to minimize the risk of bulk cargoes shifting during adverse weather, the *IMO Code of Safe Practice for Solid Bulk Cargoes* recommends that all bulk cargoes are trimmed level on completion of loading before the vessel leaves port. Unfortunately, this practice is often ignored, and has resulted in ships developing lists during the voyage when the cargo shifts or settles more to one side than the other, occasionally with disastrous consequences.

### 3.7 Grain Stability

The free-flowing characteristics of grain reduces the stability of the ship; grain which does not completely fill a compartment displays a free surface effect similar to a liquid in a partially filled tank. As the ship rolls, the grain is likely to flow to one side of the compartment, where it will cause the ship to list, and perhaps capsize. The OOW must ensure that all compartments which are planned to be filled have all the spaces under the decks and hatch covers filled as much as possible. Any compartment which is to be partially filled must have the surface of the grain trimmed absolutely level.

One of the basic requirements of the *IMO Grain Regulations* is that the Master must demonstrate that at all times during the forthcoming voyage the vessel will have sufficient stability to take into account the adverse heeling effects caused by an assumed pattern of movement of the grain in the holds. This is usually accomplished by completing the calculations on special forms provided by the marine safety agencies in the loading port. The reader wishing to obtain further information on this subject is advised to study *The Nautical Institute's publication Bulk Carrier Practice.*

### Keeping to the pre-plan

On larger ships, the Chief Officer will have constructed his pre-loading/ discharging plan to ensure that the ship remains within her allowable maximum values of shear forces and bending moments at all times. The OOW must ensure that the planned sequence of ballast and cargo operations is strictly maintained. If these two operations are permitted to get out of step, the ship may be subjected to unacceptable stresses, which could lead to structural failure. It is essential that the OOW informs the Chief Officer immediately if he detects that the cargo or ballast operations are not keeping to the preplan

### 3.8 Damage control

The permitted maximum values of shear forces and bending moments apply to the dimensions of the ship's structure as she was built. Hence it is important for the OOW to report any damage or decay (heavy corrosion, detached parts of the structure, etc.) which he sees, as this could effect the validity of such values, Guidance on what to look for is contained in appendix 5. A ship which is damaged is not as strong as it was, and it is more likely that the structure could be overstressed or overloaded.

The OOW should be aware of the effects of stress on the ship's structure when any compartment is flooded. He should also understand the use of ballast to change the ship's trim or list in an emergency.

### 3.9 Bending Moment and Shearing Force Calculation

When planning the stowage of the cargoes and ballast, consideration to the following with respect to hull strength must be observed.

1. **Bending moment and shearing force**

   a. Planning must be carried out so as to avoid local concentration of loads and discontinuity so that there is no excessive hogging and sagging.

   b. Cargo loading and ballasting must be closely monitored so as not to exceed to permissible range of bending moment and shearing force of the ship.

2. **Local strength**

   a. Cargo must be stowed so as not to exceed the permissible weight of the respective locations.

   b. For the local permissible weight of each ship (permissible weight on top of hatch covers, etc), refer to the permissible weight shown in the final as-built drawings.

   c. When local load becomes excessive, distribute the local load with dunnage or reinforce the deck and take other necessary measures.

**- Check of strength**

If necessary, as a result of stowage calculations, confirm that the hull strength calculation plan before cargo loading/unloading and the final calculation results are correct, then, must obtain the approval of the Master.

**- Longitudinal strength bending moment and shearing force**

**Longitudinal Strength** – it is the most important factor for the ship's safety. Longitudinal Bending Moments (BM) and Shearing Forces (SF) throughout the hull must be kept within the permissible limits of the ship's longitudinal strength.

Bending Moment and Shearing Force acting on the hull during navigation consist of still water components [still water bending moment (Ms) and still water shearing force (Fs) which are caused by the ship's loading condition, and wave-induced components [wave bending moment (Mw) and wave shearing force (Fw)] which are caused by waves at sea. Therefore, in order to keep BM and SF within the permissible limits, proper maneuvering of the ship is required to reduce the wave-induced components, moreover, proper loading condition are important to keep Ms and Fs within certain moments.

In actual shipping operation, loading conditions may be different from the standard loading conditions prepared and calculated for such ships during construction can be expected. In these cases, according to the procedure and calculation of loading conditions must be checked from the viewpoint of longitudinal strength.

Therefore, further to ship's longitudinal strength calculation, it is useful to study beforehand the basic theory and principle for the above.

**- The Strength of Ships** – the problem of calculating the necessary strength of ships is made difficult by the many and varied forces to which the ships structure is subjected during its lifetime. These forces may be divided into two groups, namely statical forces and dynamical forces.

The static forces are:

1. The weight of the structure, which varies throughout the length of the ship.
2. Buoyancy forces, which vary over each unit length of the and are constantly varying in seaway.
3. Direct hydrostatic pressure.
4. Concentrated local weights such as machinery, masts, derricks, winches, etc.

The dynamical forces are due to:

1. Pitching, heaving and rolling.
2. Wind and waves.

These forces cause bending in several planes and local strains are set up due to concentrated loads. The effects are aggravated by structural discontinuities. This Chapter is considering the cause of longitudinal bending and its effect upon structures.

**- Stresses** – a stress is the mutual action between the parts of a material to preserve their relative positions when external loads are applied to the material. Thus whenever external loads are applied to a material, stresses are created within the material.

**- Tensile and Compressive Stresses** – when an external loads is applied to a material in such a way as to cause an extension of the material is called a "tensile" load, whilst an external load tending to cause compression of the material is a "compressive" load.

**Figure:** 1

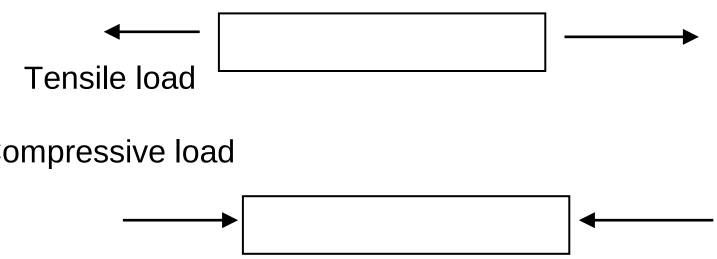



Figure 1 show a piece of solid material of cylindrical section, which an external load W is applied. In the first case the load tends to cause an extension of the material and is therefore a tensile load, the applied load creates stresses within the material and these are called *"tensile"* stress. In the second case the load applies is one of compression and the consequent stresses within the material are called *"compressive"* stresses. When a tensile or compressive external load is applied to a material the material will remain in equilibrium only so long as the internal forces can resist the stresses created.

**- Shearing stresses** – A shearing stress is a stress within a material, which tends to break or shear the material across.

**Figure:** 2

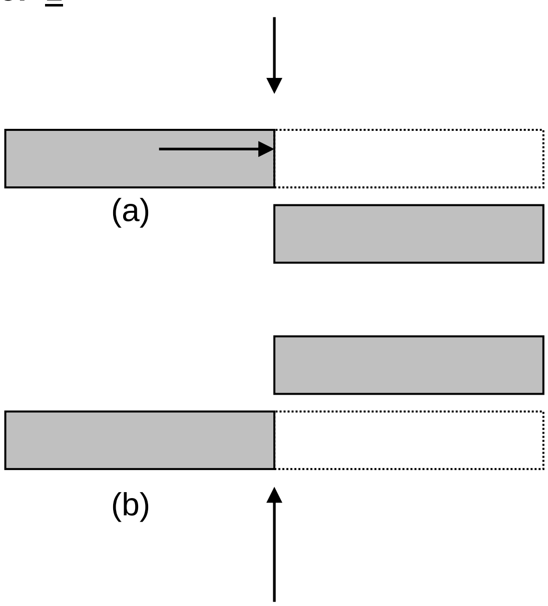


Figure 2 illustrate shearing stresses, which act normally to the axis of the material.
In the following text when the direction of a shearing is such that the section of the right-hand side of the material tends to move downwards, as shown in figure 2 (a), the stresses is considered to be positive, and when the direction of a stress is such that the section on the right hand side tends to move upwards as shown in Figure 2 (b), the shearing stress is considered to be negative.

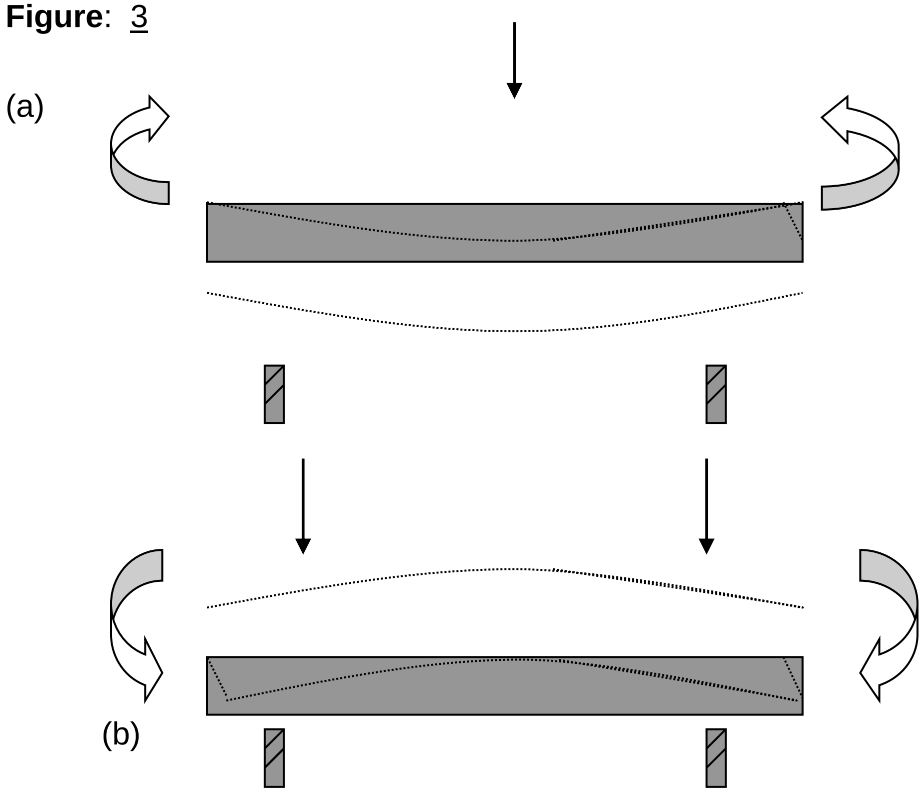
Shearing stresses are resisted by the material but shearing will take place when the shear stress reaches the ultimate shear of the material.

**- Complementary stress** – it has been stated that when a direct load is applied to a material, stress are created within the material and that the material will remain in equilibrium only so long as the internal forces can resist the stresses created.

**Supported Beams**

**Bending Moments in Beam** – the shear forces and bending moment created within a beam depend upon both the way in which the beam is supported and the way in which it is loaded. The bending moment at any section within the beam is the total moment tending to alter the shape of the beam as shown in figure 3 and is equal to algebraic sum of the moments of all loads acting between the section concerned and either end of the beam.

**Figure**: 3



In the following text, when a bending moment tends to cause "*sagging*" or downwards bending of the beam as shown in Figure # 3(a), it is considered to be a negative bending moment and when it tends to cause "*hogging*" or convex upwards bending of the beam, as shown in figure 3(b), it is considered to be positive. Also, when bending moments are plotted on a graph, positive bending moments are measured below the beam and negative bending above.

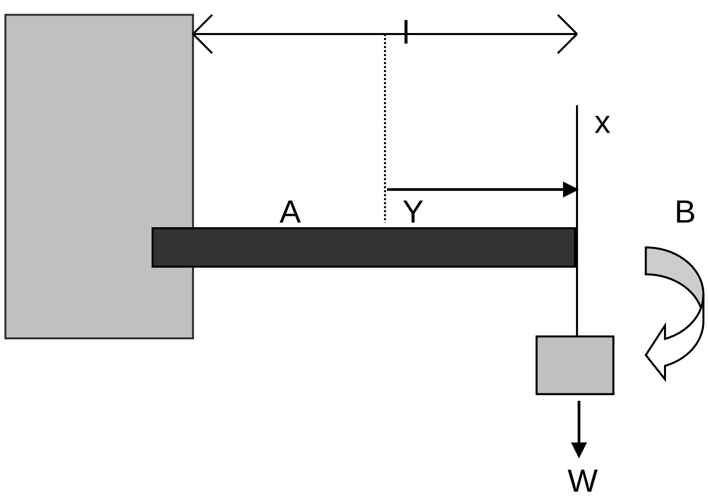
**- Shear Force and Bending Moment Diagrams** – The shear forces and bending moments created in a beam, which is supported and loaded in a particular way, can be illustrated graphically.

Consider the first case of cantilevers, which are supported at one end only:

***Case 1***:

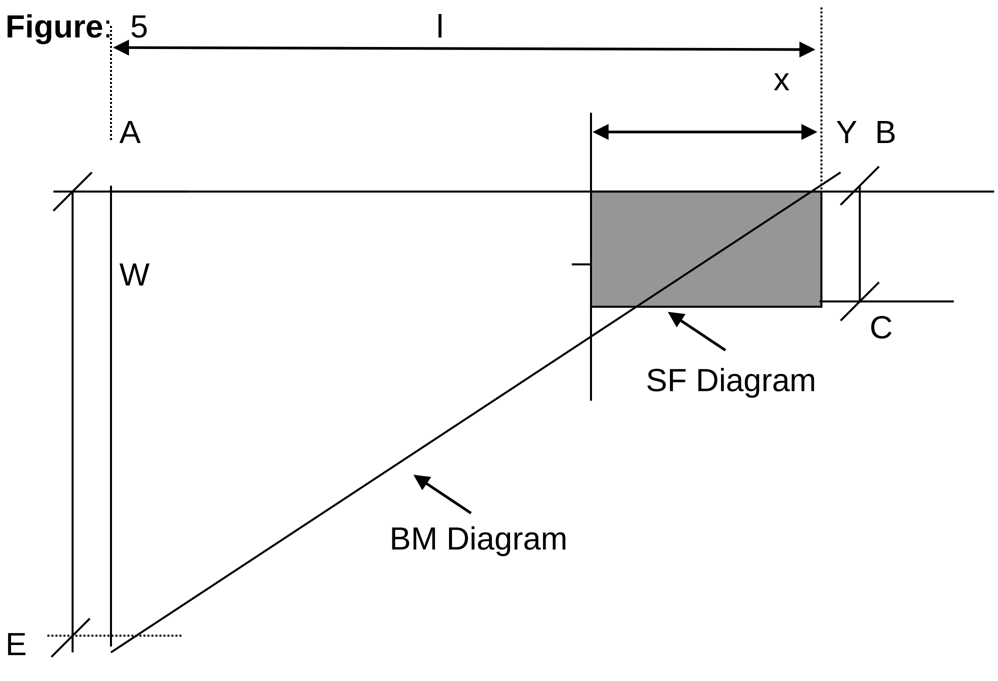
The beam AB in figure 4 is fixed at one end only and carries a weight "W" at the other end.

**Figure**: 4




If the weight of the beam is ignored then at any point Y in the beam, which is at distance X from the end B there is a positive shearing force W and a positive bending moment W x X. There is thus a positive shearing force W at all sections throughout the length of the beam. This is shown graphically in figure # 5 where AB represents the length of the beam (l), and the ordinate AC, which represents the shearing force at A, is equal to the ordinate BD which represents the shearing force at B.

**Figure**: 5




The bending moment at any section of the beam is the algebraic sum of the moments of forces acting on either side of the section. In the present case, the only force to consider is W which acts downwards through the end B. Thus the bending moment at B is zero and from B towards A the bending moment increases, varying directly as the distance from the end B. The maximum bending moment, which occurs at A, is equal to W x l. This is shown graphically in figure 5 by the straight line BCE.

The shearing force and bending moment at any point in the length of the beam can be found from the graph by inspection. For example, at Y the shearing force is represented by the ordinate YF and the bending moment by the ordinate YC.

It should be noted that the bending moment at any point in the beam is equal to the area under the shearing force diagram from the end of the beam to that point. For example, in figure 6, the bending moment at Y is equal to W x X and this, in turn, is equal to the area under the shearing force diagram between the ordinates BD and YF.

# 4. UNLOADING SYSTEM: OPERATION AND MAINTENANCE

## 4.1 Hatch Covers

### - Single Pull Hatch Covers

The classic modern hatch cover is the “single pull” which remains the most common of all the various forms now in service and may rightly be described as the natural successor to traditional beams and boards. This cover derives its name from its immediate predecessor, the ‘multi-pull’ cover, which consisted of a series of individual panels similar to those of the single pull, but unconnected. Each panel has to be rigged before being pulled one at a time into stowage.

The complete cover consists of a number of narrow panels, which span the hatchway and are linked together by chains. In the closed position, the panels’ sides sit firmly on a horizontal steel bar, attached all round the top edge of the coaming, which takes the weight of the cover. Just inside the side plates is a rubber gasket attached to the cover, which rest on a steel compression bar forming a watertight seal. Extending from the side coamings at the ends of the hatchways where the covers are stowed are steel rails, which allow the individual hatch panel to be transferred to their stowage location when the hatch is opened.

### - Folding Covers (hydraulic or wire-operated)

Folding covers may be fitted at both weather deck and tween-deck hatchways. In its simplest form, this type of hatch cover consists of two flat-topped panels, similar in basic construction to those of the single pull system. Complex configurations may have three or more panels at each end of the hatchway, although installations with uneven number of panels are rare. Wire-operated covers having more than two panels require special rigging and their operation is therefore slow.

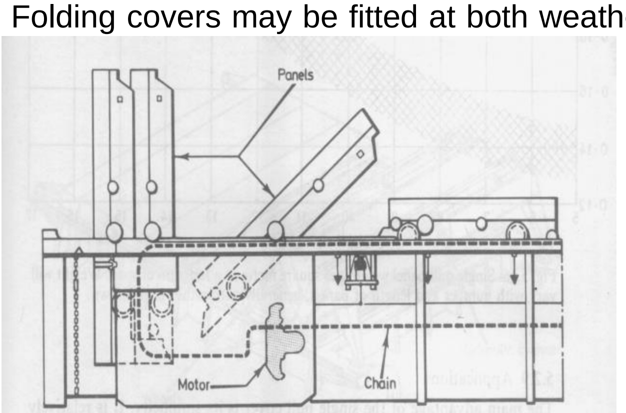



Fig. 5.15. Long chain drive. In this case the leading panel is fixed to a continuous chain powered by an external drive unit.

**- Direct Pull Covers**

Direct pull covers are a recent development, usually found in general cargo ships where multi-panel covers have to be operated by a wire, using ship's gear. Three-panel covers are usual. The panel at the stowage end is fitted with a hinged stowing arm; the second panel is hinged to the third at its bottom edge. The second panel carries a fixed closing arm, which, during the opening operation, engages a guide and is deflected downwards. The trailing edge of the third panel is supported on a wheel, which runs on a track at the top of the coaming. All the above components, except the sheave, are fitted to both sides of the cover.

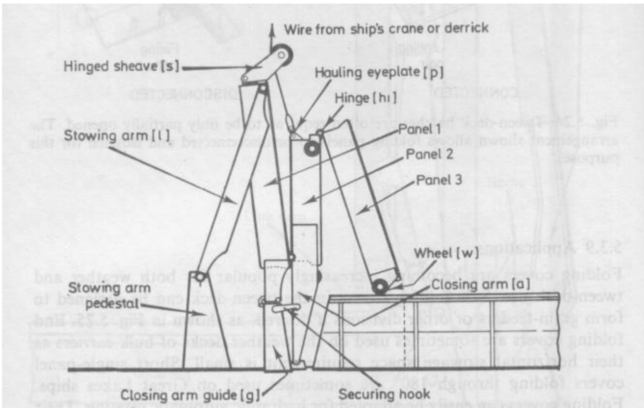



Fig. 5.26. Direct pull cover in the open position. The key letters refer to the text in Section 5.4.

**- Roll-stowing Covers – Rolltite**

Roll-stowing covers are often called Rolltite, the trade name of a type of hatch cover supplied by MacGregor, which has panels that roll on to a drum for stowage. The cover has been developed from a roll-stowing cover originally designed by Ermans. It consist of a number of panels spanning the hatchway, each pair of which is longer than the pair immediately before it, viewed from the stowage end. A single wheel resting on a track at each side supports the leading panel. The track is inclined towards the coaming top at the stowage end and each panel has a horizontal and vertical section.

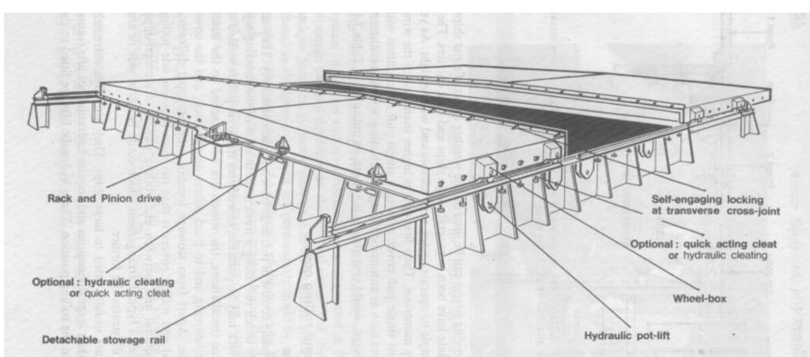



Fig. 5.37. A pair of typical side-rolling covers with rack and pinion drive and hydraulic lifting and cleating.

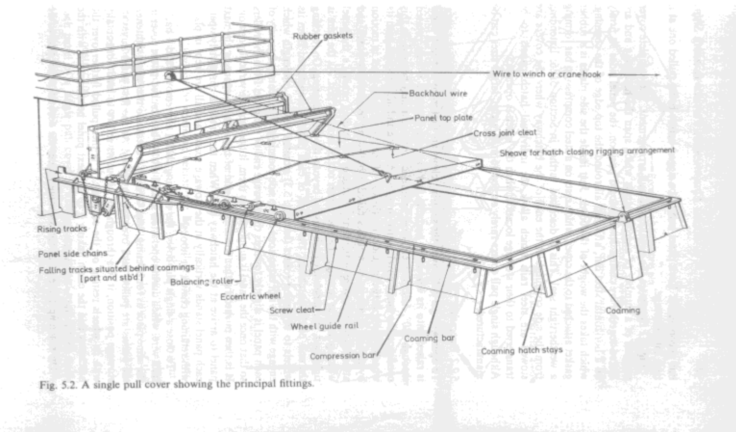


Fig. 5.2. A single pull cover showing the principal fittings.

The pressure pad or roller of the vertical section rests on an inclined ramp situated on the inside of the coaming. A stowage drum is situated at one end of the hatchway. This extends over the full width of the hatchway and is connected to the cover by means of bridging arms at both sides. The drum is mounted on a structure situated some distance from the end of the hatchway, which also contains the powering mechanism.

**- Side and End Rolling Covers**

Rolling covers usually consists of two large panels at each hatchway. They are fitted with wheels, which roll along a track at both sides of the coaming top. Stowage rails, which maybe portable, extend this track via pillars welded to the deck. In some installations, the wheels are not attached to the hatch cover but to the coaming and to a fix pillars on deck, and the cover rolls across them. Apart from stowage location, the principal difference between side and end rolling covers is that the joint between the side rolling panels is longitudinal and between end rolling panels is athwart ship.

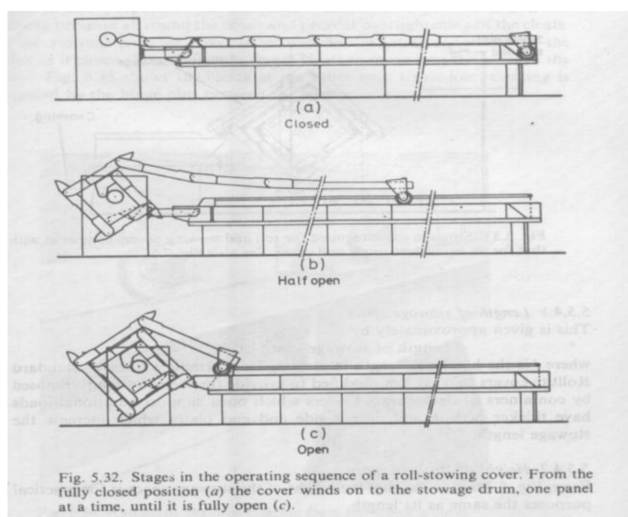


Fig. 5.32. Stages in the operating sequence of a roll-stowing cover. From the fully closed position (*a*) the cover winds on to the stowage drum, one panel at a time, until it is fully open (*c*).

These covers are usually fitted to large ships. They are often extremely heavy owing to their large dimensions and require hydraulic pot lifts (rams) to raise them into the rolling position. These hydraulic lifts are fitted to the coaming below the wheels (in their closed position).

**- Lift and Roll Covers (piggy back)**

Lift and roll covers often called piggyback are a development of rolling covers. Each cover consists of two panels, one of which has powered wheels. In the way of the 'dumb' panel, four hydraulic rams, which act vertically upwards, are fitted to the coaming. These engage in lugs on the sides of the panel to lift it high enough above the coaming for the motorized panel to roll underneath. The dumb panel is then lowered onto the motorized panel so that both can be moved together. The side coamings can be extended so that the two panels can be stowed beyond the hatch end.

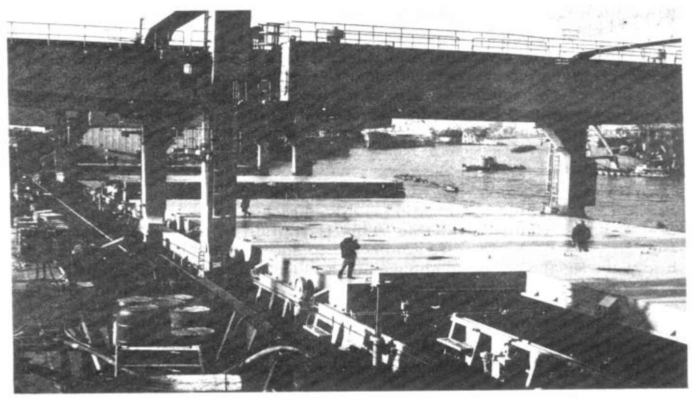


Fig. 5.45. Lift and roll (piggy-back) covers on a forest products carrier. A 'dumb' panel is shown resting on top of a powered panel. The two gantry cranes span the full width of the hatches.

Alternatively, these covers can be side-rolling, stowing abreast the hatchway.

**- Pontoon Covers**

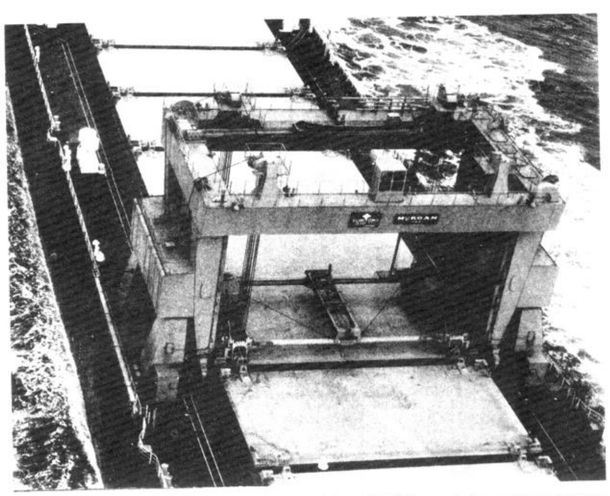


Fig. 5.54. Pontoon weather deck covers fitted in a LASH vessel. Pontoon covers are also shown in Figs. 8.7 and 10.5. Note the 500-tonne gantry crane.

Pontoons are the simplest form of steel hatch cover and are merely lifted on and off the hatch coaming. Two types are generally fitted;

-single piece covers for weather decks particularly on cellular container ships;

-multi-panel covers on tween-decks of simple multi-deck cargo vessels.

Single piece covers are large and awkward to handle but since they can be lifted off the ship completely, no on-board stowage space need be provided. Often, they can be stowed on top of adjacent hatch covers.

This is an advantage in large container ships where the non-opening deck space must be kept to a minimum. Hatchways can be covered by a single panel or by a series of interlocking panels. They are used for both weather and tween-deck hatchways. Tween-deck pontoons are usually in several sections so that they may be lifted through the weather deck hatchway and stowed on deck. The size of pontoons is limited by the capacity of the lifting gear available to remove them.

## 4.2 Deck Cranes

Craneage in ships, and in ports, has been one of the more outstanding developments in transportation technology in an endeavor to increase handling facilities through improved lifting and speed capacities. In this connection, the average 5-ton crane in use in ships at the end of the Second World War has now been overtaken by capacities up to 25-30 tons. Specialized cranes, for particular classes of loads, and ships, can handle up to 40 tons of general character.

International regulations now set more stringent tests in crane construction, covering drums, wires and sheaves; necessary safety equipment and control devices. Included also are provisions to meet environmental considerations in minimizing noise, which can have more disturbing effects upon crane drivers, loading supervisors, and stevedores working in the holds. As the size of the crane increases, so can the noise be more pronounced. It is interesting therefore to note that the I.S.O. (International Organization for Standardization) has issued ratings for noise levels to be observed and crane manufacturers take these into account.

Furthermore, distinctions are made between general cargo cranes, grab cranes and heavy unit cranes since the dynamic forces activating on these different handling/lifting procedures, require different constructional considerations.

### - Deck Cranes in General

Electro-hydraulic single deck cranes range, generally, over hoisting capacities of 3-40 tons.

Cranes fitted as “fixed” benefit from mountings that provide height visibility well above the hatch openings. Visibility and line of vision are important, if not vital, to crane grab operators.

Effective hoisting, luffing and slewing are the three essentials of good crane work and are the activities needful of attention by Cargo Officers, depending upon the type of labor employed as cab operators. Unnecessary acceleration, retardation, sudden and rapid restriction increases the normal stresses provided by a load upon the cargo gear, apart from its effect upon the mechanism of the crane, however, robust this may be. Modern deck cranes incorporate these three functions by automatic lever controls in the operator's cabin.

### 4.2.1 Grab Bucket (Conventional)

**Particulars**

Four sets of Orange Peel Type Grab Bucket are stowed on port main deck including one (1) spare. Each grab weighs 7.5 tons with a capacity of 15 cu. meters. It is secured on the rest stand with 6 turnbuckles.

**Changing from Lifting Beam to Grab Bucket**

- Remove turnbuckle lashing off the grab.
- Set the lifting beam on deck by lowering operation. Shift switch to "BY-PASS" when limit switch is actuated.
- Remove grabbing rope joint and connect to fitting metal at grab side confirming "S" & "Z" lays fitted on both sides.
- Remove hoisting rope from lifting beam.
- Shift select switch to "GRAB".
- Swing the jib until it is directly above the grab upper fittings while slowly picking-up wire ropes by hoisting operating.
- Attach hoisting wires to connecting chain on grab side then secure with spring pin.
- Shift "ROPE WIND" switch to "GRAB" then make hoisting operation until all four (4) wires are balanced.
- Switch "ROPE WIND" switch to normal.
- Operate grab opening/closing and confirm limit switches if properly activated.
- Gear is now ready for working on grab bucket.

**Changing from Grab to Lifting Beam**

- Set grab bucket to rest stand on deck.
- Slack wires by lowering operation.
- Remove hoisting ropes from connecting chain.
- Continue paying out wires until it rest on deck then remove grabbing wire.
- Swing jib directly above lifting beam set on deck.
- Connect hoisting and grabbing wires to lifting beam.
- Shift "ROPE WIND", switch to "HOIST" then "GRAB" and make hoisting operation until four (4) wires are balanced.
- Confirm hoisting & grabbing wire-connecting points are about 1.0m apart.
- Shift "ROPE WIND". Switch to "NORMAL".

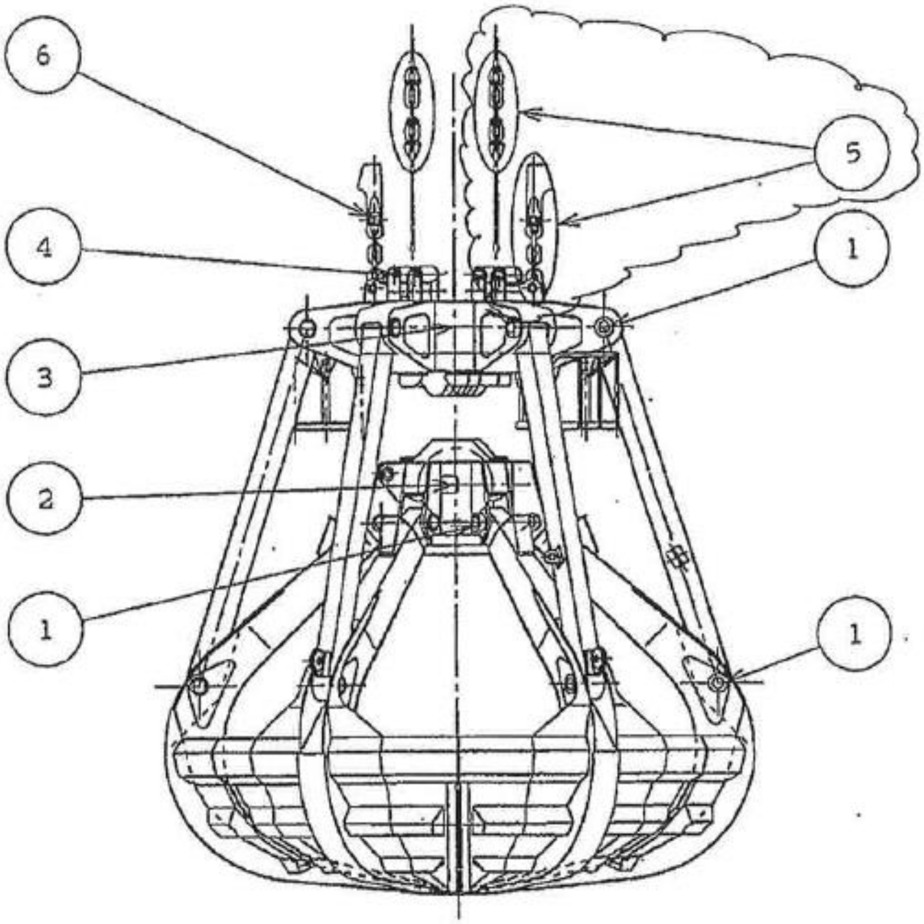
- Change over key switch to "HOOK" and operate hoisting up operation.
- Gear is now ready for working with the lifting beam.

**Replacement of Grab Wire Ropes**

- Replace the lifting beam with the grab bucket.
- Settle the grab bucket fully opened on deck, disconnect grabbing ropes at its joints and secure the ropes (crane sides) with a messenger line tied to the railings.
- Remove the cotter stopper and pullout rope cotter off the sheave.
- Cut the bended end of the old wire and attach a guide rope by knitting together with a seizing wire. (pulling grips cannot be used as the diameter of the wire is just exactly the same groove of the cotter sheave.
- With the guide rope properly attached, pull the old wire manually out from the guide rollers until completely free.
- Remove the guide rope from the old wire and attach the end of the new wire. Confirm that the correct type of rope (Z or S) is attached.
- Pull the guide rope manually with utmost care not to break the ropes at its joints until the new wire is rove completely through all the sheaves up to the cotter sheave.
- Secure temporarily the end of the wire and replace the other wire on the same procedures as above.
- Fit the end of the two wires in the cotter sheave in opposite directions. Pull the wire with a chain block to secure tightly the rope cotter. Be certain that the rope ends do not protrude out of the cotter sheave.
- Connect the newly fitted grab wires to the grabbing wires (crane side) and perform opening/closing operation of the grab bucket until the cotter stopper can be properly secured.
- Replace the grab bucket with the lifting beam and secure the jib on the jib rest.

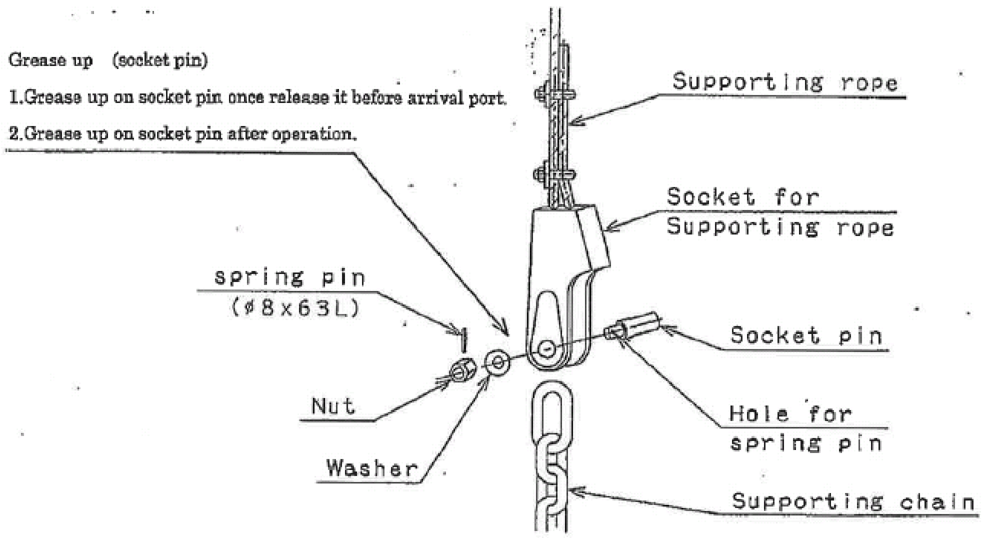
| No. | Name | Q' ty | Method | Lubrication interval | Remark |
|---|---|---|---|---|---|
| 1 | AXLE | 18 | GREASE GUN | 1 TIME/8 HOURS | |
| 2 | DO | 4 | DO | DO | |
| 3 | DO | 4 | DO | DO | |
| 4 | PIN | 8 | DO | DO | |
| 5 | CHAIN | 2 | GREASE | 1 TIME/48 HOURS | The grease for wire rope cannot be used. |
| 6 | PIN | 4 | DO | DO | |

8) GREASE UP POINTS FOR GRAB BUCKET

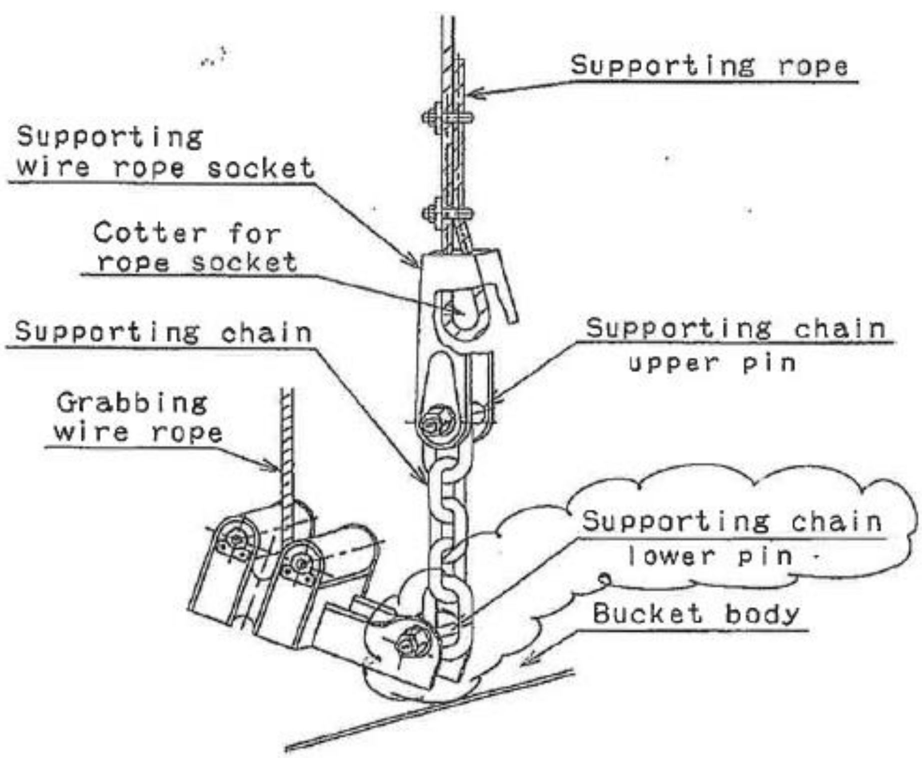



* The grease nipple is using PT type pin type.
* Please supply with oil enough until oil supply can view grease on the side in a grease gun.
* Grease should apply EP-2 grease.

Rope joint for supporting (hoisting)



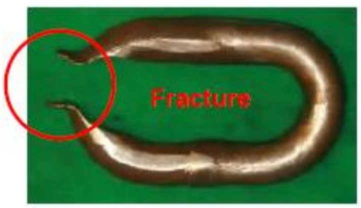

Supporting chain and rope guide block

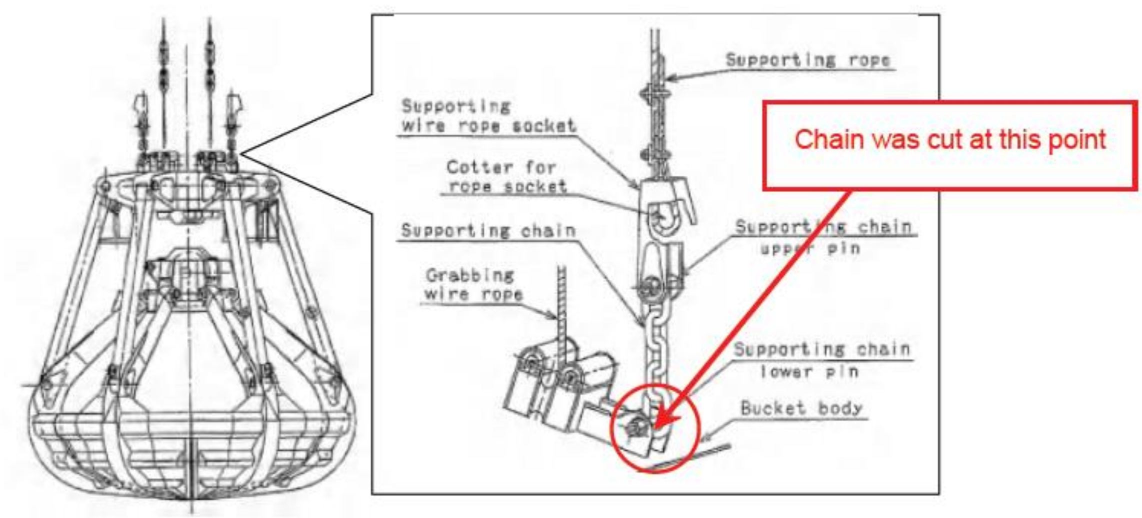


### 4.2.2 CCSR 2011-05(1-Dec-11): Damage to Grab Bucket Support Chain

Recently, the grab bucket support chain, which links the hoisting wire and the grab bucket, was damaged on a chip carrier under NYK operation while the carrier was at a port in Japan. Fortunately, the grab bucket was supported by the hoisting wire and grabbing wire and thus did not fall. However, this trouble could have resulted in a serious injury or accident. Therefore, we would like to provide an outline of this trouble and the below lessons learned so that a similar accident can be avoided in the future.

**Outline:**
During the discharging operation using the ship's crane, the No. 1 crane's grab bucket support chain suddenly fractured. At this moment, the grab bucket was opening and wood chips were being dropped into the No. 2 hopper. The fractured link was missing and was suspected to have contaminated the wood chips, but it was eventually found in the No. 3 cargo hold by stevedores. The chain was fixed using a ship's spare. After support chains of other cranes were examined, cargo work was resumed.




**Cause of Accident**
A laboratory analysis was carried out, and it was found that the lowest link of the support chain (the S-twist wire side) was fractured because the thickness of this link had decreased greatly. The original diameter of this link was 30 mm. It had been used for more than five years. The analysis revealed only about 3 mm of thickness remaining when this link fractured. The upper link of the chain also showed decreased thickness, to about 12 mm from its original 30 mm.

After this trouble, we examined the condition of support chains on other vessels, and we discovered the thickness of some chains to have worn down as well. Some chains couldn't be inspected because the lower pin was stuck and could not be taken out due to a lack of maintenance. An inspection of this part is usually carried out visually. Although inspection of this part is important, we recognized that the inspection by the crew is often not sufficient.

**Lesson Learned**
We have learned the following from this accident to prevent a similar accident in the future:
1) Careful regular inspections are essential for all support chains, not only the parts that are visible but also the parts that are not.
2) Replacement criteria for the support chain should be prepared and must be maintained and monitored.
3) The condition and specifications of support chains should be confirmed as soon as practicable. If the condition is poor, a replacement plan and schedule should be discussed with your management company.

# 5. PORT PARTICULARS

## 5.1 Loading Ports

The choice of the loading ports would depend on its ability to accommodate the ship and cargo including provisions for cargo loading equipments. The main component in choosing the loading port is the length of quay and the depth of water alongside, numerous cranes equipped with grabs and, possibly most important of all, an extensive area for off-loading. It is not always possible for such cargoes to be cleared from the port area as quickly as a vessel can be loaded or discharged. Space is therefore essential for lorries to be loaded at the back of the berth at all times.

A bulk berth can load at any rate between 2,000 – 15,000 tons a day depending on the equipment available and the density of the cargo. Logically, the identical grab may pick up 20 tons of iron ore in one go, but if filled with a lighter substance such as phosphate, the daily turnover would be much lower.

Modern coal loading ports facilities can load as much as 10,000 tons per hour.

## 5.2 Discharging Ports

Bulk cargoes are destined for the manufacturing industries, and arrive in huge bulk. The importers cannot cope with the sudden delivery, to say, 60,000 tons. They will have their own domestic stocks on the port site and these are maintained at a reasonably regular amount by an even flow of Lorries distributing to the various factories, etc., with which the importer deals.

The grab cranes usually discharge bulk cargoes into giant hoppers which, in turn, feed into road or rail trucks or onto a conveyor belt for storage at the quay side.

Other equipment on these quays would usually include bulldozers for leveling off and otherwise controlling the state of the dumps, and a smaller version of the bulldozer, sometimes called a calf-dozer, is frequently used on board a vessel to help clean out the last cargo from the holds. Numerous port developments are being undertaken to accommodate different ship requirements for the port to corner the trade.

## 5.3 Port Restrictions

Details of any restrictions imposed by a certain port, such as, port limit, documents, pilotage, anchorage, maximum size of the vessel required, tugs, berthing, etc. should be consulted in the Guide to Port Entry, Coast Pilot Information, etc.

A prudent mariner should be aware of these restrictions to avoid any violation imposed by local authorities.

With the implementation of ISPS code on July 2004, crew personnel should understand/considerate about port security personnel, Coast guards and other port officials are strict due to the threat of terrorism.

*<u>FROM BULKER STARS – NYK LINE INSTRUCTIONS</u>*

*We request all vessels that call the port of Newcastle in Australia to note the below-mentioned procedure in order to prevent any delay in cargo loading.*

***Background***
*PWCS (Port Waratah Coal Services Limited) recently issued the attached letter titled "Vessel Suitability at PWCS." A recent review of vessel loading and deballasting performance at PWCS has identified 70 vessels that have demonstrated "poor performance" and are thus not suitable for loading at Kooragang Coal Terminal (KCT). A vessel load rate between 4,500 tph and 5,000 tph is considered to be "moderate performance," and vessels demonstrating such load rates will be accepted for future voyages if there is a commitment to and demonstration of improvement provided to PWCS prior to the next nomination.*

***Vessel Performance Criteria***
*PWCS recommends the following criteria be adopted for all vessels preparing to load at PWCS Terminals (all criteria are for both KCT and CCT Terminals unless otherwise stated). Vessels are to be capable of loading at an average load rate of 4,500 tph as a minimum;*

*□□ KCT Minimum Vessel Load Rates:*
*Cargo size < 95,000t must be > or = 5,000tph*
*Cargo size > 95,000t must be > or = 5,500tph*
*□□ CCT Minimum Vessel Load Rates:*
*Single head only (1 shiploader): > or = 1,900tph*
*Dual head (2 shiploaders): > or = 3,000tph*
*□□ No deballast stoppages. The deballasting time must be less than the nominated load time. Deballasting must be completed before the Interim Draft Survey.*
*□□ Interim Draft Survey must be a running survey and less than 15 minutes. Land based Marine Surveyors are available to assist in achieving this objective.*
*□□ For vessels loading multiple cargoes each cargo must be completed in its entirety before commencing the next cargo.*
*□□ Minimum cargo size to be 20,000 t.*
*□□ The vessel must be ready to sail no later than 1 hr from last coal on board.*
*□□ Vessels should endeavor to load the first 2 or more passes to complete holds.*

*Though the minimum vessel load rate is shown above, but you should be aware that the maximum ship loading capacity at KCT is 10,500tph and actual loading rate often comes more than 6,000tph.*

***<u>Findings</u>***
*We carried out an investigation of why the identified vessels received poor performance ratings, and we discovered the following:*

***(1) Vessels requested an unnecessary sequence without considering the consequences***

*Even though the stress and trim of the vessel were acceptable to complete each hold (without end hatches) in one pass, vessels requested two or more passes to complete each hold.*

***(2) Unnecessary time and stoppage for the interim draft survey***

*Some vessels took a long time to read unnecessary points of draft (seaside fwd and aft) for the interim draft survey. If you have the frame sketch of the draft mark positions, you can easily calculate your fwd and aft draft using the difference in the midship draft.*

***(3) Insufficient trim while stripping and bad planning***

***(4) Deballasting using main pumps***

*Several vessels stopped pumps immediately even though the tanks still had ballast water and did not concentrate on using the main pumps to deballast. Those vessels do not have a ballast console, and the engineer does not stand near the pumps at the final stage of pumping out ballast from each tank.*

***(5) Unnecessary stoppage without considering the consequences (unnecessary safety margin)***

*Some vessels request that loading be stopped for four to five hours every voyage in the interest of safety, even though the vessel really only needs a stoppage of only one or two hours.*

***Recommendation***

*In Newcastle, we recommend that you satisfy all items of the vessel performance criteria mentioned above. Further, you are requested to inform the operator of your situation without any delay to the stowage plan if you have any difficulties following the above criteria.*

# 6. SHIPHANDLING

## 6.2 Maneuvering

By convention, engines are designed to have clock-wise turning shafts when going ahead and when viewed from astern. For this reason, right-handed propellers are nearly universal in single-screw ships. Twin-screw ships invariably have outward-turning screws, i.e. the propeller on the right side of the ship is right-handed, and the propeller on the left side is left-handed. When going astern, both propellers naturally turn inwards.

Triple-screw ships are usually maneuvered on the outer two screws, the center one being used to increase ahead or astern power.

Quadruple-screw ships have a pair on each side, a right-handed pair on the starboard side and a left-handed pair on the port side. They are usually maneuvered on the outer screws only. A turbine-equipped ship with a four screws generally has the outer pair only capable of going astern.

The thrust of the propeller blade is divided into two components, a fore-and-aft one and a very small athwart ships one. The latter is called *transverse thrust, screwing effect, or starting bias.*

The result of this force may be reduced by considering the propeller to be a wheel, carrying the stern through the water at right angles to the vessel's line of motion. The cause, however, considering an immersed propeller, is mainly due to the suction exerted upon the hull immediately behind the rotating blades.

Summarizing then, in a single-screw ship with a right-handed propeller:

***When going ahead,*** the bow cants to port, the swing decreasing as way is gathered and possibly changing in the opposite sense.

***When going astern***, the bow cants strongly to starboard and will continue to do so until correcting helm is used.

**- Peculiarity of Shiphandling on Bulk Carriers**

Due to their size, Panamax and Cape-size Bulk Carriers require extreme caution when being maneuvered specially in loaded condition. The Officer must bear in mind that lateral nor fore and aft motion of these ships may not be visible during the initial stages of the maneuver. However, this so called "absence of motion" does not mean the ship is not responding at all. On the contrary, this "absence of motion" is due to the tremendous amount of weight of the vessel which restricts her initial movement. It is prudent therefore to anticipate, that once movement/s become visible the inertia of the vessel may result in an "overshoot" if not carefully monitored.

Panamax Bulk Carriers are vessels whose principal dimensions (LOA, Max breadth and Draft) will enable them to safely transit the Panama Canal with all its restrictions. While Cape-size Bulkers, due to their size and principal dimensions, cannot safely transit the Canal. They're regular trading route passes the Capes (Cape Horn, Cape of Good Hope & Cape Agulhas) thus the name Cape-size.

### 6.2 Anchoring

The Master shall prepare a plan for anchoring in accordance with the anchoring procedures. With the use of the ship's maneuvering data, the plan should contain but not limited to:

a) approach tracks and courses to steer;

b) wheel over position;

c) points at which to reduce speed;

d) the position at which to reverse the engine;

e) the position to drop anchor;

f) means of monitoring progress and determining arrival at critical points;

g) clear and specific instructions from Master, and other important matters.

1. Selection of anchorage – Investigate the port beforehand, and select th most suitable anchorage. The following criteria must be considered in the selection of suitable anchorage:

- ⇨ Holding quality of the bottom
- ⇨ Adequacy of room for swing
- ⇨ Protection from wind and sea
- ⇨ Availability of suitable exit in event of extreme weather
- ⇨ Availability of objects for position determination
- ⇨ Local port regulations for anchoring
- ⇨ Company, agent or local authority instructions
- ⇨ Guidance from Sailing direction, Guide to Port Entry and other publications

2. Determining of anchoring method-normally, anchoring is by single anchor, but double anchoring, two anchor mooring or other appropriate anchoring methods shall be determined considering weather and sea conditions, depth and room for anchorage, etc.

3. Deciding which anchor to use-either port or starboard to use considering the anchoring method, attitude of the ship when approaching the anchorage, and the tidal current set, frequency of use of both anchor up to the present, countermeasures against expected rough weather, etc. Also, decide which anchor to use first before the other.

4. Deciding on the length of anchor chain- when deciding on the amount of chain to be extended, give consideration of anchoring, the size of the anchorage, and the weather during the anchored period. Prudent Mariner should consider the capacity of the windlass and the depth of the bottom.

Example: Determining the amount of anchor chain to laid out:

For Normal Anchoring S = 3D + 90 meters

For rough weather anchoring S = 4D + 145 meters

Where: S – the length of anchor chain laid out

D – the depth of the water in meters

One shackle is equal to six fathoms (1-fathom=90 feet or 27.45 meters)

5. Anchoring approach plan- prepare a plan for gradually decreasing speed suitable for the maneuverability of your ship. Illustration below will serve as guidance/reference:

Example: Method of reducing speed gradually

**- Huge vessel fully loaded**

| Distance to anchorage position (miles) | Speed ( knots) | Order |
|---|---|---|
| 7 | About 12 | S/B Engine |
| 6 | 10 | H/Ahead |
| 5 | 8 | S/Ahead |
| 4 | 6 | D/Slow |
| 3 | 5 | Stop Engine |

Note: If it is necessary to drop the headway speed to less than 5knots, place engine on *Dead Slow Astern* at appropriate times.

(As the ship head will swing, do not run the engine for more than 11 minutes)

When within 0.5 NM, take off the ship's headway and come to stop by going from Slow Astern to Half Astern.

**- Handy size bulk carrier**

| Distance to anchorage position (miles) | Speed ( knots) | Order |
|---|---|---|
| 5 | About 12 | S/B Engine |
| 4 | 10 | H/Ahead |
| 3 | 8 | S/Ahead |
| 2 | 6 | D/Slow |
| 1 | 5 | Stop Engine |

Note: Engine speed should be gradually reduced before coming to S/B engine and the speed should be at Nav. Full when the S/B Engine is reached.

When within 0.5 NM, take off the ship's headway and come to stop by going from Slow Astern to Half Astern.

The cable is laid out, and engines are used to relieve stresses in the cable just before the vessel brings-to. The Master usually prefers to stop his vessel at the anchorage by going astern. When the propeller wash reaches the ship abeam of the bridge, he uses that as a guide that the ship has lost way. The engines are then kept going dead slow astern as the anchor is let go. Engines are stopped almost immediately and the vessel drifts astern laying out her cable, which grows continually ahead. Just before the required scope is out, the engines are touched (kicked) ahead so that the vessel gets her cable as gently as possible. This method ensures the chain being clear of the hull plating at all times.

In water up to 20 meters deep the anchor and the cable should be let go on the run, allowing about double the depth of cable to run, before checking it on the brake. If the cable is snubbed as soon as the anchor touches the bottom the anchor will be dragged along the seabed and will be unable to grip. Further, with the weight of the anchor off the cable, it sometimes happens that when the brake is released the cable will not render itself.

In water of over 20 meters, the anchor should be first being walked back to within 4 or 5 meters from the sea bed, and let go from there. This ensures that the anchor will not damage itself falling a considerable distance on to hard bottom, and also that the cable will not take charge and run out so rapidly that it becomes extremely difficult to hold it on the brake. This practice therefore considerably lengthens the life of the brake linings.

In deep anchoring depths, 50 meters or over, the entire operation of anchoring should be done under power. The gypsy should not be taken out of gear at all, because the heavy weight of cable between seabed and hawse pipe will undoubtedly take charge. Before this process, you must check the windlass capacity, considering the length of chain paid out and the depth of the bottom.

In a wind, it is better to approach the anchorage heading upwind. The ship is more easily controlled and will make little leeway. If the wind cannot be brought ahead, the ship can let go the anchor in the usual way and, using her engines to relieve stresses on the cable, swing to wind as she brings-to.

In a tideway, the vessel should stem the tide and again anchor with headway or sternway, as in calm weather or in a wind. Her helm will be of use even while making no way over the ground due to the tidal stream running past her.

Please refer to anchoring procedure in the SMS Manual.

## 7. CHARTER PARTY

### ❖ Contract of affreightment:

An agreement whereby an owner agrees to carry goods or supply his vessel to carry goods, and is the contract under which he is paid freight.

### ➢ Principal types of contract of affreightment:

- Charter party: Contract between the ship owner and the charterer.
- Bill of Lading: Contract between the carrier (who may be the ship owner or the charterer) and the owner of the goods. These are invariably issued even when the ship is chartered.

❖ **Charterparty:**

- A charterparty is a contract for the hire of a ship, under which the ship owner provides the use of the ship for a specified period of time (a time charter) or for a specified voyage (a voyage charter), and the charterer pays for the hire or freight.
- Under a time or voyage charter, the master and crew are employed by the owner, but receive instructions from both the owner and the charterer.
- Besides time and voyage charterers, other types of charters are demise, or bareboat whereby the charterer becomes the temporary owner of the vessel and employs his own master and crew.

**7.1 Time Charter:**

- A time charterparty is a contract, against an agreed payment, for a stated period, short or long term.
  The C/P may allow the period to be extended or shortened, and generally there is flexibility about the date for starting and ending the C/P, to allow for, the completion of the preceding, and the following voyages. Such time charters are referred to as period charters. Sometimes the time charter may be for a single voyage (for e.g. ‘one time charter voyage’ or ‘one North Pacific round voyage’) where the period of the charter is the time necessary to perform the voyage. Such charter is referred to as a time trip charter.
- For any time charter, the hire of the vessel will be at a daily, weekly or monthly rate for e.g. 8000 dollars per day, and this may be based on the tonnage of the vessel.
- A lump sum ballast bonus may be paid to compensate the owner for part of the cost of delivering the ship at the loading port.
- The owner appoints the master and crew.
- Under time charters the owner normally pays for:
  - Crew wages
  - Hull and machinery and P & I Insurances
  - Provisions, stores and spares
  - Lub oils and fresh water
  - Repairs and maintenance and delays caused thereby
- The owner is also required to pay for other items as agreed in the C/P and these may include:
  - Initial hold cleaning
  - Off hire survey (or 50% of joint on/off survey)
  - Time lost due to plant breakdown and cost of temporary cargo equipment to cover breakdown of ship’s gear
  - Deviation expenses
  - Fines due to ship’s operations

  - Non-compulsory tugs and pilotage (Pilotage which is 'recommended' or 'usual for the trade' is usually for charterer's account.
- The charterer will normally be required to pay for:
  - Daily hire.
  - The cost of bunkers delivered and consumed during the charter period.
  - Port charges and canal dues.
  - Stevedoring costs.
  - Compulsory tugs and pilotage.
  - Additional insurance premiums for breaking Institute Warranty Limits and trading in war zones.
  - Hold cleaning by crew during charter and on redelivery (the charterer may have the option of redelivery the vessel dirty if he makes a payment in lieu of hold cleaning).
  - Supply and labour for the application of special hold coatings.
  - Supply of special cargo fittings and dunnage.
  - Cargo fumigations.
  - Victualling of supercargoes.
  - On hire survey (or 50% of joint on/off survey)
  - Radio communications (to charterer / cargo related)
  - Reasonable entertainment costs.
- A time charter contains an off-hire clause for the benefit of the charterer, whereby if the ship is not in full working order to provide the services required and there is a loss of time because of that failure, (e.g., failure of main engine or ships cargo gear, arrest of a ship for smuggling) then the charterer is not liable for hire or the cost of bunkers for the time so lost. The vessel is in such cases said to 'Go off-hire'.
- A time C/P will normally stipulate the service speed and fuel consumption to be achieved in good weather conditions by the vessel in ballast and when loaded. Good weather is generally described as 'wind speed not exceeding 16 knots or force 4' (this system takes no account of wind direction and of current and swell. For e.g. a vessel may be required to do 14 knots at 34 MT/day when loaded and 14 knots at 30 MT/day in ballast.
  If a vessel fails to achieve the speed and consumption required by the C/P, underperformance and overconsumption claims may be brought by the charterer. It is therefore important that speed, fuel consumption, weather conditions, stoppages, changes of course, currents, damage to the vessel, changes in trim & displacement and any other factors influencing the performance of the vessel during the charter period are accurately recorded in the deck and engine log books as there is scope for both owner and charterer to manipulate the situation and secure as advantage or conceal a deficiency.
  The C/P may state that in case of a dispute, data provided by weather routing organizations will be favoured over that contained in the deck log book. Many

masters have a tendency to instruct the bridge watch keepers to log down wind force as 5 or above.

- Most C/P's state that written notice of liability in case of stevedore damage must be tendered by the ship to the party causing the damage within 24 hours of the occurrence. This notice is generally in a format provided for by the owner such as a stevedore damage form. Stevedore damage is usually settled between the owner and the stevedore, though it is the ultimate responsibility of the charterer as stevedores are servants of the charterer. If the notice is given then the charterer may escape his liabilities. If the damage is not discovered until later, because it was not apparent, the owner will claim against the charterer.

### 7.2 Voyage charters:

- A voyage C/P is a contract to hire the ship for the carriage of specified goods on a defined voyage or voyages, between specified ports or regions, for an agreed payment (freight), which may depend on the quantity of cargo carried (e.g. US$10 per tonne) or which may be a lump sum (e.g. US$ 100,000), whereby the sum may be paid or the use of the whole or part of the ship.
- The voyage charter provides for a fixed time called 'laytime', for loading and unloading the vessel. Laytime may be expressed as 'X thousand tones per weather working day' in which case laytime depends on tonnage loaded. If no laytime is stipulated, then there is an implied agreement that the charterer will load and discharge within a reasonable amount of time.
- If the charterer fails to load and unload within her laytime, he will be liable to pay the owner compensation at a rate mutually agreed upon. This is called demurrage. If no demurrage rate is stipulated, charterer will be liable to damages.
- Conversely, if the charterer succeeds, in loading or discharging the vessel in less than the time allowed under the charter, he will be allowed to receive 'Dispatch' at the rate provided. This benefits the owner in that he can use his vessel again more quickly. The dispatch rate is usually 50% of the demurrage rate.

### 7.3 Sub-chartering:

- Usually, vessels are hired by a charterer from the owner under one C/P (head charter), and then sub chartered by the first charterer to a sub-charterer under a second C/P (sub-charter).
- There may be one or more sub charters and these may be time or voyage charters, although generally the last charter in the chain will be a voyage charter.
- The first and any other intermediate charterer becomes known as the 'disponent owner' and is responsible to the sub-charterer for the owner's obligations.

- The first charterer remains responsible to the owner for performance of the head charter.
- The master must be alert to any conflicting instructions from disponent owners and sub-charterers.

**7.4 Fixing of a charter:**

- The owner's commercial department instructs the company's shipbroker to find a charterer and fix the vessel for further employment. The broker, who is aware of the company's policy and ship's particulars, seeks to find the best return.
- When a suitable charterer has been found, the company will complete a voyage estimate to see if the voyage will be profitable.
- The objective of voyage estimating is to calculate the approximate return on a voyage after deducting expenses from the expected return, and is completed on a voyage estimate form.
- During this process, the master of the vessel may be requested to provide vessels details and cargo calculations to determine whether the ship is suitable to carry a particular cargo. In fact the master may be asked to investigate a succession of possible voyages which are never confirmed, and though this is frustrating for the ship's officers, it is most important that utmost care is taken and mistakes are avoided.
- To fix a ship, there are many different standard C/P forms which are invariably used in an amended form with additions to and deletions from the basic printed wording. A C/P also has attached to it a large number of typed clauses referred to as 'additional' or 'rider' clauses, as agreed between the negotiating parties. These clauses deal with methods of payment, settling of disputes, insurances where the master has little or no involvement or they may deal with matters which are the master's responsibility.
- The voyage estimate form has space for insertion of 'Actuals' where actual earnings and costs are entered so that profitability of a voyage can be seen.

**7.5 Knowledge and compliance of Charterparty terms:**

- The master is frequently not provided with a copy of the C/P, and receives only owners' and charterers' voyage orders, which contain extracts of the C/P as each party considers it is necessary for him to know.
- The master should not hesitate to insist upon being provided with a legible copy of a C/P, because it has been known for charterers' orders to contain instructions which are not provided for in the C/P, and the master is unable to be fully aware of his rights and responsibilities and to ensure that the orders he has been given are valid.
- If a copy of the C/P is available to him, he should study the full contents in detail.

- The voyage orders in any case must be carefully studied by the master, chief mate and chief engineer and all other officers should be informed of these orders as they affect them. The voyage orders may be received by fax, telex, e-mail or regular mail.

### 7.6 Delivery and redelivery (On-hire and Off-hire) surveys:

- The start and finish of the charterparty are generally marked by delivery and redelivery surveys
- Their purpose is to observe and record the condition of the ship and the measure the bunkers aboard.
- The results provide facts for settling any claims relating to damage to the ship or bunkers consumed
- The surveys are normally undertaken by a surveyor representing the charterer, with a second surveyor or the master or chief mate representing the owner.
- The surveys list every item of damage in the holds and in the adjacent cargo working areas and require the soundings of all bunker tanks along with the bunker temperatures.
- In cases where the redelivery survey takes place in the discharging port, but the charter ends say no dropping the outer pilot, the measured bunker quantities must be corrected for the quantity of bunkers to be consumed from time of survey to time when the charter ends.
- On-hire and off-hire surveys can be the same as delivery and redelivery surveys, but can also be required during the course of a charter, if for any reason as discussed earlier, the vessel goes off-hire

### 7.7 Master responsibilities:

- It is the masters' obligation to protect the lives of the crew, ensure the safety of the vessel and the safety of the environment.
- He is also required to carry out the contract of carriage and preserve and care for the cargo on board and to carry it safely with reasonable dispatch.
- In a voyage the master is the owners' agent in providing necessaries which are to be provided by the owner, he is the charterers' agent for providing necessaries to be paid for the charterer and he may also act as the agent of the cargo owner in protecting the cargo owner's interest in the cargo.

## 7.8 Chartering Terms

**All Told** – total deadweight

**Advance Freight** – Freight taken from shippers to cover ship's disbursement during loading. The sum advanced is shown on the bills of lading and is insured by the shippers.

**Back Freight** – Freight charged to a shipper when a vessel cannot deliver her cargo at intended destination and has to return to the loading port with it.

**Cancelling Date** – the date mutually agreed upon between the shipowners and charterer, on which the vessel must be ready to load at the latest. Should the vessel miss her canceling date, charterers are entitled to cancel the charter party.

**Charter Party** – An agreement by which a shipowner agrees to place an entire ship, or part of it, at the disposal of a merchant or other person, for the conveyance of goods, binding the shipowner to transport them to a particular place, for a sum of money which the merchant undertakes to pay as freight for the carriage. Sometimes called as CHARTER.

**Charterer** – The person to whom is given the use of the whole of the carrying capacity (earning space) of a ship for the transportation of goods or passengers to a stated port or for a specified time. The remuneration and conditions of the contract are contained in the charter party.

**Chartered Freight** – Term by which freight is known when payment is made for the cargo space of an entire vessel or a part thereof under the charter party agreement.

**Days and Running Days** – Means consecutive calendar days counting from midnight to midnight and unless contract or custom dictate otherwise, includes Sundays and holidays whether work is actually done, or normally done at the port or not.

**Deadfreight** – The sum payable to the shipowner when the charterer has failed to load "a full and complete cargo" in accordance with the provisions of the contract.

**Demise Charter** – The charterer appoints the master, supplies the crew, acts as carrier, and takes over the full control of the ship, employing her as if she were a unit of his own fleet. The shipowner's remuneration takes the form of hire money usually fixed at a certain rate per ton of summer deadweight per calendar month, and payable in advance. The owner may retain the right to require the removal of the master and chief engineer, if dissatisfied.

**Demurrage** – If the charterer or consignee detains a ship beyond the agreed number of lay days or, where the lay days are indeterminate, detains her for unreasonable time, he will be in breach of the charter party so that the shipowner will be entitled to either “damages for detention” or “demurrage”.

**Despatch Money** – The shipowner becomes liable to pay dispatch money to the charterer or receiver when the loading or discharging process is completed before the laydays have expired.

**Distance Freight** – When it is impossible for the cargo to be discharged at the agreed port of discharged, delivery may be given at some other port, which is the nearest safe port. If the distance to such safe port is substantially in excess of the distance to the port originally contemplated, extra freight or distance freight, may become payable by the terms of the charter party.

**Distress Freight** – Times when chartering market is abnormally quiet, the owner of a tramp ship which might otherwise have to laid up may, having promised a tempting “starting parcel”, decide to place the ship on the berth as a general ship and advertise accordingly. If subsequently finding it difficult in obtaining completion cargo at normal or near normal rates, they may in preference to dispatch the ship with excessive vacant space resort to booking shipments at rates very far below those generally prevailing. Such low rates are referred to as
‘distress rates’.

**Free in and out** – means it is the responsibility of the charterers to load, or the consignees to discharge the cargo for their respective accounts.

**Freight** – The remuneration to which the carrier of goods by sea is entitled on the performance of his contractual obligations or otherwise, depending on the terms of the contract. According to the nature of the goods carried and/or the custom of trade, freight may be payable at an agreed rate per ton deadweight, per measurement ton, per freight ton or other unit, or ad valorem basis.

**Freight on Damaged Goods** – This is due in full but will be subject to counterclaim for damages unless the carrier is protected by exception clauses in the contract of affreightment or by common law exceptions. If the goods are so badly damaged that they have ceased to be goods of the kind shipped, then no freight can be claimed.

**Full and complete cargo** – relates to a full cargo in accordance with the custom of the port, which will bring the vessel to her permissible draught, either winter, summer or tropical loadline as the case may be.

**Lay Days** – This expression describes the number of days allowed by the charter party for loading and for discharging the cargo or, if so-called "reversible" lay days are provided for, for both processes.

**Laytime** – The time lost waiting for berth to count as loading/ discharging time. The laytime will commence to run when the ship starts to wait for a berth and will continue to run, unless previously exhausted, until ship stops waiting.

**Lump Sum Freight** – A ship may be chartered on a lump sum basis implying that a fixed amount of freight is payable by the charterer regardless of whether a full cargo is shipped or not. So long as some cargo is by some means delivered at the proper destination, the lump sum is payable in full, though it may be subject to counterclaim where goods have been stolen, jettisoned or lost, and the shipowner is not protected by 'exceptions'.

**Notice of Readiness** – Written intention stating that the vessel is ready to load or discharge in all aspects.

**Open Charter** – The charter party does not specify the kind of cargo to be loaded or the port of destination.

**Reporting Day** – This is the day on which the master's notice of readiness is tendered to the charterer or consignee.

**Reversible Lay Days** – A charter party may provide that a ship is to load and discharge a cargo at a given average rate per day, in which case lay days are said to be "reversible".

**Safe berth / safe port** – from a nautical point of view a berth is considered safe if a vessel can safely reach it.  During her stay at the berth in question the vessel must always lie safely afloat without touching the bottom at low tide.

**Sunday and Holidays Excepted** – A charter party provides that Sundays and holidays are not to count as lay days, those days still do not count even if they have not been used for working by agreement between the master and the charterer, however, if the agreement in the charter party is that Sundays and holidays are not to count 'unless used', then the position is different. The term 'holidays' applies only to official public or local holidays, and not to the time arbitrarily taken off by the workmen.

**Time Charter** – Vessel is leased to another person or company for a definite period, where he operates the vessel as though it is one of his own fleet. In Time Charter, the master is particularly concerned with requisition, provision and drydock. The payment for the vessel's service rendered is termed as "charter hire"

**Voyage Charter** – Is the use or hire of a ship for a particular voyage or a series of voyages. The payment for the vessel's service rendered is called "Charter Freight". The master is particularly concerned with laytime, demurrage and dispatch.

**Weather Working Day** – A working day of 24 hours on which work is not prevented by bad weather, whether work is intended or not.

**Weather Working Day of 24 Consecutive Hours** – This is a working day where anytime in which bad weather halts cargo operations, or would have if work was intended or contemplated, is not to count as laytime, whether the bad weather occurs in normal working time at port or not.

**Working Days** – Working days are days on which work is normally done at the port concerned, and is a 24-hour day from midnight to midnight even if work does not continue throughout the whole period. When lay days are described as working days they exclude Sundays and officially recognized holidays.

**Working Days of 24 Hours** – Each period of 24 hours in which work is normally done counts as one lay day even though the 24 hours are spread over two or more calendar days. Example, the ordinary working hours of the port is from 6 a.m. to 6 p.m., a working day of 24 hours would occupy two calendar days.

**Working Day, Weather Permitting** – For time to be lost with this type of day, loading or discharging must actually be interrupted or prevented by bad weather.

**- <u>Shipping Abbreviations</u>**

| | | |
|---|---|---|
| B/L | – | Bill of Lading |
| FOB | – | Free on Board |
| FWD | – | Fresh Water Draft |
| MOLCO | – | More or Less Charterer's Option |
| MOLOO | – | More or Less Owner's Option |
| MSD | – | Maximum Sailing Draft |
| NOR | – | Notice of Readiness |
| SB/SP | – | Safe Berth / Safe Port |
| SHINC | – | Sundays and Holidays Included |
| SWAD | – | Salt Water Arrival Draft |
| SWD | – | Salt Water Draft |
| TO | – | Turn Over |
| WWD | – | Weather Working Day |
| WWDSHEX | – | Weather Working days, Sundays and Holidays Excepted |
| WWDSHINC | – | Weather Working days, Sundays and Holidays Included |

NYK SHIPMANAGEMENT

# MV NYK - FIL

DRAFT SURVEY FORM

**Port:** ____________________ **Voyage Number:** ____________

**Cargo:** ____________________ **Stowage Factor** ____________

| | Initial | Intermediate | Final |
|---|---|---|---|
| Date & Time | ☐ ____________ | ☐ ____________ | ☐ ____________ |

| **FWD** | | **MIDSHIP** | | **AFT** | |
|---|---|---|---|---|---|
| **Port** | | **Port** | | **Port** | |
| **Stbd** | | **Stbd** | | **Stbd** | |
| MEAN | | **MEAN** | | MEAN | |
| Correction | | | | | |
| Draft $_{Corrected}$ | | | | | |

| | | |
|---|---|---|
| Trim $_{Apparent}$ | | (AFT Draft $_{Mean}$ - FWD Draft $_{Mean}$) |
| Trim $_{Corrected}$ | | (AFT Draft $_{Corrected}$ - FWD Draft $_{Corrected}$) |
| Fwd & Aft Mean $_{Corrected}$ | | |
| Midship Mean | | |
| Mean of Means | | (Midship Mean + (Fwd & Aft Mean $_{Corrected}$) / 2 |
| Quarter Mean | | (Midship Mean + Mean of Means / 2 |

| | | |
|---|---|---|
| Displacement | | |
| Increment | | Increment = TPC x Increment |
| Displacement $_{Total}$ | | |
| Trim Correction | | Trim Correction = T $_{Correction\ 1}$ + Trim $_{Correction\ 2}$ |
| Displacement $_{Corrected\ for\ Trim}$ | | |
| Density | | T $_{Correction\ 1}$ =(( TPC x LCF x Trim) / LBP)100 |
| Disp $_{Corrected\ for\ Density}$ | | T $_{Correction\ 2}$ = ((Trim$^2$ x $D_m$ x 50) / LBP) |
| Net Displacement | | |
| Non-Cargo | | |
| Light Ship | | |
| Constant | | |
| Cargo Loaded $_{Manual}$ | | |
| Cargo Loaded $_{Computer}$ | | Disp $_{Corrected\ for\ Density}$ = (Displacement x Density) / 1025 |
| Difference | | |

**TPC** ____________

**LCF** ____________

**LBP** ____________

| **Non-Cargo Weigths** | |
|---|---|
| a. Fuel oil | |
| b. Diesel Oil | |
| c. Fresh Water | |
| d. Ballast Water | |
| | |
| **TOTAL** | |

$D_M$ = $MTC_1$ - $MTC_2$

$MTC_1$ = MTC at Draft $_{Quarter\ Mean}$ + 50 cm

$MTC_2$ = MTC at Draft $_{Quarter\ Mean}$ - 50 cm

# MV SPRING FALCON

DRAFT SURVEY FORM

**Port:** Porto Trombetas, Brazil  **Voyage Number:** ABCL-006

**Cargo:** Bauxite in Bulk  **Stowage Factor** ______

Initial [ ]  Intermediate [ ]  Final [ ]

Date & Time ______ ______ ______

| FWD | | | MIDSHIP | | AFT | |
|---|---|---|---|---|---|---|
| | **Port** | ***8.3000*** | **Port** | ***9.3400*** | **Port** | ***11.4000*** |
| | **Stbd** | ***8.4200*** | **Stbd** | ***10.2000*** | **Stbd** | ***11.4500*** |
| | **MEAN** | 8.3600 | **MEAN** | 9.7700 | **MEAN** | 11.4250 |
| Correction | | ***-0.0440*** | *-0.042102* | | *0.1743008* | ***0.1840*** |
| Draft $_{\text{Corrected}}$ | | 8.3160 | *8.3179* | | *11.5993* | 11.6090 |

| | | |
|---|---|---|
| Trim $_{\text{Apparent}}$ | 3.0650 | (Fwd Draft $_{\text{Mean}}$ + Aft Draft $_{\text{Mean}}$) / 2 |
| Trim $_{\text{Corrected}}$ | 3.2930 | (Fwd Draft $_{\text{Corrected}}$ + Aft Draft $_{\text{Corrected}}$) / 2  *3.2814* |
| Fwd & Aft Mean $_{\text{Corrected}}$ | 9.9625 | |
| Midship Mean | 9.7700 | |
| Mean of Means | 9.8663 | (Midship Mean + (Fwd & Aft Mean $_{\text{Corrected}}$) / 2 |
| Quarter Mean | 9.8181 | (Midship Mean + Mean of Means / 2 |

| | | |
|---|---|---|
| Displacement | ***47650.8000*** | |
| Increment | ***42.8166*** | Increment = TPC x Increment |
| Displacement $_{\text{Total}}$ | 47693.6166 | |
| Trim Correction | -34.5137 | Trim Correction = T $_{\text{Correction 1}}$ + Trim $_{\text{Correction 2}}$ |
| Displacement $_{\text{Corrected for Trim}}$ | 47659.1029 | |
| Density | ***0.9960*** | T $_{\text{Correction 1}}$ =(( TPC x LCF x Trim) / LBP)100  -114.7701 |
| Displacement $_{\text{Corrected for Density}}$ | 46310.6990 | T $_{\text{Correction 2}}$ = ((Trim$^2$ x $D_m$ x 50) / LBP)  80.256399 |
| Net Displacement | | |
| Non-Cargo | 805.4000 | |
| Light Ship | ***7938.0000*** | |
| Constant | ***240.0000*** | |
| Cargo Loaded $_{\text{Manual}}$ | 37327.2990 | |
| Cargo Loaded $_{\text{Computer}}$ | ***37330.2400*** | Displacement $_{\text{Corrected for Density}}$ = (Displacement x Density) / 1025 |
| Difference | 2.9410 | |

| | |
|---|---|
| **TPC** | ***52.86*** |
| **LCF** | ***-1.20*** |
| **LBP** | ***182.00*** |
| **$D_M$** | **26.9400** |
| MTC1 = MTC of Draft $_{\text{Quarter Mean}}$ + 50 cm = | ***656.15*** |
| MTC2 = MTC of Draft $_{\text{Quarter Mean}}$ - 50 cm = | ***629.21*** |

| **Non-Cargo Weigths** | |
|---|---|
| a. Fuel oil | ***519.00*** |
| b. Diesel Oil | ***47.40*** |
| c. Fresh Water | ***179.00*** |
| d. Ballast Water | ***60.00*** |
| | |
| **TOTAL** | **805.40** |

## LOADING SEQUENCE

| CARGO HOLD | FULL CAPACITY CUBIC METER | FULL CAPACITY CUBIC FEET | STOWAGE FACTOR | FULL CAP FT3/LT | FULL CAP M3/MT | ACTUAL CARGO WT | PERCENT in HOLD |
|---|---|---|---|---|---|---|---|
| CH-1 | | | | | | | |
| CH-2 | | | | | | | |
| CH-3 | | | | | | | |
| CH-4 | | | | | | | |
| CH-5 | | | | | | | |
| CH-6 | | | | | | | |
| CH-7 | | | | | | | |
| CH-8 | | | | | | | |
| CH-9 | | | | | | | |
| TOTAL | | | | | | | |

M.V. OCEAN COMFORT

VOY No.: ____________ PORT: ____________

CARGO: ____________ DATE: ____________

____________ DENSITY: ____________

____________ LOADER: ____________

____________ RATE: ____________

QUANTITY: ____________ Ball RATE: ____________

| | VANCOUVER CANADA | |
|---|---|---|
| | ARRIVAL | DEPARTURE |
| FW | | |
| DW | | |
| DO | | |
| FO | | |
| FPT | | |
| WBT#1 | | |
| WBT#2 | | |
| WBT#3 | | |
| WBT#4 | | |
| WBT#5 | | |
| WBT#6 | | |
| AFT | | |
| CH# 6 | | |
| TOTAL | | |
| S / G | | |
| FWD | | |
| AFT | | |
| MID | | |
| TRIM | | |

| CH 9 | CH 8 | CH 7 | CH 6 | CH 5 | CH 4 | CH 3 | CH 2 | CH 1 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| WBT 6 | WBT 5 | WBT 4 | | WBT 3 | | WBT 2 | | WBT 1 | FPT |

| | LOAD PORT | DISPORT |
|---|---|---|
| | | |
| S/G | | |
| FWD | | |
| AFT | | |
| MID | | |
| TRIM | 0.02 | |
| | OCEAN | INPORT |
| S/F | | |
| B/M | | |

| RUN No. | CARGO GRADE | MT | MT | MT | MT | MT | MT | MT | MT | MT | LOADING OPRTN QUANTITY | TIME | DE-BALLASTING OPERATION TANK No. & QUANTITY | DRAFT FWD | AFT | MID | TRIM | AIR DRAFT | DEFL MM | SF | B.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | | | | | | | | | | |

Prepared By : ____________ CH/OFFICER

____________ FOREMAN

CAPT. ISIDRO C. OBLENA
MASTER

ANY DEVIATION FROM THE ABOVE PLAN ONLY AFTER DISCUSSION WITH THE CHIEF OFFICER