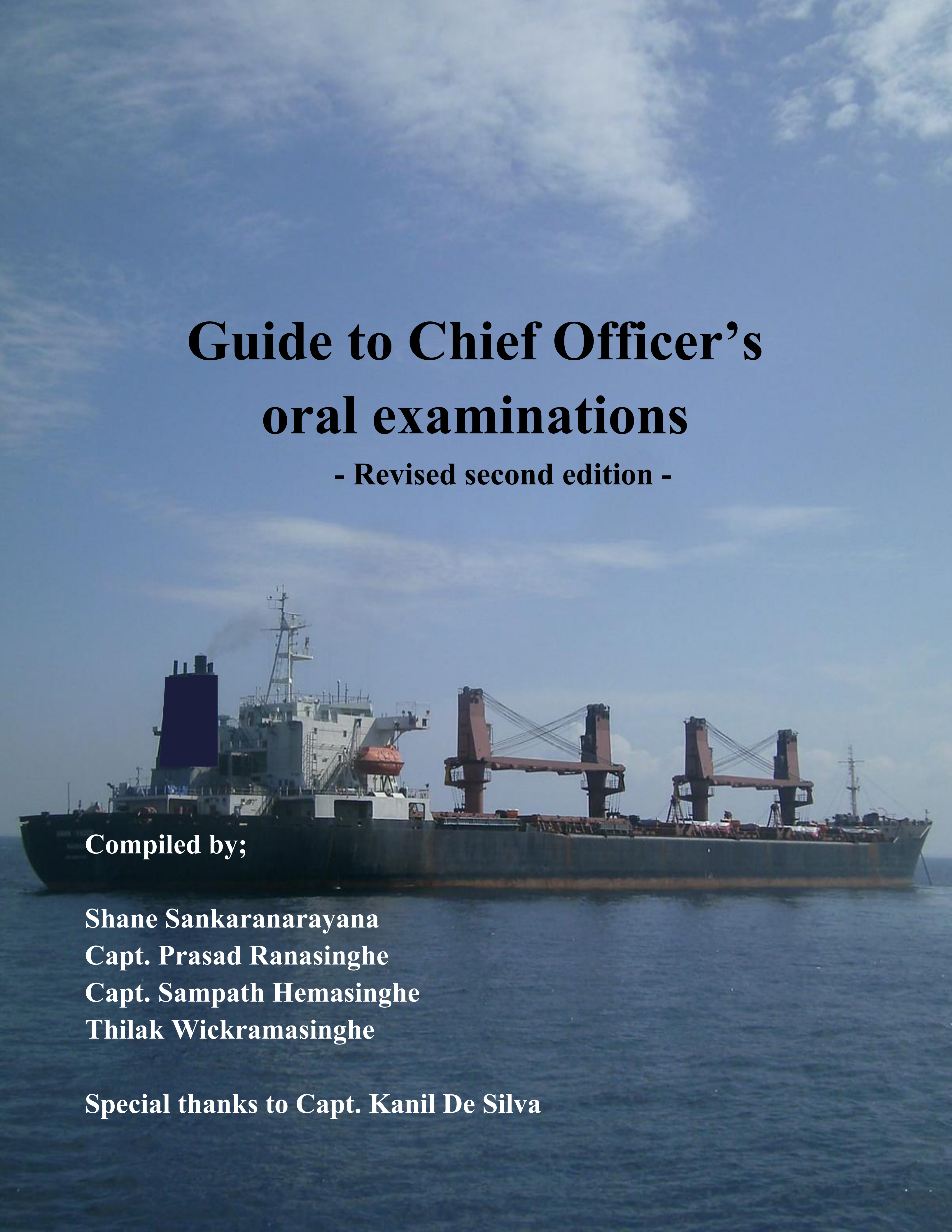

Guide to Chief Officer's oral examinations

- Revised second edition -

Compiled by;

Shane Sankaranarayana
Capt. Prasad Ranasinghe
Capt. Sampath Hemasinghe
Thilak Wickramasinghe

Special thanks to Capt. Kanil De Silva

Dear Students,

Keep the following points in mind when reading this book:

- **Focus:** This booklet focuses mainly on the practical aspects of a Chief Officer's duties. Additional information is included where necessary.
- **Theory:** Theoretical concepts are omitted unless deemed necessary.
- **International Updates:** Refer to the websites of the IMO, ILO, WHO, IACS, Classification Societies, and P&I Clubs to stay updated on the latest amendments to conventions, codes, and safe industry practices.
- **National Legislation:** Refer to the DGMS website for updates on Sri Lankan legislation and the latest Merchant Shipping Notices (MSNs).
- **Case Studies:** Review recent case studies in addition to the ones listed in this booklet.
- **Core Knowledge:** Maintain a strong understanding of all previously learned subjects.
- **Reference Publications:** Consult all relevant publications on cargo operations and safe practices—such as the IMDG Code, EmS Guide, MFAG, IMSBC Code, BLU Code, Timber Code, Grain Code, IS Code, ISGOTT, IBC Code, IGC Code, Thomas' Stowage, and the Code of Safe Working Practices for Merchant Seamen to ensure total familiarity.
- **Onboard Manuals:** Understand how to use stability booklets, damage control plans, damage stability books, cargo securing manuals, ballast water management plans, garbage management plans, ship security plans, ship drawings, and ship-to-ship (STS) operations manuals.
- **Foreign Regulations:** This guide includes information from UK Marine Safety Notices (MSN, MGN) and other international publications. These notices apply only to vessels registered in those specific countries unless your flag state adopts similar practices

Wish you all the best!

Shane Sankaranarayana,
NDT, BTEC, MSc, LLM
Associate Dean,
Department of Navigation,
CINEC Campus,
Malabe,
Sri Lanka.
www.cinec.edu

Capt. Prasad Ranasinghe,
Master mariner Class I
BSc in Maritime Science
Senior Lecturer,
Department of Navigation,
CINEC Campus,
Malabe,
Sri Lanka.
www.cinec.edu

Capt. Sampath Hemasinghe,
Master mariner Class I
NDT, BSc, MBA
Senior Lecturer,
Department of Navigation,
CINEC Campus,
Malabe,
Sri Lanka.
www.cinec.edu

Thilak Wickramasinghe,
BSc in Maritime Science
Deputy Head of Department,
Department of Navigation,
CINEC Campus,
Malabe,
Sri Lanka.
www.cinec.edu

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Contents

DUTIES & RESPONSIBILITIES OF A CHIEF OFFICER

Authority

The chief officer is the second in command onboard and he shall take over the command of the vessel if the master is incapacitated until the company appoints a new master.

In addition to the primary duties mentioned below, the chief officer shall comply with any other tasks delegated, instructed, or ordered by the master in a professional manner.

Responsibilities

1. Maintenance

The chief officer shall ensure the maintenance of the following areas / items are planned and executed in accordance with the Planned Maintenance System (PMS) and the same is recorded:

a) Maintenance & cleanliness of outside of accommodation.
b) Maintenance of hull.
c) Maintain the cleanliness & upkeep of areas within the accommodation spaces excluding the engine room, emergency generator room and the CO_2 room.
d) Maintenance and cleanliness of the main deck, poop deck and forecastle deck.
e) Deck gears – cargo gears, cargo hold opening / closing devices, pilot hoists, gangways, deck lifters (on car carriers), ramps (on car & ro-ro carriers), provision crane etc.
f) Forward & aft mooring gears including the windless.
g) Pump room (on tankers).
h) Ballast tanks & freshwater tanks.
i) Cargo spaces.
j) Cargo securing devices.
k) Storerooms belong to the deck department.
l) Weekly & monthly tests of LSA equipment.
m) Weekly & monthly maintenance, thorough examination, operational testing, overhaul and repairs of all types of lifeboats, rescue boats, launching appliances and on-load and off-load release gears shall be conducted under the direct supervision of the chief officer.
n) Weekly & monthly tests of FFA equipment.

He may take advice and support of the engine staff when deem necessary.

He is also responsible for preparing the dry dock list in cooperation with the chief engineer when requested by the superintendent.

The chief officer is responsible for ordering and maintaining stocks of stores and spare parts necessary for the deck department in accordance with the SMS.

2. Training

Chief officer is responsible for the training of the deck cadets in accordance with the company SMS and customary practices at sea.

He is also responsible for training the junior deck ratings and junior deck officers to enhance their performances.

3. Record keeping and reporting

The chief officer must ensure:

- records of maintenances and repairs are maintained.
- weekly, monthly, annual tests of the LSA & FFA recorded and reports forwarded to the company.
- the work and rest hours of the persons in the deck and catering departments are maintained and documented.
- the accidents, near misses and non-conformities relevant to the deck department are reported and actions taken to rectify them.
- the Master is informed any matter that will have an impact on the safety, pollution prevention and security.
- garbage record book, biofouling record book, ballast water record book and oil record book part II (on tankers) are maintained.

4. Safety Officer (if the company has appointed chief officer as the safety officer)

If chief officer is the Safety Officer onboard and he/she shall;

- implement and maintain safety culture onboard;
- ensure appropriate PPE is used during onboard operations and sufficient stocks are maintained.
- conduct safety meetings;
- conduct risk assessments and take preventive measures;
- plan & conduct safety, security and pollution prevention drills under the supervision of the master;

- carryout investigations into near misses & accidents and take corrective and preventive actions;
- inform the master in case of non-conformities observed.

5. SSO (if the company has appointed chief officer as SSO)

Chief officer is the Ship Security Officer (SSO).

Chief officer is responsible for maintaining ship's security equipment and reviewing the Ship Security Plan.

The chief officer shall report any breach of security to the Company Security Officer (CSO).

If the chief officer is not the SSO, he/she shall assist the Ship Security Officer (SSO) in reviewing the Ship Security Plan and shall report security related incidents to the SSO.

6. Pollution prevention

The chief officer shall implement the company's pollution prevention policy and shall be responsible for the;

- ballast water management;
- garbage management;
- biofouling management;
- maintenance of SOPEP (in case of a tanker, SMPEP); and
- If the vessel is a tanker, chief officer will be responsible for the management of cargoes in accordance with the MARPOL Annex I or II as well.

7. Cargo Operations and ship's stability

The chief officer shall;

- plan and conduct safe loading and discharging operations;
- plan and conduct safe ballasting and de-ballasting operations;
- ensure the vessel is complying with stability requirements, and the hull stresses are within the limits as appropriate to the operational area of the vessel;
- comply with the requirements of IMDG Code, IMSBC Code, BC Code, ISGOT as appropriate;
- secure the cargoes in accordance with the vessel's Cargo Securing Manual;

- maintain the records of temperatures, manage spare parts and maintains records of spare parts of reefer containers; and
- make damage reports in case of cargo or ship damage during cargo operations.

8. Catering department

The chief officer shall ensure;

- that the galley, cool room, provision room are clean and in hygienic condition;
- the provisions are segregated and stowed in accordance with the company's instructions;
- personal engage in food preparations are maintaining their cleanliness and hygiene; and
- the company's best practices are utilized in food preparation;

9. Watchkeeping and manoeuvring

Unless changed by the master, the chief officer shall conduct 0400 hrs to 0800 hrs and 1600 hrs to 2000 hrs watches at sea and at anchorages. He shall relieve the master when the master is at the con or carrying out manoeuvring duties when requested by the master.

10. Medical Officer

The chief officer is responsible for;

- managing the ship's hospital, medicines and equipment in accordance with the flag state requirements;
- maintaining the cleanliness and hygiene of the ship's hospital;
- issuing medicines and providing medical treatments for persons when necessary; and
- keeping records of medical treatments given.

11. Efficiency management

The chief officer is responsible for enhancing the ship's efficiency by complying with the relevant areas of the SEEMP and instructions given by the company and the charterers.

Chief officer’s standing orders and instructions

Standing orders

Some companies require the Chief Officer to establish standing orders to ensure that proper guidance is provided to junior officers regarding safety, security, and pollution prevention.

Standing orders are permanent, written directives applicable to all junior officers. Junior officers are required to read and sign these orders, and they must seek clarification from the Chief Officer, if necessary, before signing.

The SMS should specify where standing orders must be written. Generally, the chief officer’s standing orders are recorded in the Port Logbook, the Cargo Logbook, or the Chief Officer’s Standing Orders/Instructions Book.

The company may require the chief officer to obtain the Master's approval before issuing these orders. At a minimum, the chief officer’s standing orders must address the following regarding cargo operations:

- Operation of cargo gears;
- Cargo stowage;
- Cargo securing arrangements and cargo securing material management;
- On container ships – Stowage and handling of IMDG cargoes, high cube containers, Out Of Guage (OOG) containers and reefer containers;
- On car carriers – Handling of ramps, liftable decks and deck lifters;
- On tankers – Handling of cargo pumps, pump room operations and Crude Oil Washing (COW) operations;
- On bulk carriers and general cargo ships – Handling of grabs, use of forklifts & bulldozers inside cargo holds and cargo trimming operations;
- Ballast water operations;
- Bilge water management;
- Operation of cargo hold closing devises;
- Management of mooring integrity;
- Maintenance of the gangway watch;
- Handling of spare parts and provisions when received;
- Bunkering operations;
- Safety, fire and security rounds;
- Ship to shore and internal communications;
- Handling of emergencies; and
- Occasions when the chief officer to be called.

Instructions

"Instructions" refer to temporary measures the Chief Officer may expect from junior officers on different occasions. For example, temporary specific measures applied in one port, whereas Standing Orders apply across all ports.

Chief Officer may issue instructions when deemed necessary for safety, security, and pollution prevention. The company Safety Management System (SMS) state where these instructions should be written, though they can be written in the same document as the Standing Orders.

Junior deck officers must read and sign these instructions before taking over their watch at port.

Taking over duties as a chief officer

a) As you walk on the pier to join the vessel, have a general inspection of the ship's hull, draught marks etc.
b) While walking on the gangway, see the general condition of the gangway; see whether the life buoy, fire plan, shore leave board, security logbook etc. are available.
c) See whether the gangway watchman is available with safety gear and he is following the security related duties.
d) While walking in alleyway see the general condition of the interior of the vessel.
e) Hand over the documents to the master.
f) Meet the outgoing chief officer and take the following information from him.
    - Present loading condition, loading/discharging plans, ballast/deballasting plans, cargo securing plans, DG declarations, shipper's documents related to present cargo and other cargo information.
    - Draught restrictions during the passage, if any.
    - Calculated departure draughts, trim and GM.
    - Special requirements on cargo segregation, stowage, trimming and lashing at present.
    - Special requirements related to present passage and cargo.
    - Information about stores, fresh water etc. expecting from this port.
    - Information about the next port and the cargo details, if available.
    - Master's special orders regarding cargo work and operations on the deck.
    - Charterers requirements regarding cargo & cargo handling.
    - Pending work which are related to statutory surveys and information related to surveys expected.
    - Urgent equipment, spare parts, materials etc. already ordered and yet to be ordered.
    - Information about pending NCRs.
    - Information related to pending work according to the PMS.

- Information about company SMS, manuals & roles/responsibilities of chief officer including the duties during emergency situations (if you are new to the company).
- Chief officer's files and records.
- Arrangement of the watch schedule of officers and crew.
- An idea about the navigational equipment.
- Any special defects or areas need special attention related to cargo work, navigation, deck maintenance, windlass, mooring winches, provision crane, gangways, stability calculating equipment etc. (eg – malfunctioning of equipment, defects, lack of securing materials etc).
- Familiarization with the operation of cargo handling pumps, valves controlling panel on tankers.
- Familiarization with the crude oil washing operations and inerting procedures on tankers.
- Keys of the stores and the lockers under the custody of the chief officer.
- Positions of manuals, plans, publications, stability books, lashing manuals, list of inventories etc. which are under the chief officer's custody.
- Familiarization with the stability computer.
- Familiarization with the operation of ballasting / de-ballasting panels.
- Familiarization with the company record keeping systems, document management system on the computer.
- Amounts of fresh water available and production rates (if applicable).
- General overview of the staff.
- Finally, the handing over notes.

g) If the chief officer is also the SSO onboard:
   - Position of the SSP and keys of the locker.
   - Position of the ship security alert system.
   - List of inventories of security related equipment

h) If the chief officer is also the Safety Officer Onboard:
   - Immediate actions to be taken in accordance with the safety committee meeting minutes.
   - Safety officer's duties in accordance with the company SMS.
   - Documents to be maintained by the Safety Officer.

i) Ensure to follow the safety familiarization practices as required by the SMS.
j) Ensure the handing over is carried out as per the company instructions.
k) Immediately after taking over ensure the vessel's stability condition, draughts, stresses, visibility criteria and propellor immersion requirements are within limits.

Joining a brand-new ship as a chief officer

You will be already familiar with the company policies, procedures and the roles/responsibilities of a chief officer if you have been sailing with the same company.

If it is a new company, chief officer's roles/responsibilities can be obtained from the company manuals. If required any clarification, the master and the superintendent can be consulted. Remember, in most of the standard companies, if you are joining for the first time as a chief officer, you will be briefed on the company regulations before joining the vessel.

When joining a brand-new ship, the dock yard persons will provide training on the operation of the:

- windless and mooring equipment;
- cargo handling gears such as cranes and derricks;
- hatch opening closing mechanisms;
- stability software;
- ballasting / de-ballasting operations;
- cargo handling gears such as pump operations, valve operations, COW systems on tankers;
- inert gas systems on tankers;
- lifeboat and life raft lowering;
- fixed firefighting systems and smoke detection systems;
- ship's ramps and bow visors;
- critical navigational equipment;
- emergency generators; and
- emergency steering systems.

You must have a thorough knowledge of all the above operations, and you must ensure that the junior officers and the crew members are well familiar with the above operations, safety systems and the areas in accordance with their job descriptions.

Make sure the safety familiarization is provided to the officers and the crew in accordance with the SMS.

Make sure to assign emergency duties to the staff and the muster lists are completed and readily available. All must be aware of their emergency duties and the operation of the LSA and FFA equipment.

You should ensure that the LSA and FFA equipment are in appropriate places and readily available for use.

If you are the SSO, you should know the position of ship's security alert system and take the custody of the SSP. Staff should be trained on security related duties and they should know the position of citadel.

Check whether the stability booklets, loading manuals, cargo securing manuals etc. are appropriately endorsed. Before departure, ensure the vessel is appropriately ballasted, stresses are within limits, stability criteria, visibility range criteria and propellor immersion criteria are complied with.

Make sure to conduct one abandon ship drill and one fire drill before departure or within 24 hrs after departure.

You are also required to help the master;

- in implementing the ISM Code;
- in implementing MLC 2006; and
- to organize safety committee and appoint safety representatives onboard.

Ensure that the necessary medicines and the medical equipment are onboard as per the flag state regulations and the ship's hospital is properly arranged.

Filing and documentation system must be in accordance with the company SMS.

Placards and notices to be posted in accordance with the company SMS.

You are required to implement the garbage management and the ballast water management systems onboard.

SHIP'S CERTIFICATES AND SURVEYS

1) Categories of certificates

- **'Permanent Certificate' or 'Full term certificate'**

  This is a certificate issued upon satisfactory completion of an initial or renewal survey. A permanent/full term certificate is valid until the next periodical/renewal survey is due. A permanent/full term certificate may also be issued or reissued when all deficiencies which led to the issuance of a conditional certificate are corrected[1].

- **Interim Certificate**

  An "Interim certificate" is a certificate issued by the attending surveyor upon satisfactory completion of a survey in order to permit the ship to trade while the permanent/full term certificate is prepared. An interim certificate is usually valid for five months from the date of issuance[2].

Above two definitions do not apply to the ISM Code, ISPS Code and MLC 2006 certification. The validity periods of the Interim Certificates issued under these Codes & the Convention are as follows:

- ✓ Interim DOC (ISM Code) – 12 months
- ✓ Interim SMC (ISM Code) – 06 months
- ✓ Interim ISSC (ISPS Code) – 06 months
- ✓ Interim MLC (MLC 2006) – 06 months

- **Interim Certificate of Class (or Interim Class Certificate)**

  This certificate is issued by a classification society immediately upon completion of the survey of the vessel to enable it to trade while the report of the classification surveys is processed by the gaining Society pursuant to issuing its full-term Class Certificate[3].

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[1] IACS, Duties of Surveyors under Statutory Conventions and Codes, No. 98, https://iacs.s3.af-south-1.amazonaws.com/wp-content/uploads/2022/05/20154958/rec98rev3.pdf (last visited 09/05/2026)

[2] Ibid

[3] IACS, Procedure for transfer of class, PR1A, https://iacs.s3.af-south-1.amazonaws.com/wp-content/uploads/2022/01/11144441/PR-1A-Rev.9-Aug-2023-CLN.pdf (Last visited 09/05/2026)

- **'Conditional Certificate' or 'conditionally issued certificate'**

  This is a certificate with the appropriate expiry dates that is issued by the attending surveyor when deficiencies/defects exist which cannot be corrected in the port of survey. A conditional certificate is valid only for a period long enough to permit the ship to proceed to the port where the correction will be made. Some Administrations require that these certificates be called and annotated "**Short Term certificates**" [4].

  Shipping Circular No. 10 issued by the Maritime and Port Authority of Singapore allows approved Recognized Organizations to issue dispensation, on behalf of the Administration for the malfunctioned equipment listed in the Annexes of this circular[5]:

  ✓ Malfunction of equipment under Safety of Navigation
  ✓ Malfunction of equipment under Radio Communications
  ✓ Malfunction of equipment under MARPOL Annex I
  ✓ Malfunction of equipment under MARPOL Annex IV
  ✓ Malfunction of equipment under MARPOL Annex VI
  ✓ Malfunction of equipment under Ballast Water Convention
  ✓ Malfunction of equipment under Emergency Systems
  ✓ Malfunction of other Shipboard equipment
  ✓ Malfunction of Life saving appliances

  Application for dispensation of malfunctioned equipment listed in this Shipping Circular shall be submitted by the company to the ship's classification society (Class) and be supplemented with the relevant supporting documents. Class is authorised to issue relevant **short-term certificate** and/or statutory **condition** with a validity of up to two months, pending the repair or replacement of the malfunctioned equipment after satisfactory verification of the application. Further extension of short-term certificate and/or statutory condition beyond two months, Class shall consult the Administration[6].

- **Provisional certificate**

  The term 'provisional certificate' is not defined internationally. Generally, 'provisional certificates of registry' are issued by flag administrations before entering ships into their permanent registry. It is a temporary certificate of registry which allows the shipowners

[4] IACS, Duties of Surveyors under Statutory Conventions and Codes, No. 98, https://iacs.s3.af-south-1.amazonaws.com/wp-content/uploads/2022/05/20154958/rec98rev3.pdf (Last visited 09/05/2026)
[5] https://www.mpa.gov.sg/media-centre/details/no.-10-of-2025---issuance-of-dispensation-by-recognised-organisations-(ros) (Last visited 09/08/2026)
[6] Ibid

to complete the required formalities before entering ships into their permanent registry. The validity period depends upon the administration. Refer the examples below:

- ✓ United Kingdom – valid either for three months from the date of issue, or until the ship's arrival in the UK, or termination by the Registry on request from the owner, whichever is sooner[7]
- ✓ Singapore – 12 months[8]
- ✓ Panama – 06 months[9]
- ✓ Sri Lanka – 06 months[10]

Some flag states may allow to extend the provisional certificate of registry & some flags does not. In accordance with the Sri Lankan regulations, no extensions granted.

- **Exemption certificate** (excluding the Ship Sanitation Control Exemption Certificate issued under International Health Regulations)

  An Exemption is a permanent release from compliance with a Statutory Convention requirement due to the existence of specific circumstances as sanctioned by the provisions of that Convention. The 'Exemption Certificate' is linked to, and retained with its associated statutory certificate, and is issued by the Recognized Organization (OR) under authorization from the DGMS (flag state). Authorization for issuance of an Exemption Certificate is considered on a case by case basis formed on the existence of some measure of equivalency to meet the intent of the requirement being exempted and a recommendation from the RO[11].

  Exemptions may be granted in accordance with SOLAS, load line convention, MARPOL, MLC 2006, ballast water convention etc.

  On most occasions, the validity period of an exemption certificate would be similar to the validity period of the corresponding full-term certificate.

[7] https://ukshipregister.co.uk/registration/merchant-part-1/provisional-registration (Last visited 09/05/2026)
[8] Guide to the registration of ships in Singapore, https://www.mpa.gov.sg/docs/mpalibraries/mpa-documents-files/shipping-division/singapore-registry-of-ships/register-with-srs/registration-procedure/registration-guide---aug-2024.pdf?sfvrsn=3081a288_0 (Last visited 09/05/2026)
[9] https://www.pmacertification.com/procedure/ (Last visited 09/05/2026)
[10] Requirements for the Sri Lankan Ship Registry, http://www.dgshipping.gov.lk/web/images/pdf/handbook_for_shipowners.pdf (Last visited 09/05/2026)
[11] MSN 27/2016, DGMS, Sri Lanka

- **Dispensation Letter (dispensation certificate)**

A temporary allowance granted in writing (Dispensation Letter) by the Director General of Merchant Shipping, Sri Lanka to permit a ship to proceed without being in full compliance with a specific Convention requirement due to mitigating circumstance preventing the immediate rectification of the subject deficiency. Dispensations are issued with time specific corrective action requirements, compliance with which are reportable to the Administration by the expiration date[12].

Dispensation Letters are issued with a specific term limit of validity-either for a single voyage, or for a set period of time, and are generally limited to the minimum period of time necessary for the ship to reach a port where rectification of the deficiency can be accomplished[13].

When it comes to seafarers, dispensations letters are required in the following circumstances:

Occasion issued	Applicable Convention	Duration of validity	Application in Sri Lanka
Lack of DSD certified people to carryout security related duties in accordance with SSP	STCW	30 days	Yes
No certified persons to carryout duties of SSO	STCW	30 days	No
Lack of an officer or an engineer in accordance with the minimum safe manning document	STCW	06 months	Yes
No master or chief engineer, but **only in circumstances of force majeure**	STCW	Shortest period	Yes
If do not have a certified cook onboard	MLC 2006	30 days	Yes

- **Certificate of equivalent competency (CEC) or Certificate of Recognition (COR)**

Unlike the above categories of certificates, this is issued to the seafarer rather than the vessel. Seafarers who do not hold a COC issued by the ship's flag administration must obtain a Certificate of Equivalent Competency (CEC). The validity period of CEC cannot exceed that of the original COC. In some administrations, this is referred to as a Certificate of Recognition (COR).

[12] Ibid
[13] Ibid

2) Statutory certificates and trading certificates

There are no any internationally recognized definitions for these terms. But, when considering the meaning of the term, ‘statutory certificates’ means certificates that are required to be carried onboard in compliance with the regulations of the flag state. Trading certificates means certificates that are not required by the statute of a flag state but, required by certain trades or organizations or charterers etc. for trading purposes.

However, some flag states categorize all certificates required to be carried on board by their regulations as trading certificates

Statutory certificates may include the following depending upon the flag state regulations[14]:

a) Irrespective of the type of the cargo carried onboard, following certificates to be carried on board:
   - Certificate of Registry
   - Certificate of Class (if the flag state requires to class a vessel)
   - Dispensation Certificate (if and when applicable)
   - Crew Accommodation Certificate or Crew Accommodation Exemption Certificate
   - Ship Sanitation Control Exemption Certificate/Ship Sanitation Control Certificate
   - Ship’s medical chest certificate
   - International Tonnage Certificate (1969)
   - International Load Line Certificate or International Load Line Exemption Certificate
   - Minimum safe manning Certificate
   - International Oil Pollution Prevention Certificate
   - International Sewage Pollution Prevention Certificate
   - Safety Management Certificate
   - International Ship Security Certificate (ISSC) or Interim International Ship Security Certificate
   - International Anti-fouling System Certificate
   - International Air Pollution Prevention Certificate
   - International Energy Efficiency Certificate
   - International Ballast Water Management Certificate
   - Certificate of insurance or other financial security in respect of civil liability for bunker oil pollution damage

[14] Refer to the ‘List of certificates and documents required to be carried on board ships, 2022’ by IMO or the latest for further details

- Certificate of insurance or other financial security in respect of liability for the removal of wrecks

b) In addition to above (a), cargo ships may carry:
- Cargo Ship Safety Construction Certificate
- Cargo Ship Safety Equipment Certificate
- Cargo Ship Safety Radio Certificate
- Cargo ship Safety Certificate (this will replace the above three certificates)
- Exemption certificate if applicable (an exemption certificate issued under any of above four certificates will not replace the original applicable certificate. The exemption certificate (if issued) is to be carried onboard along with the applicable original certificate)

c) In addition to above (a), passenger ships may carry:
- Passenger Ship Safety Certificate
- Special Trade Passenger Ship Safety Certificate
- Special Trade Passenger Ship Space Certificate
- Certificate of insurance or other financial security in respect of liability for the death of and personal injury to passengers

d) In addition to above (a), oil tankers may have:
- Certificate of insurance or other financial security in respect of civil liability for oil pollution damage

e) In addition to above (a), chemical tankers may carry:
- International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (NLS Certificate)
- Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk or International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk **OR**
- International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk

f) In addition to above (a), gas tankers may have:
- Certificate of Fitness for the Carriage of Liquefied Gases in Bulk **OR**
- International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk

g) In addition to above (a), ships trading in Polar areas may have:
- Polar Ship Certificate

Trading certificates may include the following:

- Suez Canal certificate
- Panama Canal certificate
- Certificate of Class (when there are no flag state requirements to class a vessel)
- Certificates that are required by the port states to have onboard while entering such ports, but not required by the ship's flag state

3) Difference between inspections, audits and surveys

Audits are conducted to ensure that a ship is **complying with the procedures** implemented onboard. This includes referring to procedures, records, checklists, certificates and observations of working practices onboard. Audits are required to be conducted by:

- ISM Code and
- ISPS Code

Inspections are carried out to ensure the **compliance with regulations**. MLC 2006 requires to conduct inspections and port state control officers carry out inspections to ensure the vessels are maintained as per the regulations.

Survey means a **technical examination of a ship** to ensure the equipment are working in order; applicable records are maintained and to ensure the relevant requirements of the applicable conventions are met. Following conventions and codes require to have surveys onboard in order to issue and maintain certificate required by such conventions:

- SOLAS convention (Safety equipment certificate, Safety construction certificate, Safety radio certificate etc.)
- MARPOL convention (certificates required by Annex I, II, IV and VI)
- Load Line convention
- IGC / GC Code
- IBC / BCH Code

4) Types of surveys and bottom inspections

Various surveys must be carried out in accordance with IMO instruments to issue or maintain the certificates required for a ship. These inspections are often referred to as statutory surveys. Conversely, classification societies carry out similar surveys to issue or maintain a certificate of class. Though there could be slight deviations between the statutory surveys and class surveys both serve to ensure safety of the vessel. Brief description of surveys required by IMO instruments are briefly described below:

a) Initial survey

It is a complete inspection before a ship is put into service of all the items relating to a particular certificate. The initial survey should be held before the ship is put in service, or when a new instrument applies to an existing ship, and the appropriate certificate is issued for the first time[15].

b) Annual survey

This is a survey carried out within +/- 03 months of the anniversary date of the relevant certificate. A general inspection will be carried out to ensure that the relevant equipment or applicable areas have been maintained and remain satisfactory for the service.

c) Intermediate survey

This is carried out as required by the relevant regulations of the IMO instruments. It should be held within +/- 03 months of the second anniversary date or within +/- 03 months of the third anniversary date of the appropriate certificate and should take the place of one of the annual surveys.

The intermediate survey should be an inspection of items relevant to the particular certificate to ensure that they are in a satisfactory condition and are fit for the service for which the ship is intended.

d) Periodical survey

Periodical surveys are required to maintain Cargo Ship Safety Equipment Certificate, Cargo Ship Safety Radio Certificate and Cargo Ship Safety Certificate only.

In the case of cargo ship safety equipment certificate, periodical survey is carried out within +/- 03 months of the second anniversary date or within +/- 03 months of the third anniversary date and this will be having a scope similar to an annual survey.

[15] https://safety4sea.com/do-you-know-the-various-types-of-survey-onboard/ (Last visited 15/05/2026)

In the case of cargo ship safety radio certificate, periodical survey is to be undertaken within +/- 03 months of each anniversary date. This also has a similar scope as an annual survey.

e) Renewal survey

It is the same as a periodical survey but also leads to the issue of a new certificate.

The renewal survey should be held before the appropriate certificate is renewed. The cargo ship safety construction renewal survey may be commenced at the fourth annual survey and may be progressed during the succeeding year with a view to completion by the fifth anniversary date. The survey items of the fourth annual survey should not be credited to the completion of the renewal survey[16].

f) Inspection of the ship's outer bottom

This is an inspection of the underwater part of the ship and related items to ensure that they are in a satisfactory condition and fit for service.

For cargo ships, two inspections of the ship's bottom to take place out of the water within any five-year period, and at intervals of not exceeding 36 months (in accordance with the Cargo ship safety construction certificate). This is further explained under the heading of dry docking below.

On passenger ships, inspection of the ship's bottom to be carried out annually, but two inspections within any five-year period are to take place out of the water at intervals not exceeding 36 months.

g) Additional surveys

Whenever an accident occurs to a ship or a defect is discovered which affects the safety or integrity of the ship or the efficiency or completeness of its equipment, the master or owner should make a report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible for issuing the relevant certificate.

[16] https://safety4sea.com/do-you-know-the-various-types-of-survey-onboard/ (Last visited 15/05/2026)

The Administration, the nominated surveyor or recognized organization responsible for issuing the relevant certificate should then initiate an investigation to determine whether a survey, as required by the regulations applicable to the particular certificate, is necessary.

This additional survey, which may be general or partial according to the circumstances, should be such as to ensure that the repairs and any renewals have been effectively made and that the ship and its equipment continue to be fit for the service for which the ship is intended.

5) Validity periods of certificates & types of surveys required

Certificate	Validity period	Annual	Periodical	Intermediate	Renewal
Certificate of class	05 years	+/- 3 months the anniversary date		+/- 3 months of the 2nd or 3rd anniversary date	Within 3 months before the date of expiry
Certificate of registry	UK - 05 years[17] Sri Lanka – 04 years[18]				Need to apply for a new certificate before expiry
International Tonnage Certificate	No expiry date (unless flag is changed)				
Passenger ship safety certificate*	01 year				Renewal survey, +/- 3 months of anniversary date
Cargo ship safety equipment certificate*	5 years	+/- 3 months the anniversary date	+/-3 months of the 2nd or 3rd anniversary date		Within 3 months before the date of expiry
Cargo ship safety radio certificate	5 years		+/- 3 months of each anniversary date		within 3 months before the date of expiry
Cargo ship safety construction certificate*	5 years	+/- 3 months of each anniversary date		+/- 3 months of the 2nd or 3rd anniversary date	within 3 months before the date of expiry
Cargo ship safety certificate**	5 years	+/- 3 months of each	+/-3 months of the 2nd or 3rd	+/- 3 months of the 2nd or 3rd	within 3 months before the date of

[17] UK Ship Register, A guide to registration, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/799033/2019_April_A_Guide_to_Registration_V4.pdf, (Last visited 10/05/2026)

[18] Requirements for the Sri Lankan ship registry, http://www.dgshipping.gov.lk/web/images/pdf/handbook_for_shipowners.pdf, (Last visited 10/05/2026)

		anniversary date	anniversary date (periodical or Intermediate)	anniversary date (periodical or Intermediate)	expiry
International Load line certificate*	05 years	+/- 3 months of anniversary date			within 03 months before the date of expiry
IOPP Certificate*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
International pollution prevention certificate for the carriage of Noxious Liquid Substances in bulk*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
International sewage pollution Prevention Certificate*	05 years				within 03 months before the date of expiry
Engine International Air Pollution Prevention Certificate*	No expiry date (this is required to get IAPP)				
International Air Pollution Prevention Certificate*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
International Energy Efficiency Certificate*	No expiry date (unless flag is changed)				
IGC/GC*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
IBC/BCH*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
Minimum safe manning Certificate	Valid until change of flag or change of equipment or structural or operational conditions which affect manning level				
International Ballast Water Management Certificate*	05 years	+/- 3 months of anniversary date		+/- 3 months of 2nd or 3rd anniversary date	within 03 months before the date of expiry
Polar ship certificate*	Cargo – 5 years Passenger – 1 year	Cargo ships – Aligned with Cargo ship safety certificate or Cargo ship safety construction certificate Passenger ships – Renewal survey – annually			

Ship Sanitation Control Exemption Certificate (SSCEC) Ship Sanitation Control Certificate (SSCC)	06 months	**Notes** • SSCEC is issued when the no health risks are found onboard. • SSCC is issued when health risks are found, and actions taken to rectify the matter. • SSCEC may be extended for a period of one month until the ship arrives at a port

Notes

***Initial Survey** is required to be carried out before the ship is put into service
**** Cargo Ship Safety Certificate** – This certificate covers the requirements of the following certificates:

- Cargo Ship Safety Radio Certificate,
- Cargo Ship Safety Equipment Certificate
- Cargo Ship Safety Construction Certificate

6) Certificates which need audits and inspections to be carried out

Certificate	Validity period	Audit / Inspection	Annual	Intermediate	Renewal
Interim DOC*	12 months	Audit			
DOC	05 years	Audit	+/- 3 months before or after anniversary date		Before the date of expiry
Interim SMC*	06 months	Audit			
SMC	05 years	Audit		between the 2nd & 3rd anniversary dates	Before the date of expiry
Interim International Ship Security Certificate*	06 months	Audit			
International Ship Security Certificate	05 years	Audit		between 2nd & 3rd anniversary dates	within 06 months before the date of expiry
Interim Maritime Labour Certificate*	06 months	Inspection			
Maritime Labour Certificate	05 years	Inspection		between the 2nd & 3rd anniversary dates	before the date of expiry

*An initial verification will be undertaken before the vessel is put into service.

7) Load line certificate

Condition of Assignment

There are certain conditions to be met with, prior to issuing a load line certificate at the completion of the construction of a vessel and they are known as Conditions of Assignment. In brief, Condition of Assignment ensures that:

- she has sufficient reserve buoyancy;
- decks are high enough for the crew to carryout operational and navigational activities;
- safe access and safe working conditions available onboard;
- she complies with structural strengthening requirements; and
- she complies with watertight and weather tight requirements.

Equipment, areas and documents that come under Load Line Certificate

- Approved stability book (comes under SAFCON as well);
- Approved loading manual (loading & discharging sequences manual) for tankers & bulk carriers – comes under SAFCON and IOPP surveys as well;
- Document of authorization for the safe carriage of grain;
- Record of conditions of assignment;
- Approved stability calculation equipment (comes under SAFCON as well);
- Hatch ways and hatch coamings;
- Portable beams used for closing holds & their securing arrangements;
- Pontoons;
- Cleats;
- Cargo ports (openings in the ship side but below the freeboard deck for the purpose of loading / discharging) & their securing arrangements);
- Watertight & weather tight openings (testing of operation of watertight doors comes under SAFCON as well);
- Machinery space openings;
- Ventilators;
- Sounding pipes;
- Scuppers;
- Side scuttles (port holes below the free board deck and enclosed supper structures) and their securing arrangements including dead lights;
- Freeing ports (water draining ports on raised decks);
- Gangways / accommodation ladders; and
- Guard rails / gunwales.

Preparation for a load line Survey

- Ensure the former findings are rectified.
- Keep the stability information ready.
- Ensure the testing of stability computer is carried out in accordance with the flag state regulations and records available.
- All sounding pipes, vent pipes, must be provided with closing/opening devices, with permanently attached and in operating condition.
- Ensure all the watertight doors can be closed watertight (free of cracks, rubber beadings in good condition, rubber beadings are not painted, hinges greased, handles greased etc).
- Make sure the portholes are rust free and the rubber beadings are not painted and are in good order. All the cabins on the weather deck and below the weather deck should have portholes with dead lights (a steel or aluminium lid, refer the picture below). These dead lights also must be rust free and must have rubber beadings.

Deadlight[19]

- Ensure the hatches can be closed watertight. The cleats, rollers, wedges should be in good working condition. Water draining system on the hatch coaming must be in good order. The rubber gaskets in the pontoons should be in good condition.
- If required, a hose test can be tried out on pontoons to ensure the watertight integrity is maintained.
- Check whether the booby hatch covers are working properly.
- Ensure the non-return valves on overboard discharging is in good condition.
- Check the scuppers and freeing ports for any blockages.
- De-rust and paint load line marks & draught marks.
- Guard rails and bulwarks should be in good condition and rig lifelines if required.
- Ensure the accommodation ladder/gangway is in order, and the pilot ladders are in good condition.
- Keep ready the keys for storerooms, stairways etc.

[19] https://www.wartsila.com/encyclopedia/term/porthole-port-light-sidescuttle, (Last visited 10/05/2026)

- Generally, ensure the ship is watertight below the main deck, and weather tight above main deck.

Usually, these are maintained as per the "Planned Maintenance Schedule". It is advisable to commence preparation at least 3 to 4 months before the expected survey date and use the 'survey checklist' issued by the vessel's classification society.

Method of carrying out chalk test

Chalk test is done on hatch covers as well as weather tight doors onboard. Apply chalk on the compression bar (the steel plate which will be compressed by the rubber beading) on the hatch coaming or on the weather tight doors and close them properly with cleats, the tightening screws or available securing methods. Then, open the hatch again and check the rubber beading, if an unbroken, regular, even and firm chalk mark is present, the closing device can be considered as weather tight.

Method of carrying out hose test

This method is usually used for testing the weather tightness of hatch covers. The hatch covers to be well secured with its securing devices such as cleats etc. A water jet with a pressure of not less than 200 Kn/m^2 should be aimed at the seams of the hatch covers from a distance of about 1 m away from the seam. Usually, the water from the fire line is used for this purpose. One surveyor will monitor the application of the water pressure from the deck, and another surveyor will observe any leakages from inside the holds. Hold can be considered as weather tight if no water leaking is found.

Method of carrying out light test

This method is also used for testing the weather tightness of hatch covers. This must be done when good sun light is available or with a strong torch light. Close the holds as mentioned above, and the surveyor will observe for any penetration of light from inside the hold.

Method of carrying out ultrasonic test

This method is also used for testing the weather tightness of hatch covers. Close the holds as mentioned above. An ultrasonic wave generator will be kept inside the hold, and a wave receiver will be moved along the seams of the hatch covers. If any small openings are available, this can be detected by the wave receiver.

8) Cargo Ship Safety Equipment Certificate

Form E

This form includes the safety equipment which are required to be carried onboard for the purpose of issuing the Cargo Ship Safety Equipment Certificate and the numbers of such equipment to be carried onboard.

Documents and equipment that come under Cargo Ship Safety Equipment Certificate

- Nautical charts;
- Nautical publications;
- International code of signals;
- IAMSAR Manual Volume III;
- Deviation record book;
- Approved fire control plan;
- Approved lifesaving appliances plan;
- Muster lists;
- Records of LSA & FFA maintenances;
- Records of fire drills, boat drills, enclosed space & recovery drills, emergency steering gear drills;
- New joiner's emergency familiarization checks;
- SOLAS training manuals (LSA & FFA);
- Certificate for pilot ladder; and
- Pilot ladder maintenance records.

Preparation for Cargo Ship Safety Equipment survey

Ensure that:

- the former findings are rectified;
- the above-mentioned documents and records are properly maintained and available onboard;
- **hard copies** of the **International Code of signals** and **IAMSAR Manual Volume III** are onboard;

- lifeboat, it's equipment, securing arrangements and davits are in order;
- inflatable life rafts have been serviced within the last 12 months and ensure the hydro-static release unit is in order;
- survival craft portable radio equipment is in order;
- the life buoys, MOB markers, life jackets, immersion suits, pyrotechnics, SART (SART comes under Safety Radio Certificate as well) are in order;
- the bridge equipment such as BNWAS, rate of turn indicators, rudder angle indicators, RPM/pitch indicators, echo sounders, speed logs, GPS, VDR, LRIT, AIS, ARPA, radars, ECDIS, back up arrangements for ECDIS, azimuth circle, gyro compass, magnetic compass, navigational lights etc. are in working order;
- signals (cylinder, black balls, diamond) are in order;
- the charts and publications are corrected and up to date;
- communication system with bridge & emergency steering is in order (this comes under SAFCON Certificate as well);
- the fire control plans are posted and is legible;
- the fire dampers, sky lights are in working order;
- the fire/smoke detection system, fire pump including the emergency fire pump, fire hoses, nozzles, fixed firefighting system, fireman's outfits, BA set, portable and non-portable fire extinguishers are in order;
- no accumulation of oil in exhaust ventilation system in the galley; and
- pilot transfer arrangements are properly maintained.

9) Cargo Ship Safety Construction Certificate (SAFCON)

Documents that come under SAFCON certificate

- Ship's manoeuvring diagram and manoeuvring booklet;
- Record of emergency steering gear drills (comes under load line as well);
- Approved ship's stability book (also comes under load line certificate);
- Approved loading manual (loading & discharging sequences manual) for tankers & bulk carriers – comes under load line and IOPP surveys as well;
- Approved damage stability book and damage control plan – comes under the IOPP survey as well;
- Approved cargo securing manual;
- Emergency towing procedure manual;
- Enhance survey reports file (for oil tankers, chemical tankers and bulk carriers);
- Ship structure access manual (for oil and bulk carriers); and
- Coating technical file.

Preparation for the survey

Ensure that:

- the former findings are rectified;
- above mentioned documents and records are available & maintained;
- all certificates and documents are available & valid;
- enhanced survey report and evaluation reports are onboard;
- stability calculations, damage stability calculation methods and damage control plans are readily available;
- cargo securing manual is approved and available;
- ship structure access manual is on board (for oil tankers and bulk carriers);
- the coating technical file is onboard and proper records maintained (if applicable);
- records of manning & unmanning of engine room are entered in the logbook;
- ship's manoeuvring information is available on the bridge, and the manoeuvring booklet is onboard;
- emergency towing arrangements are readily available;
- testing of emergency steering carried out, drills are conducted and evidence available;
- the auxiliary steering arrangements are in order;
- compass or heading indicator in the emergency steering gear room indicates the correct heading;
- communication between bridge and emergency steering gear room is in order (this comes under Safety Equipment Certificate as well);
- bridge rudder angle indicators are in order;
- anchoring & mooring arrangements properly maintained, and any restrictions / warnings marked and in operational condition;
- collision bulkhead is damage free;
- bilge pumps are operating in order;
- cargo hold bilge alarms in order;
- all the watertight doors can be properly operated, locally and remotely;
- all fire doors are working order;
- openings on the shell plating below the free board deck is in working condition;
- water draining systems are in order, in vehicle spaces where fixed water spraying is used as firefighting medium;
- emergency escapes are in order and properly marked;
- no new materials containing asbestos are installed;
- ship's identification mark is permanently marked and clearly apparent;
- if over 5 years of age – prepare ballast tanks for inspection;
- if over 10 years of age – prepare selected cargo spaces for inspection (tankers only);

- if over 15 years of age – prepare selected cargo spaces for inspection (dry cargo ships only);
- spark arresters on the ventilators to the bunker tanks are in order;
- the remote hold ballast and dry space water level indicators are in good condition; and
- no structural changes are done without class approval.

Additionally, on tankers make sure that (most of the following comes under the IOPP surveys as well):

- cargo tank pressure / vacuum valves are in good condition;
- cargo tank venting, purging and gas freeing systems are in working order;
- COW system is in order;
- stripping systems are in working order;
- pump room ventilation system is in good order;
- emergency lighting in the pump room is in good condition;
- prepare the pump room for inspection (no loose gear, no leaks, no combustible material, access ladders in good condition etc.); and
- the pressure gauges on the cargo discharging lines are in good order.

10) Cargo Ship Safety Radio Equipment Certificate

Form R

The "Form R" lists the;

- minimum number of persons required to operate the vessel's radio installation;
- required equipment to be carried onboard; &
- methods used to ensure the availability of radio facilities such as:
  - ✓ Duplication of equipment;
  - ✓ Shore based maintenance; and
  - ✓ At sea maintenance capability.

Preparation for safety radio survey

Ensure that:

- the former findings are rectified;
- the radio licence is valid;
- the latest editions of ITU publications are onboard;

- the operating procedure manuals of the radio equipment are onboard;
- the ship's call sign and ship station identity are posted;
- proper entries are made on the GMDSS log book;
- DSC equipment, radiotelephony, MF radio installation, MF/HF radio installation, direct printing telegraphy, INMARSAT ship earth station, NAVTEX, EGC receiver, EPIRB, SART (SART comes under Safety Equipment Certificate as well) etc. are working in order;
- the batteries are not expired in the equipment such as EPIRB, SART etc.;
- the daily, weekly, monthly etc. testing of equipment are recorded;
- the GMDSS battery room is ventilated;
- GMDSS back-up batteries are properly maintained and records available;
- sufficient illumination is available at the radio installation; and
- sufficient spare parts and tools are available.

11) International Oil Pollution Prevention Certificate

Form A & Form B

IOPP certificate is supplemented with **"Record of construction and equipment for ships other than oil tankers" (Form A)** and **"Record of construction and equipment for oil tankers" (Form B)**. As the name of the form suggests, it contains constructional features and equipment that she is required to carry to eliminate / control pollution by oil. Among other things, this includes;

- Whether the vessel is permitted to carry ballast water in fuel oil tanks under normal conditions or not;
- List of equipment available onboard to control discharge from machinery space bilges and fuel oil tanks;
- List of equipment available onboard to control discharge from cargo pump room bilges and cargo oil tanks;
- Details of oil filtering equipment with alarm and automatic stopping device manufacturer, type of filters used, type of stopping device);
- Details of oil discharge monitoring and control equipment;
- Approval standards (IMO resolution numbers of the required standards) of the oil filtering equipment and oil content metre;
- Identification of tanks used for the storage of **oily bilge water**;
- Identification of tanks used for the storage of **oil residues (sludge)**; and
- Whether a SOPEP is onboard or SMPEP is onboard.

Preparation for an IOPP survey

Make sure that;

- an approved damage stability calculation book is available;
- calibration certificates of the oil filtering equipment are available;
- the oil filtering equipment is working in order; and
- onboard bulk carriers and tankers need to have CAS (Condition Assessment Scheme) Statement of Compliance and CAS Final report

On oil tankers ensure that:

- oil record book Part – II is correctly maintained;
- proper means of communication between the deck watchkeepers and the cargo control room is available;
- the stripping system is working in order;
- with regards to the oil discharge monitoring equipment:
  - ✓ make sure it is working in order;
  - ✓ the operating and maintenance manual is available;
  - ✓ the equipment is calibrated and certificate available;
  - ✓ type approval certificate is available; and
  - ✓ audible and visual alarms and the equipment is working in order.

- the segregated ballast tanks and dedicated clean ballast tanks are oil free;
- an approved STS (Ship To Ship) operation plan onboard (if applicable);
- the loading condition and intact stability book is approved and available (comes under load line and SAFCON surveys as well);
- damage stability calculation software is onboard and working in order and it's document of approval is onboard;
- slop tanks and it's piping arrangement to be in order;
- UTI are working in order;
- with regards to COW systems:
  - ✓ COW operational manual is approved and onboard;
  - ✓ Ensure sufficient number of operational drive units are available as specified by the manual;
  - ✓ system must be working in order;
  - ✓ no leaks on the system;
  - ✓ over pressure release unit on the pumps used for COW are operational; and
  - ✓ pressure test the system with working pressure.

- an updated SOPEP is onboard;
- remotely operated valves and manual valves which need to be kept closed at sea are in operational condition; and
- no leaks on ballast pipes passing through cargo tanks and cargo pipes passing through ballast tanks.

12) <u>Preparation for ISM audit</u>

Documents and records

Ensure that;

- the former findings are rectified;
- SMS manuals are the latest versions, revisions are properly recorded, the filling system is in accordance with the SMS, and the documents are controlled in accordance with the SMS;
- all officers & crew are familiar with the relevant areas of the SMS manuals and signed as evidence for understanding it;
- the SMS is updated in accordance with the latest amendments to the international conventions;
- notices & updates sent by the company are read by the applicable staff and it must be signed by them;
- all statutory certificates are in order and copies displayed as required by the flag state;
- the vessel is manned in accordance with the minimum safe manning certificate, the seafarers are complying with the certification requirements (depending upon type, size, trade of the vessel and the rank the seafarers) and all have a valid medical certificate;
- the official, deck & other required logbooks (such as ballast water logbook, garbage logbook, GMDSS logbook, Oil record book Part II etc) must be in order, up to date and statements/data which are required to be entered in accordance with the SMS are entered;
- operating manuals & drawings of equipment & ship are on board;
- all officers & crew are familiar with the company policies;
- all maintenance records are updated;
- the QMS reviews being conducted & sent to office;
- internal and external audit records are on board and corrective actions taken;
- a copy of the valid DOC is on board;
- the records of drills are up to date;
- reporting to the company are made in accordance with the SMS;
- latest editions of nautical publications, charts & IAMSAR Manual (Volume III) and notices to mariners available;

- the watch schedules are posted;
- the master has frequently issued standing orders and night orders;
- LSA & FFA training manuals are onboard and updated accordingly;
- the posters which are required by the SMS (Eg – steering change over procedure, instructions with regards to lookout etc.), garbage management process etc. correctly displayed;
- muster lists are updated, and the crew is aware of their duties;
- IMO symbols on life jackets, lifeboats, rafts, escape routes, muster stations etc. are displayed and clearly visible;
- the donning instructions of life jackets, immersion suits etc. are clearly visible;
- operating instructions for emergency generator, fire pump, emergency steering, fixed firefighting systems, remote stops, lifeboat/life raft launching etc. must be clearly displayed;
- the applicable check lists are used during the operation of the vessel;
- the records of permit to work systems and risk assessments are available;
- an emergency towing booklet is onboard - (comes under SAFCON survey as well);
- all records of inspections, repairs, tests of lifeboats and launching devices to be signed by the person who carried out the work and counter signed by company representative or master;
- emergency contact list is available; and
- SOPEP or SMPEP is available depending upon the type of the vessel.

Safety & environment protection

Ensure that:

- LSA & FFA are maintained properly;
- escape routes are clear from obstacles;
- hull, deck and accommodation areas are maintained properly;
- all ventilation flaps are marked with open/close positions and they are identified. Ensure that they are fitted with flame screens and the dip trays are cleaned with plugs connected;
- the SOPEP equipment is in order and inventories are updated;
- a permit to work system is used when required;
- a risks assessment is carried out before commencing any work;
- work & rest hours are being complied with;
- unannounced blood alcohol tests are carried out on seafarers who do watches;
- maintenances of lifeboats and launching appliances are done in accordance with the manufacturer's instructions and under the direct supervision of a senior officer (in most companies, under the direct supervision of the Chief Officer); and

- appropriate PPEs are used onboard during operations.

Navigation, bridge equipment and procedures

Ensure that:
- passages are planned from berth to berth;
- bridge equipment is tested in accordance with the SMS and manufacturer's instructions;
- bridge equipment is maintained in order;
- passage plans are used, and all officers have signed it, to ensure that they have read it;
- all the logbooks are properly maintained;
- proper methods of position fixing are used as appropriate; and
- the safety information received are regularly checked (Eg – NAVTEX, EGC, weather faxes etc).

Cargo Operations

Ensure that:
- the pollution prevention requirements are complied with; and
- cargo handling is carried out in accordance with the SMS which includes;
  - ✓ use of cargo plans for loading and unloading.
  - ✓ use ballasting / de-ballasting sequence plans.
  - ✓ use of cargo lashing plans

Calibration of measuring and testing equipment

Ensure that:
- calibration kits for portable gas measuring instruments are available and calibration records are available; and
- testing of equipment onboard is carried out in accordance with the PMS and manufacturer's instructions.

Accident/Incidents/Near misses

Ensure that:
- All accidents/incidents/near misses are documented, and company is informed; and
- corrective actions are taken, based on the incident's root cause analysis.

Training

Ensure that:

- LSA & FFA training manuals are read by all staff and signed;
- Trainings are conducted according to the company's training matrix and training records are available on board;
- records of CBT provided and use of Safety videos are maintained;
- ensure onboard safety familiarizations are provided at the time of joining;
- type specific ECDIS training is provided to the master and to all navigation officers;
- all are aware of the DPA and the role of the DPA; and
- training on cargo handling is given as appropriate.

13) <u>Preparation for ISPS audits</u>

Ensure that:

- former audit findings are rectified;
- the copy of the DOC is valid, and the latest CSR is available;
- the name and address of the company on SSP, DOC, SMC and CSR are the same;
- the SSO is qualified (having the SSO certificate);
- an approved SSP is available and any amendments approved;
- procedures are available to review and update the SSP periodically;
- records of periodical reviews of SSP are available;
- record of information for last ten ports and DoS are available;
- records of internal audits and inspections available;
- reports of security incidents are available;
- the security related duties are assigned, and the staff is aware of their duties and SSO is known by all the staff;
- security policy and security procedures are known by all the persons;
- trainings and drills conducted according to the SSP and records available onboard;
- actions to be taken in case of breach of security are known by all persons;
- the SSP is protected from unauthorized access;
- procedures available to respond to security threats or breaches of security;
- procedures for evacuation in case of security alerts are available;
- reporting procedures available;
- records of security related communications with flag state and ports are readily available;
- CSO and the contact numbers are known by all persons;
- measures are available to prohibit unauthorized access to the vessel;
- measures are available to prevent taking dangerous substances and devices onboard;

- measures are available to prohibit unauthorized items coming onboard along with cargoes and ship stores;
- the required security procedures at the gangway are complied with and security log is maintained;
- restricted areas identified and measures available to prohibit unauthorized access;
- procedures that need to be followed in all levels of security are available;
- list of security equipment and their locations available;
- security equipment is tested, calibrated and in working order; and
- make sure SSO is aware of the duties of SSO which will include but not limited to:
  - ✓ how to carryout security assessment;
  - ✓ how to plan and carry out inspections, audits, searches, security drills etc.;
  - ✓ how to operate security equipment;
  - ✓ operational limitations of security system; and
  - ✓ Position and operation of security alert system.

14) Port state (PSC) inspections

No need to have special preparations required to undergo a PSC inspection if the vessel is maintained as per the international standards, customary practices, with good seamanship practices and if a safety culture is implemented onboard. Consider the following in order to ensure that the vessel is ready for an inspection.

Certification and documentation

- Ship's certificates must be valid and properly endorsed where necessary;
- Crew must have certificates, flag state endorsements and other documents applicable for the rank and type of the ship; and
- Ship's record books and records must be properly completed and signed by relevant parties (deck logbooks, official logbooks, GMDSS log, oil record book (Part II), garbage record books, ballast water record, work and rest hour records etc).

Navigational safety

- Latest editions of nautical charts and navigational publications are available and corrected to the latest edition of the notices to mariners available onboard.
- Bridge equipment must be in working order and any exemptions certificates are available if required;
- Relevant navigational notices are posted and available on the bridge;

- AIS must be updated; and
- Day shapes must be available onboard.

Lifesaving, firefighting, security and pollution prevention

- Relevant security measures must be observed at the gangway;
- Lifeboats and associated equipment must be ready for lowering;
- All the LSA and FFA equipment onboard must be in their respective positions ready for immediate use in an emergency;
- Emergency fire pump, emergency generator and emergency lighting systems must be in good order and condition;
- Portable and fixed firefighting systems must be maintained properly;
- LSA and FFA training manuals must be updated;
- Drills conducted as per the drill matrix and records maintained; and
- All crew must be well familiar with their safety, security and pollution prevention duties and the operation of LSA and FFA equipment effectively.

General condition

- General appearance of the vessel must be in good condition;
- Living condition onboard must be acceptable;
- Crew must be always safety conscious; and
- SMS is properly implemented and a safety culture must be available.

15) <u>Ballast water management survey</u>

Ensure that;

- an approved ballast water management plan is onboard;
- the local ballast water management requirements where the vessel is trading are onboard [Example – Intra North Sea Contingency Area – This is established by Belgium, Denmark, Germany, Norway, the Netherlands, Sweden and the United Kingdom for the purpose of Ballast Water Exchange plus Treatment (BWMS) because the **challenging water quality (CWQ)*** has continued to affect operations in ports in North Sea States. This Contingency Area will expire on 26 June 2030 unless extended by the

aforementioned States and will be reviewed on a yearly basis to update the map and coordinates as appropriate[20]];

- a ballast water record book is onboard;
- the documents related to D – 2 standards (treatment facilities) are onboard, such as:
  - ✓ a type approved certificate;
  - ✓ manufacturer's operating manuals;
  - ✓ installation commissioning procedures;
  - ✓ calibration procedures;
  - ✓ past calibration records; and
  - ✓ maintenance records of the equipment.

- an officer in charge of ship's ballast water is appointed (usually, the chief officer) and all persons (including the said officer) who are engage in ballast water management shall be trained and must be aware of the ballast water operations;
- the ship's ballast water and sediments are managed in accordance with the procedures;
- correct entries are entered in the ballast water record book, officer in charge of the ballast water has signed each entry and the master has signed each completed page;
- the records on the ballast water record book are available at least for last two years;
- the sampling points are available and clear of obstructions to take samples; and
- enclosed space entry procedures are complied with when entering ballast water tanks.

* **Challenging water quality (CWQ)** refers to ambient uptake water having quality parameters [including but not limited to high *total suspended solids* (*Total suspended solids* are defined as solids in water that can be trapped by a filter), or *turbidity*] that cause a properly installed, maintained and operated type-approved BWMS to be temporarily inoperable due to an operational limitation or an inability to meet operational demand. However, temperature and salinity are not parameters that define CWQ[21].

16) <u>Harmonised System of Survey and Certification (HSSC)</u>

The objective of the HSSC is to standardize the period of validity and the intervals between surveys for eleven certificates that need to be carried onboard to a maximum period of 05 years except for passenger ship safety certificate. The advantages of HSSC include:

- reduced number of surveys;

[20] https://www.gov.uk/government/publications/min-723-mf-ballast-water-management-the-intra-north-sea-ballast-water-contingency-area/min-723-mf-ballast-water-management-the-intra-north-sea-ballast-water-contingency-area (Last visited 14/05/2026)

[21] Refer Resolution MEPC.387(81) of IMO or the latest for further details

- less workload on seafarers as the number of surveys are reduced;
- reduction of costs;
- reduced paperwork; and
- elimination of repetition of work as certain areas are surveyed more than in one survey as marked above in red colour under different surveys.

Types of surveys under HSSC[22]

- **Initial survey** – before the vessel is put into service.
- **Renewal survey** – leads to issue a new certificate, same as a periodical survey.
- **Periodical survey** – inspection of the items as relevant to the certificate to ensure they are in a satisfactory condition & fit for service.
- **Intermediate survey** – inspection of the specific items as relevant to the certificate to ensure they are in a satisfactory condition & fit for service.
- **Annual survey** – general inspection to ensure applicable items are being maintained satisfactory for the service.
- **Inspection of the ship's bottom** – to ensure the underwater part of the vessel & related items are in a satisfactory condition.
- **Additional survey** – may be carried out after a repair & it could be a general or partial inspection.

The harmonized system provides for[23]:

- a one-year standard interval between surveys, based on initial, annual, intermediate, periodical and renewal surveys, as appropriate, except for MARPOL Annex IV which is based on initial and renewal surveys;
- a scheme providing the necessary flexibility to execute each survey, with provision for:
  - ✓ completion of the renewal survey within three months before the expiry date of the existing certificate with no loss of its period of validity;
  - ✓ a "time window" of six months – from three months before to three months after the anniversary date of the certificate for annual, intermediate and periodical surveys; and
  - ✓ items associated with the cargo ship safety construction intermediate survey that are additional to the requirements of the annual survey may, alternatively, be carried out at the second or third annual survey or between these surveys. In no case does this survey remove the need to carry out the required annual surveys.

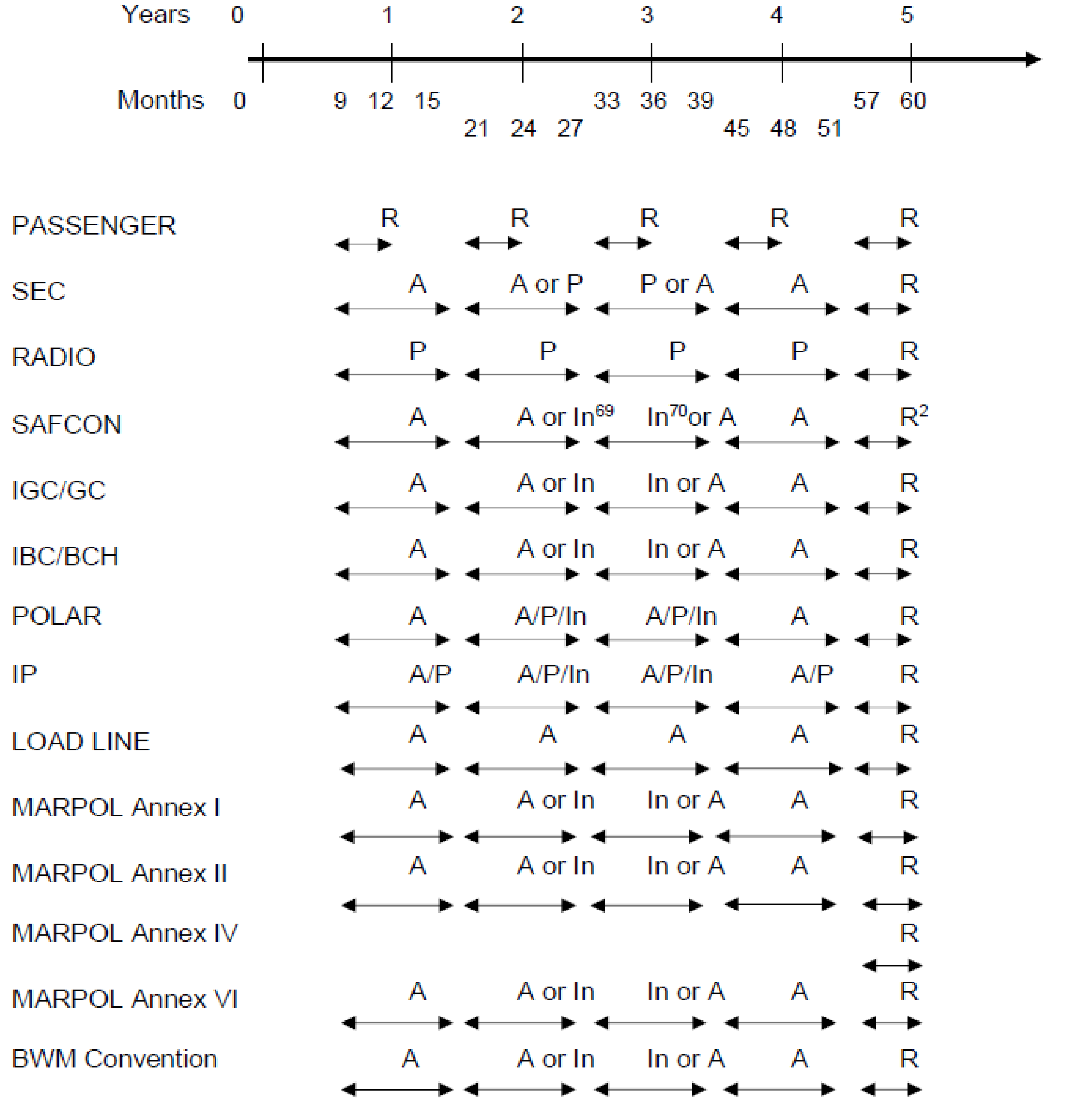
[22] Refer Resolution A.1207(34) of IMO or the latest for further details
[23] ibid

- a maximum period of validity of five years for all cargo ship certificates;
- a maximum period of validity of 12 months for the Passenger Ship Safety Certificate;
- a system for the extension of certificates limited to three months, enabling a ship to complete its voyage, or one month for ships engaged on short voyages;
- when an extension has been granted, the period of validity of the new certificate starting from the expiry date of the existing certificate before its extension;
- a flexible system for inspection of the outside of the ship's bottom on the following conditions:
  - ✓ a minimum of two inspections during any five-year period of validity of the Cargo Ship Safety Construction Certificate or the Cargo Ship Safety Certificate; and
  - ✓ the interval between any two such inspections should not exceed 36 months.

- a Cargo Ship Safety Certificate under SOLAS 74/88, as an alternative to separate Cargo Ship Safety Construction, Cargo Ship Safety Equipment and Cargo Ship Safety Radio Certificates; and
- a flexible system concerning the frequency and the period of validity of certificates, subject to the minimum pattern of surveys being maintained.

Diagrammatic arrangement of the HSSC[24]

[24] Refer Resolution A.1207(34) of IMO or the latest for further details



[69] Items associated with the cargo ship safety construction intermediate survey that are additional to the requirements of the annual survey may, alternatively, be carried out at the second or third annual survey or between these surveys.

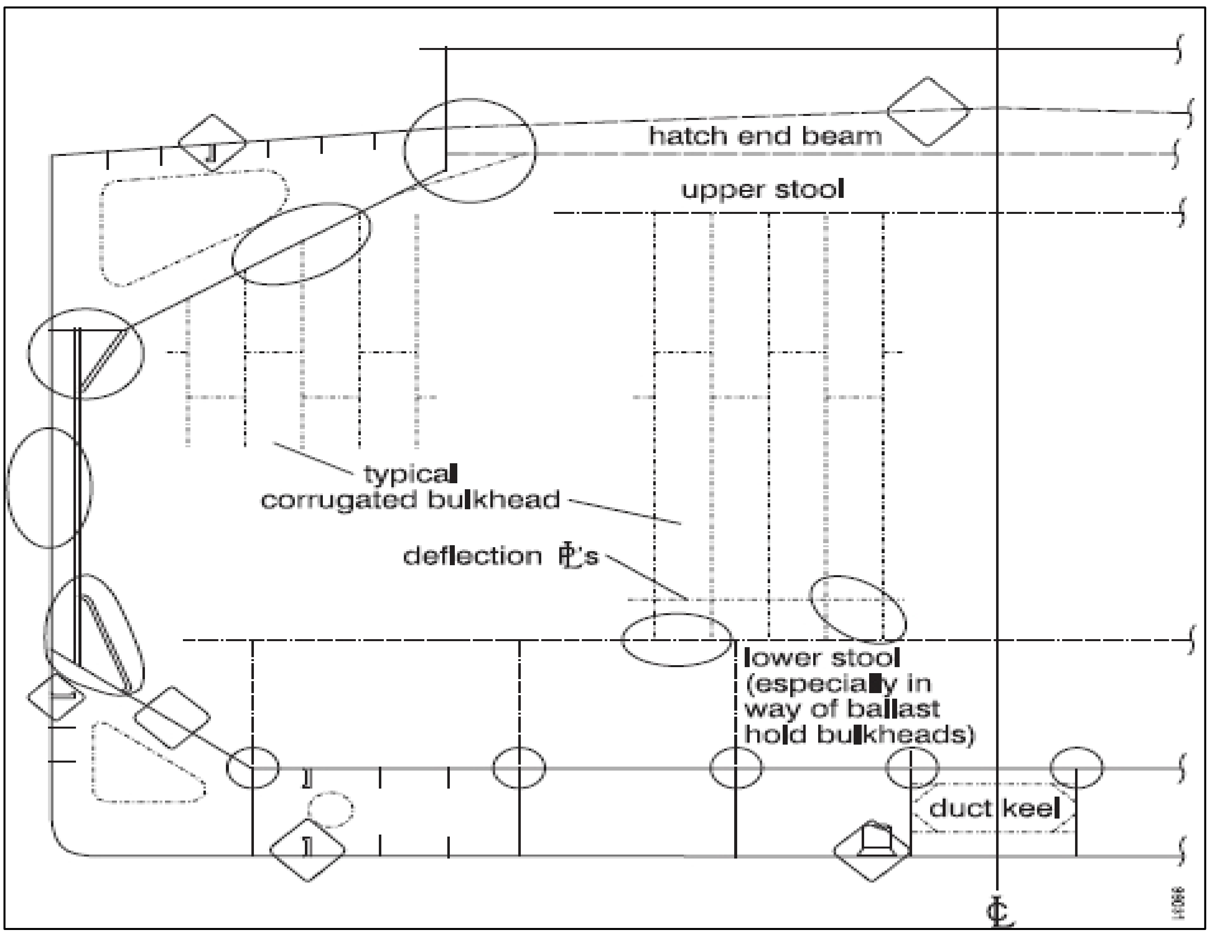
[70] The cargo ship safety construction renewal survey may be commenced at the fourth annual survey and may be progressed during the succeeding year with a view to completion by the fifth anniversary date. The survey items of the fourth annual survey should not be credited to the completion of the renewal survey.

17) Enhanced Survey Programme (ESP)

As explained above in order to maintain a ship safety, ships are required to undergo various survey requirements, such as:

- Annual surveys;
- Intermediate survey;
- Renewal survey;
- Dry docking survey etc.

Even with this survey requirements, historically, there were structural failures of bulk carrier and tankers due to various reasons. The ESP Code 2011 highlights the following locations as highly suspectable for corrosion damages and for structural failures.



Therefore, International code on the enhanced programme of inspections during surveys of bulk carriers and oil tankers, 2011 (2011 ESP CODE) was adopted by IMO with the aim of enhancing safety onboard bulk carriers and tankers.

ESP is not a new type of a survey, but it lists additional survey measures to be carried out during the above-mentioned surveys.

Brief description of the requirements of the ESP Code

The Code applies to the following types of vessels:

- Single and double-hull oil tankers;
- Single and double-side skin bulk carriers;
- Ore carriers;
- Combination carriers (OBO ships); and
- Chemical tankers

ESP Code applies to the surveys of:

- hull structure
- piping systems in way of cargo holds (for bulk carriers),
- cofferdams,
- pipe tunnels,
- void spaces,
- fuel oil tanks,
- cargo compartments and their adjacent compartments
- all ballast tanks.
- piping systems in way of cargo tanks (for tankers),
- pump rooms (tankers)

The Code contains the minimum extent of examination, thickness measurements and tank testing. The survey should be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary[25].

A close-up survey means inspection of components at closer range, usually, within the reach of hand.

The ESP Code 2011, details areas (onboard) to be surveyed and how to be done during the Annual, Intermediate, Renewal and Dry-docking surveys under the Ship Safety Construction Certificate. The scope of the survey will extend depending upon the age of the vessel as well. As

[25] ESP Code 2011

an example, refer to the table below with regards to the close-up survey requirements of a renewal survey in cargo holds of bulk carriers.

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No. 1	Renewal Survey No. 2	Renewal Survey No. 3	Renewal Survey No. 4 and subsequent
(A) 25% of shell frames in the forward cargo hold at representative positions (A) Selected frames in remaining cargo holds (B) One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type (i.e. topside, or hopper side tank) (C) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted (D) All cargo hold hatch covers and coamings (plating and stiffeners)	(A) All shell frames in the forward cargo hold and 25% of shell frames in each of the remaining cargo holds including upper and lower end attachments and adjacent shell plating (A) For bulk carriers of 100,000 dwt and above, all shell frames in the forward cargo hold and 50% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating. (B) One transverse web with associated plating and longitudinals in each water ballast tank (B) Forward and aft transverse bulkhead in one ballast tank, including stiffening system (C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted (D) All cargo hold hatch covers and coamings (plating and stiffeners) (E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches	(A) All shell frames in the forward and one other selected cargo hold and 50% of frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating (B) All transverse bulkheads in ballast tanks, including stiffening system (B) All transverse webs with associated plating and longitudinals in each water ballast tank Areas (C), (D), and (E) as for renewal survey No.2	(A) All shell frames in all cargo holds including upper and lower end attachments and adjacent shell plating. Areas (B)–(E) as for column 3

(A) Cargo hold transverse frame.
(B) Transverse web or watertight transverse bulkhead in water ballast tanks.
(C) Cargo hold transverse bulkhead platings, stiffeners and girders.
(D) Cargo hold hatch covers and coamings.
(E) Deck plating inside line of hatch openings between cargo hold hatches.

When it comes to;

- renewal surveys; and
- intermediate surveys for bulk carriers & tankers of 10 years of age or more;

the owner in cooperation with the Administration should work out a specific survey programme prior to the commencement of the said surveys. The survey programme should be in a written format and the survey should not commence until the survey programme has been agreed.

Number of surveyors

For bulk carriers and tankers of 20,000 tonnes deadweight and above, two surveyors should jointly carry out the first scheduled renewal survey after the bulk or the tanker carrier passes 10 years of age.

On bulk carriers of 100,000 tons deadweight and above, the intermediate survey between 10 and 15 years of age should be performed by two surveyors.

18) Vetting inspections

In shipping industry, the word 'vetting' means a thorough inspection process used to evaluate a vessel's safety, technical fitness, and regulatory compliance. Ship vetting started with the tanker industry and now used by charterers and ship operators in the other trades as well for the purpose of ensuring vessels are suitable for the carriage of cargoes. Vetting inspections may be undertaken by individual companies, terminal or recognized vetting organizations such as;

- CDI (Chemical Distribution Institute) – CDI is responsible for the inspection and audit of the global supply chain for the transport and storage of bulk and packaged chemicals. CDI is not a trade association; it is non-profit, non-commercial and free from political influence[26].
- SIRE (Ship Inspection Report Program) – This is a unique tanker and barge risk assessment tool used by charterers, terminal operators and government bodies to assist in the assurance of ship safety standards[27]. SIRE vetting was originated by the Oil Companies International Marine Forum (OCIMF).
- RightShip - RightShip assesses all vessels against their vetting criteria, which represents minimum requirements for good operational practices[28].

Vetting is not a statutory requirement but is a commercial requirement. Some charter parties include a vetting clause. Preparation of a vessel for a vetting inspection, completely depend upon the objectives of the individual vetting organization. Therefore, ship staff shall adhere to the inspection check list issued by the respective vetting organization. Apart from that, following points shall be kept in mind when preparing a vessel for an inspection:

- Officers and crew to be well familiarized with their duties.
- Ship staff shall know the operation of various equipment used onboard.

[26] https://www.cdim.org/psp/cdim.wp_home (Last visited 16/05/2026)
[27] https://www.ocimf.org/document-libary/71-programmes-sire/file (Last visited 16/05/2026)
[28] https://help.rightship.com/en/articles/4248900-vessel-vetting-methodology (Last visited 16/05/2026)

- Ship staff shall know their duties during emergencies and the operation of emergency equipment.
- All shall be familiar with the relevant areas of the ship's SMS.
- Maintain a good housekeeping onboard.
- Ensure all the records (logbooks, check lists and other documentary evidence) are correctly maintained and up to date.
- Make sure the maintenances onboard are carried out according to the ship's PMS and the records for the same are correctly maintained.
- Fluency of the common language used onboard.
- Ship's certification and the qualifications of the staff are appropriate and valid.

19) CAP (Condition Assessment Programme)

This is a non-mandatory, ship's condition assessment programme introduced by the classification societies for commercial purposes. CAP can be carried out on a vessel if it is requested by the ship owner or charterer.

Initially, CAP was used by the oil majors to differentiate old substandard vessels from old but good vessels. But now, CAP could be applied to all types of ships specially aged vessels to make it possible to judge the vessel based on its current condition rather than its age.

A detailed assessment of a ship's actual condition, based on strength evaluation, and fatigue strength analysis as well as a detailed-on site systematic inspection of the hull, machinery and cargo systems can be obtained.

This consists of the following option assessments and shipowners or managers can select one or both assessments for their ships:

- Assessment of the hull structure
- Assessment of the machinery and cargo systems

At the completion of the programme a vessel will be rated as below (hull structure or machinery and cargo systems or both as per the options selected).
CAP 1 – Very good condition
CAP 2 – Good condition
CAP 3 – Satisfactory Condition
CAP 4 – Unsatisfactory Condition (below the minimum standards)

The hull condition will be rated separately, and machinery/cargo systems will be rated separately.

After the completion of the CAP, the certificate of CAP indicating the ship's comprehensive rating (Overall Rating for CAP-HULL and/or CAP-MACHINERY / CARGO SYSTEM) is issued. Detailed assessment results and the relevant records are attached to the certificate of CAP. This certificate does not have an expiry date. But, the ship owner can get his vessel re-evaluated when deem necessary.

CLASSIFICATION SOCIETIES

The purpose of classification

Classification societies are organisations which develop and apply technical standards for the design, construction and survey of ships and which carry out surveys and inspections on board ships. Flag states can authorize classification societies to act on their behalf to carry out statutory survey and certification work of their ships[29].

Internationally, a class certificate is not required to be carried on board. While a vessel may technically sail without one, doing so is not commercially feasible. Therefore, most shipowners choose to classify their vessels. However, individual flag states may make classification compulsory. For example, to register a vessel under the Sri Lankan flag, the ship must be classified by an approved recognized organization that is authorized by the Director General of Merchant Shipping (DGMS)

Classification societies are also known as Recognized Organizations or ROs as well. Once a flag state accepts a classification society to act on behalf of them, it becomes a recognized organization for that flag state.

The advantages of classification

- Easier to obtain insurance with beneficial premiums.
- Re-sale value of a classified ship is higher than an un-classified ship.
- Some cargo policies require cargo to be shipped in classed vessels.
- Classed vessels guarantee that she meets statutory requirements, therefore it is an attraction to shippers.
- A large body of expert opinion is available during design and building of a vessel and during vessel's service.
- Owner has an independent opinion on the standard of construction and maintenance of his vessel.
- Availability of local surveyors worldwide, therefore inspection of damages, repairs etc. can be done easily and without delay.

[29] https://www.emsa.europa.eu/inspections/90-classification-societies.html (Last visited 16/05/2026)

International Association of Classification Societies (IACS)

IACS is an association of Classification Societies. There are about 50 classification societies around the world. Among them only twelve classification societies have the membership of IACS. The design, construction, maintenance standards of IACS members are in a high quality than non IACS members. Therefore, the IACS members have a better reputation around the world.

Members of IACS[30]

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- CCS (China Classification Society)
- CRS (Croatian Register of Shipping)
- DNV
- KR (Korean Register)
- LR (Lloyd's Register)
- ClassNK (Nippon Kaiji Kyokai)
- RINA (Registro Italiano Navale)
- Türk Loydu (a Turkish classification society)
- IRS (Indian Register of Shipping)
- PRS (Polish Register of Shipping)

Procedure of carrying out surveys in foreign ports where class surveyors are not available

Vessel's classification society can appoint another classification society (usually, a member of IACS) based in that port to carry out the required surveys, but this will be done according to the standards of the vessel's classification society. The results of the survey will be informed to the vessel's classification society, so that they can issue a certificate. Otherwise, the appointed class will endorse the existing certificate, but they will not issue a new certificate.

Dual classification

A dual class vessel is one which is classed by two Societies between which there is a written agreement regarding sharing of work, reciprocal recognition of surveys carried out by each of the

[30] https://iacs.org.uk/membership/iacs-members (Last visited 16/05/2026)

Societies on behalf of the other Society and full exchange of information on the class status and survey reports.

ROs that do not have worldwide surveyors may enter into a dual classification with other ROs that do. There are requirements implemented by IACS in relation to Dual classification.

Double classification

A double classed vessel is one which is classed by two Societies and where each Society works as if it is the only Society classing the ship and does all surveys in accordance with its own requirements and schedule.

There are requirements implemented by IACS in relation to Double classification.

Suspension of class

This depends upon the standards of the individual classification societies. Following are the standards of the CCS[31]:

- When a ship is operating beyond the limitations defined by its class characters and additional class notations or any other additional conditions as approved;
- Any damage, defect, failure or grounding that may lead to the invalidation of the assigned class may, if not reported to CCS without inappropriate delay or agreement of CCS prior to foreseen repairs not obtained;
- When any outstanding recommendation or condition of class specified by CCS is overdue, and no extension is granted by CCS;
- When continuous survey item(s) due or overdue at the time of annual survey have not been dealt with, and no extension is granted by CCS;
- When surveys after construction other than annual, intermediate or special surveys are overdue, and no extension is granted by CCS;
- When repairs of any damage, defect, failure or grounding have not been completed and surveyed as specified; and
- When the shipowner fails to arrange for the unscheduled surveys as required in the Rules for Classification of Sea-going Steel Ships.

[31] https://www.ccs.org.cn/ccswzen/columnDetail?columnid=202012150528535910 (Last visited 16/05/2026)

Automatic Suspension of class

Again, this may depend upon the standards of the class. Class will be suspended automatically, in accordance with the standards of the ClassNK[32]:

- if a special survey not being completed by the due date
- if the vessel's annual survey is not completed within three months of the due date;
- if the vessel's intermediate survey is not completed within three months of the due date; and
- if any outstanding recommendations and/or conditions of class are not fulfilled.

Cancellation of the class

This also may depend upon the standards of the individual classification society. In accordance with the ABS, class will be cancelled if[33]:

- the circumstances leading to suspension of class are not corrected within the time specified;
- a vessel proceeds to sea without having completed recommendations which were required to be dealt with before leaving port; and
- class has been suspended for a period of three (3) months due to overdue Annual, Intermediate, Special or other surveys required for maintenance of class; overdue Continuous Survey items; or overdue outstanding recommendations.

[32] https://www.classnk.or.jp/hp/pdf/tech_info/tech_img/T185e.pdf (Last visited 17/05/2026)
[33] https://ww2.eagle.org/content/dam/eagle/rules-and-guides/archives/conventional_ocean_service/2_steelvesselrules2004/part_1_e-nov04.pdf (Last visited 17/05/2026)

CONTENTS OF SHIP'S PLANS AND MANUALS

1) Among other things a **Dry-docking plan** consists of:

- positioning of keel blocks;
- positioning of shores;
- frame numbers and frame spacing;
- clearances required to remove tail shaft rudders;
- positions of the transducers of the echo sounders;
- positions of sea chests;
- positions of bilge keels;
- positions of plugs of the bottom tanks;
- positions of rudder & propeller;
- draft marks etc.

2) **Plug plan** (sometimes this is combined with the docking plan) consists of:

- the locations of tank drain plugs located on the exterior of the hull.

3) **General arrangement plan** consists of:

- principle dimensions to check the required berthing space;
- information on ship's general particulars;
- locations of all the compartments including accommodation spaces. These are provided with the aid of longitudinal side elevations and plan views;
- positioning of passages to above compartments;
- drawing of each deck from the bridge deck to the bottom most deck containing spaces and the equipment on the decks. The mooring arrangements are provided on the forecastle deck and on the poop deck;
- some general arrangement plans also provides summarized information from other plans as well, such as positioning of bottom plugs, visibility diagrams etc.

4) **Rigging plan** consists of:

- arrangement of all lifting appliances relevant to cargo operations.
- with reference to derricks, cranes and union purchase:

- ✓ Positioning of guys;
- ✓ Resultant forces on blocks, guys, wire ropes and booms;
- ✓ Positions of blocks;
- ✓ Identification marks of individual items;
- ✓ Maximum and minimum outreaches of the cranes and derricks that can be reached from it's base;
- ✓ Maximum angles that a cranes / derricks can be swung horizontally;
- ✓ Rigging arrangements and working ranges of union purchase.

- Position & size of deck eye-plates;
- Size & SWL of blocks, booms, runners, topping lifts, shackles etc.

5) **Mooring arrangement plan** consists of:

- positions of winches, windlasses, fair leads, bollards and other equipment used for mooring purposes;
- arrangement of mooring ropes for mooring purposes;
- plate thicknesses, arrangement and types of steel used in staging (seats of bollards and roller leads) used for roller leads, bollards;
- angles of roller lead (if they are angled);
- SWL of the bollards, roller leads, fair leads etc.

6) **Midship section plan** consists of:

- scantlings of plates;
- rise of floor;
- longitudinal profiles of the vessel etc.

7) **Capacity plan** consists of:

- positions of all spaces used for cargo storing, fuel oil, ballast water, fresh water, sludge, waste oil, engine room bilge water, overflow oil, drain oil etc.;
- volume of the above spaces;
- maximum weights that can be occupied;
- maximum free surface moments of spaces used to store liquids etc.

8) **Tank arrangement plan** consists of:

- positions (by means of frame numbers and distances from aft) of fresh water, ballast, fuel oil and other tanks. These positions are provided with the aid of diagrams containing longitudinal side elevations and plan views;
- distances to above tanks from aft (LCG);
- capacities of the tanks;
- vertical centres of gravities;
- maximum free surface moments etc.

9) **Shell expansion plan** consists of:

- positions of keel the plates;
- positions of the bilge keels (if available);
- position of the sheer strake, positioning of bottom plates, positioning of hull plates;
- plate thicknesses;
- frames;
- openings;
- a numbering system of the bottom and hull plates. These plates are lettered (alphabetically) from the keel towards the sheer strake and numbered (numerically) from aft to fwd for identification purposes. This is very important when identifying / reporting of the positions of plates which are damaged and need to be replaced.

10) **Cargo securing manual** consists of[34]:

- Include number, locations, type & maximum securing load (MSL) of the fixed cargo securing devices. A plan or list of such devices may be provided and shall have appropriate documents for each type of lashing device which includes name of manufacturer, simple sketch, material(s), identification marks and MSL etc.
- Number, function and design characteristics of the portable cargo securing devices, including drawings or sketches. Appropriate documentation shall be available for each type of portable cargo securing device which shall include name of manufacturer, simple sketch, material(s), identification marks MSL etc.
- Inspection and maintenance schemes for the cargo securing materials.
- Stowage and securing methods of non-standardized and semi-standardized cargoes with illustrations.

[34] Refer MSC.1/Circ.1353/Rev.2 of IMO or the latest for further details

- Stowage and securing of containers and other standardized cargoes with illustrations.
- Other allowable stowage patterns than mentioned above.
- **Cargo Safe Access Plan (CSAP)**
  - ✓ This plan is a part of the cargo securing manual. Ships which are specifically designed and fitted for the purpose of carrying containers should be provided with a Cargo Safe Access Plan (CSAP) in order to demonstrate that personnel will have safe access for container securing operations. This plan should detail arrangements necessary for conducting cargo stowage and securing in a safe manner. It should include the following for all areas to be worked by personnel[35]:
    - handrails;
    - platforms;
    - walkways;
    - ladders;
    - access covers;
    - location of equipment storage facilities;
    - lighting fixtures;
    - container alignment on hatch covers/pedestals;
    - fittings for specialized containers, such as reefer plugs/receptacles;
    - first aid stations and emergency access/egress;
    - gangways; and
    - any other arrangements necessary for the provision of safe access

11) Ship Security Plan

- Measures to prevent use of weapon or other dangerous substances onboard against ship personnel;
- Identification of restricted areas;
- Measures to prevent unauthorized access to a ship as well as to unauthorized areas;
- Procedures for responding to security related incidents (threats, breaches etc.);
- Procedures to be followed during three security levels;
- Procedures for evacuation;
- Duties and responsibilities of on-board personnel;
- Procedures for auditing the security related activities;
- Procedures for security related training and drills;
- Procedures for updating the ship security plan;
- Procedures for interfacing with port facilities;
- Procedures for reporting security incidents;

[35] Refer MSC.1/Circ.1353/Rev.2 of IMO or the latest for further details

- Identification of ship security officer and company security officer, including CSO's 24 hr contact details;
- Procedures & frequencies for testing, calibration and maintenance of security equipment;
- The location of the activating points of the ship security alert system; and
- Procedures of using the ship security alert system.

12) Coating technical file (CTF)

This is applicable for **protective coatings in dedicated seawater ballast tanks** of;

- all types of ships of not less than 500 GT;
  - ✓ for which the building contract is placed on or after 1 July 2008, or
  - ✓ in the absence of a building contract, the keels of which are laid, or which are at a similar stage of construction on or after 1 January 2009, or
  - ✓ the delivery of which is on or after 1 July 2012

- double-side skin spaces arranged in bulk carriers of 150 m in length and upward

The inspection of surface preparation and coating process shall be agreed between the ship owner, shipyard and the paint manufacturer. Evidence of these inspections will be included in the CTF and it shall contain:

- copy of Statement of Compliance or Type Approval Certificate;
- copy of Technical Data Sheet (paint manual), including:
  - ✓ product name and identification mark and/or number;
  - ✓ materials, components and composition of the coating system, colours;
  - ✓ minimum and maximum dry film thickness;
  - ✓ application methods, tools and/or machines;
  - ✓ condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and
  - ✓ environmental limitations (temperature and humidity)

- shipyard work records of coating application, including:
  - ✓ applied actual space and area (in square metres) of each compartment;
  - ✓ applied coating system;
  - ✓ time of coating, thickness, number of layers, etc.;
  - ✓ ambient condition during coating; and
  - ✓ method of surface preparation.

- procedures for inspection and repair of coating system during ship construction;
- coating log issued by the coating inspector, stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier

representative and specifying deviations from the specifications (example of daily log and non-conformity report)

- shipyard's verified inspection report, including:
  - ✓ completion date of inspection;
  - ✓ result of inspection;
  - ✓ remarks (if given); and
  - ✓ inspector signature

- procedures for in-service maintenance and repair of coating system.

The CTF shall be kept onboard throughout the lifetime of the vessel and will be issued by the shipyard. Following shall be recorded in the CTF:

- In-service maintenance;
- Repair;
- Partial re-coating activities; and
- Full re-coating activities.

13) Ship structure access manual (SSAM)

This is applicable for;

- oil tankers of 500 GT & above and
- bulk carriers of 20,000 GT and more, which are constructed on or after 1 January 2006.

A ship's means of access to carry out overall and close-up inspections and thickness measurements shall be described in a Ship structure access manual **approved by the Administration**. The Ship structure access manual shall include the following for each space in the **cargo area**:

- plans showing the means of access to the cargo species;
- plans showing the means of access within each cargo space to enable overall inspections and close-up surveys;
- instructions for Inspection and Maintenance of Means of Access;
- instructions for rigging and use of portable means of access;
- inventory of portable means of accesses;
- instructions for safety rafting (large tankers use rafts inside cargo tanks in partly ballasted conditions for close-up surveys); and
- records of inspections and maintenances of the ship's means of access.

- MSC.1/Circ.1572/Rev.2 revised the contents of the SSAM and the key changes include[36]:
  - ✓ Additional inspection requitements:
    - All means of access arrangements, including portable equipment and associated fittings, are to undergo annual inspection.[1]
    - Each inspection is to be recorded in Part 2 of the Ship Structure Access Manual (SSAM).
    - Before any examination of a space that uses PMA, a condition check of the permanent access equipment must be carried out and recorded for the specific space.

  - ✓ Updated inspection procedures:
    - Where damage or deterioration is identified, including coating breakdown or material wastage, an assessment shall be carried out to determine whether the condition affects the safe use of the access arrangement.
    - If the condition is assessed as substantial damage, details shall be recorded in Part 2 of the SSAM.

  - ✓ Enhanced inspection records:
    - Inspection records for means of access shall include the date of inspection, name and title of the inspector, confirmation or signature of the inspector, sections of the access arrangements inspected, verification of safe condition or details of deterioration or substantial damage, and a description of any repairs carried out.
    - Inspection records shall be made available to classification surveyors prior to surveys.

14) VOC (Volatile Organic Compounds) management plan

In accordance with the MARPOL Annex VI, **all the tankers carrying crude oil** shall have onboard an **approved VOC management plan**. This plan shall be available onboard before obtaining IAPP Certificate and such a plan shall contain at least[37]:

- Identification of designated person responsible for implementing VOC management plan & associated procedures onboard;
- Duties and responsibilities of other people who are engage in VOC operations;
- Operation manuals of:

[36] https://www.dnv.com/news/2026/revised-interpretation-of-requirements-to-permanent-means-of-access-pma/ (Last visited 18/08/2026)
[37] Volatile organic compound emissions from cargo systems on oil tankers, OCIMF, https://www.ocimf.org/es/document-libary/1065-volatile-organic-compound-emissions-2026/file (last visited 17/05/2026)

- ✓ Volatile Emission Control System (VECS);
- ✓ Vapour recovery system or any other VOC control system manuals;
- ✓ Inert gas system;
- ✓ Crude oil washing; and
- ✓ Operations of P/V valves

- Following drawings should also be included in the plan:
  - ✓ General arrangement plan;
  - ✓ Capacity plan;
  - ✓ Cargo tank venting system piping diagram;
  - ✓ Inert gas system piping diagram;
  - ✓ VECS piping system; and
  - ✓ Vapour recovery system or other VOC control system drawing.

This regulation also applies to gas carriers only if the types of loading and containment system allow safe retention of non-methane VOCs onboard or their safe return ashore[38].

15) STS (Ship To Ship) Operations Plan

In accordance with the MARPOL Annex I any oil tanker involved in STS operations shall carry on board an **approved Plan** prescribing how to conduct STS operations (STS manual). Such a plan will contain;

- Names and ranks of responsible persons for STS operations;
- Responsibilities of persons onboard who will be engaged in STS operations;
- STS transfer operations to be conducted under a designated Person in Overall Advisory Control (POAC) as required by MARPOL. This manual will list down suitable persons who can be designated as POAC including his/her qualifications and duties. POAC will be appointed with the agreement of Administration, cargo owners or oil tanker's operators. This manual will list down sample suitable persons who can be appointed as POAC, such as:
  - ✓ One of the masters of the vessels engage in STS operations; or
  - ✓ STS superintendent; or
  - ✓ Lightering coordinator; or
  - ✓ Mooring master employed by STS resource provider.

- Information to be reported to coastal state before the commencement of STS operations;
- Criteria to be considered when selecting an area for STS operation;

[38] https://www.imo.org/en/ourwork/environment/pages/volatile-organic-compounds-(voc)-%E2%80%93-regulation-15.aspx (last visited 17/05/2026)

- List of information that should be sent to the vessels from the STS Service provider (STS organiser), so that the masters of the vessels can prepare their own vessels for the operation;
- Navigational warning to be broadcasted before and during the transfer operation to all ships;
- Actions to be taken in case of communication failures while manoeuvring for STS operations or during the STS transfer operations;
- Fender arrangements;
- Information regarding hoses, pipe reducers, mooring equipment, lighting, ancillary equipment etc;
- Emergency signals and actions to be taken in case of an emergency;
- Guidelines for risk assessment;
- Information to be exchanged between ships;
- Guidelines for ship manoeuvrings for STS operations;
- Vessel's maximum and minimum free board heights;
- Guidelines for preparing for mooring operations;
- Pre-transfer procedures;
- Guidelines on planning the cargo transfer;
- Guidelines to be followed during the cargo transfer;
- When to suspend a cargo transfer;
- The Elimination of Electrical Current and Electrostatic Charge in Cargo Hoses;
- Guidelines on the use of communication equipment, their transmitting aerials and other navigational equipment for the purpose of avoiding fire hazards;
- Guidelines for completion of the cargo transfer;
- Guidelines for unmooring operations;
- STS transfer check lists;
- Mooring arrangement plans;
- Tank capacity plan; and
- Record of STS operations taken place etc.

16) Plans and procedures for recovery of persons from the water

The purpose of this document is to provide guidance for the master and other crew members on board the ship regarding procedures for recovering persons from water or from crafts in distress.

This document is to be kept onboard and maintained in accordance with SOLAS regulation III/17-1 and in order to achieve its purpose, crews on board should be familiar with this document. This contains;

- Responsibility of the master with regards to recovery operations;
- Recovery process:
  - ✓ Planning the whole recovery process which includes risk assessment;
  - ✓ Points to consider when bringing the vessel to the distress area;
  - ✓ Methods to bring the distress people alongside the vessel;
  - ✓ Identified rescue zones of the own vessel (areas where the distress people can be taken alongside of the own vessel for the purpose of recovering);
  - ✓ Methods of recovery when distress people are alongside. This may include:
    - Use of ladders including the accommodation ladder;
    - Use of rescue boats;
    - Use of cargo gears (if available);
    - Use of provision crane; and
    - Use of recovery net (if available).

  - ✓ Check list to be used in recovering distress people.

- Actions to be taken when people can be recovered without putting own vessel in danger;
- Taking care of the recovered persons; and
- List of ship's recovery equipment available onboard.

17) Ship's paint manual or Painting specifications

Among other things, a ship's painting manual may contain:

- Final colours of paints to be used in deferent areas of the ship (Eg. Accommodation – white colour, Cargo cranes – orange, Hull top side – grey, Hull bottom – red etc.)
- Brand names of paint (Eg. HEMPEL'S NAUTIC HI-7690, HEMPADUR 1513 etc.)
- Generic type of paints (Eg. Self polishing antifouling, Coal tar epoxy etc.)
- Names of suppliers (Eg. Dong-Ju Hampel, CORTEC etc.)
- In different areas of the ship;
  - ✓ How many coatings to be applied;
  - ✓ Brand name and colour of each coat; and
  - ✓ Dry Film Thickness (DFT) of each coat.

18) Others

Plans and documents which comes under pollution prevention measures (Example – SEEMP, Ballast water management plan, bio fouling management plane etc.) are discussed under the heading of 'Pollution Prevention' below.

RISK MANAGEMENT & ASSESSMENT ONBOARD

IMO defines risk as the combination of the frequency and the severity of the consequence[39]. In simple terms, what it means is:

Risk = **Severity of the consequences** x **Likelihood of occurrences**

Risk management is the coordinated activity to assess, control and monitor risk[40]. It also can be more elaborated as the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence[41].

Risk assessment is the process of risk identification, analysis and evaluation[42].

The ISM Code states, "Safety management objectives of the company should .... establish safeguards against all identified risks". Therefore, risk assessment is compulsory onboard, and this is achieved through flag state regulations. Some flag states have provided general formats and procedures in risk assessment methods.

Ship management companies have their own methods (which of course comply with flag state requirements) of risk assessments. Therefore, the chief officers are required to have a good idea about the ship or company specific risk assessment process.

The following is an abstract obtained from the "A Guide to Risk Assessment in Ship Operations' published by IACS[43] with regards to risk assessment onboard ships.

A hazard is a substance, situation or practice that has the potential to cause harm. Briefly, what we are concerned with, therefore, is: -

- the identification of hazards;
- the assessment of the risks associated with those hazards;
- the application of controls to reduce the risks that are deemed intolerable; and
- the monitoring of the effectiveness of the controls.

The controls may be applied either to reduce the likelihood of occurrence of an adverse event and/or to reduce the severity of the consequences. The risks that we are concerned with, are those that are reasonably foreseeable, and relate to:

- the health and safety of all those who are directly or indirectly involved in the activity, or who may be otherwise affected;

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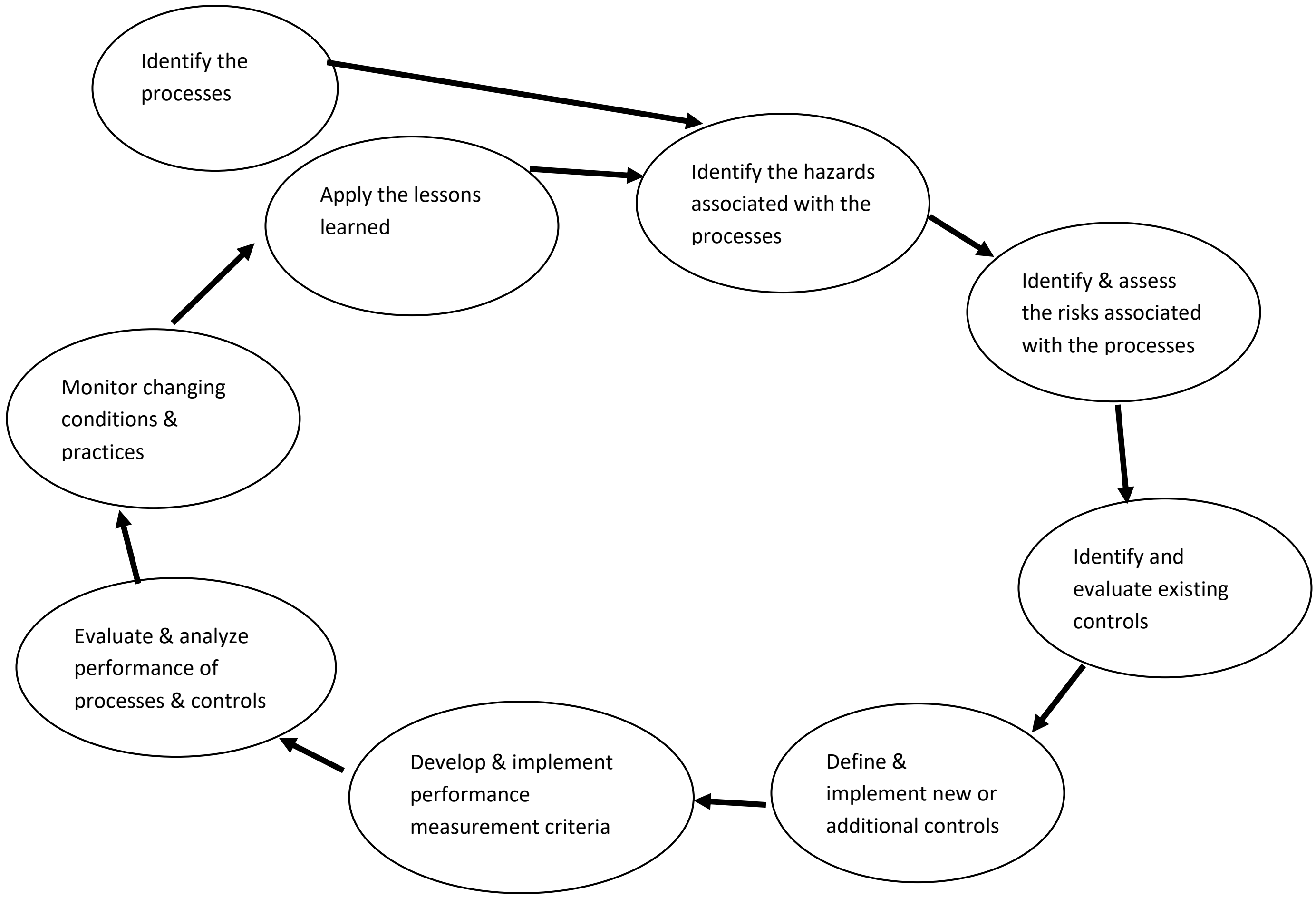
39 Refer MSC-MEPC.2/Circ.12/Rev.2 or the latest of IMO
40 https://britanniapandi.com/2024/08/understanding-effective-risk-assessment/ (Last visited 17/05/2026)
41 ISO 8402:1995/BS 4778
42 ISO 31000:2018 Risk management – Guidelines, ISO.
43 IACS, No. 127 (June 2012) (Rev.1 Nov 2021)

- the property of the company and others; and
- the environment.

The risk management process may be summarized by the flowchart below.



Compiler's notes:

Therefore, risk management means the whole process of mitigating and / or eliminating the risks and in practical terms, this includes;

- analysing of the former accidents onboard, near misses onboard, requirements of the ship's SMS, company circulars and former accident that occurred within the fleet. This will help you to take **proactive measures** in managing risks. Basically, this means application of lessons learned.
- Identify the risks involved with various duties onboard. This may also depend upon the age of the ships, equipment onboard, trade, type of the vessel, number of people onboard etc.
- Critically analyse the hazards involve with the present process onboard the vessel against the lessons learned and internationally required standards.

- Evaluate the existing controls against the international standards.
- Discuss with the senior management onboard to decide the amendments to be entered into the existing process.
- Apply or implement additional controls and monitor the successfulness of the same while re-assessing it when changing circumstances.
- Evaluate the outcome and see any further amendments are required.
- Finally, remember the analysing and the evaluation of the existing process has to be an ongoing process.

Risk assessment is an element of risk management. This is something that we do before we start a job onboard, but risk management is a continuous process to eliminate risks from the whole system onboard.

Further information taken from 'A Guide to Risk Assessment in Ship Operations' published by IACS:

The identification of hazards is the first and most important step in risk assessment process since all that follows depends on it. It must be complete and accurate, and should be based, as far as possible, on observation of the activity. But hazard identification is not as easy as it may first appear.

Completeness and accuracy can be achieved only if the process is systematic. Those charged with the task must have sufficient training and guidance to ensure that it is conducted in a thorough and consistent manner. The terms used should be clearly defined and the process must be fully described; for example, hazards must not be confused with incidents, and incidents must not be confused with consequences.

There are many methods and tools used for risk assessment available and the Company is free to use the most suitable one. Some of these most used methods of risk assessment include:

- Checklists
- Preliminary hazard analysis
- Job safety analysis
- Quantitative risk analysis
- Qualitative risk analysis (Preliminary Hazard Analysis)
- SWIFT
- What if analysis
- 5 Whys analysis
- Fault tree analysis (FTA)
- Event tree analysis (ETA)
- Bow tie analysis (BTA)

- Failure mode and effects analysis (FMEA)
- Hazard and operational analysis (HAZOP)

In the example of Qualitative Risk Analysis (Preliminary Hazard Analysis) method the risks associated with each hazard are evaluated in terms of the likelihood of harm and the potential consequences. This, in turn, enables the organization to establish priorities and to decide where its scarce resources may be used to greatest effect.

The combination of likelihood and consequence is normally illustrated as follows:

RISK ESTIMATOR

5 x 5 RISK MATRIX						
LIKELIHOOD	Highly Probable	5 Moderate	10 Major	15 Major	20 Severe	25 Severe
	Probable	4 Moderate	8 Moderate	12 Major	16 Major	20 Severe
	Possible	3 Minor	6 Moderate	9 Moderate	12 Major	15 Major
	Unlikely	2 Minor	4 Moderate	6 Moderate	8 Moderate	10 Major
	Rare	1 Minor	2 Minor	3 Minor	4 Moderate	5 Moderate
		Very Low	Low	Medium	High	Very High
		CONSEQUENCES				

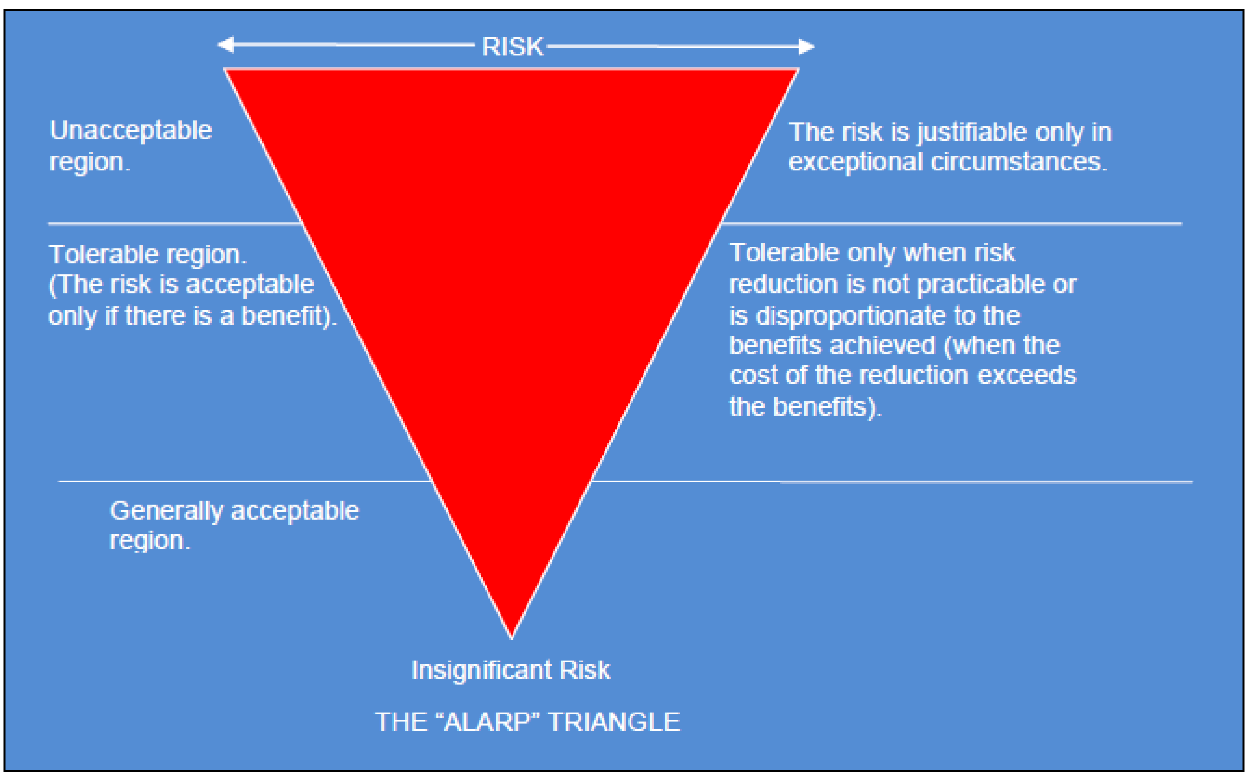
The table below indicates the recommended response in each case.

Minor	No additional controls are required. Monitoring is required to ensure control is maintained.
Moderate	Efforts are required to reduce risk. Controls are to be implemented within a specified time.
Major	New work not to start until risk reduced. If work in progress, urgent action to be taken. Considerable resources may be required.
Severe	Work shall not be started or continued until the risk has been reduced. If reduction is not possible, the activity shall be prohibited.

The tables above are for illustrative purposes and are not mandatory. The risk matrix may be expanded to include more rows and columns, depending on how finely the company wishes to distinguish the categories. The terms used for likelihood and consequence may be changed to assist understanding. For example, likelihood may be expressed in terms of “once per trip”, “once per ship year” or “once per fleet year”, and consequence may be made more specific by the use of “first aid injury”, “serious injury” or “death”, not forgetting the consequences for property and the environment.

When deciding on priorities for the application of controls, the frequency of the activity should also be taken into account; for example, it may be more urgent to address a “moderate” level of risk in a process that occurs every day than to impose controls over an activity that involves “substantial” risk, but will not be carried out in the near future.

Furthermore, the terms applied to the levels of risk in the table above should not be interpreted too rigidly. Risk should be reduced to a level that is as low as is reasonably practicable (ALARP). If a “tolerable” level of risk can be reduced still further for a reasonable cost and with little effort, then it should be. Standards of tolerability tend to be far stricter after an accident than before. The ALARP concept is often illustrated thus:



The people chosen to undertake risk assessments should be those most familiar with the area, and who have most experience of the task to be assessed. The process must be systematic, and in order to make it so, it may help to categorize areas and activities as in the following example.

Assessment Unit	**: Deck**
Activity	**: Tank cleaning**
Hazard	**: Toxic atmosphere or lack of oxygen**
Risk (before controls)	**: Intolerable (likely and extremely harmful)**
Recommended Controls	**: Atmospheric testing, ventilation, use or availability of breathing apparatus**

Compiler's notes:

As stated before, the companies can have their own methods of risk assessment. At the same time, companies may have already assessed the risks involved with known duties and jobs on board. These known duties and jobs may include, but not limited to:

- dry docking
- anchoring
- mooring operations
- coastal navigation
- navigation with pilot onboard
- electrical work
- enclosed space entry
- cargo work

The chief officer may use these risk assessments as they are or modify them. Chief officers must be careful not to blindly use company-provided risk assessments, as conditions may have changed. If the risks of a required job or duty are not pre-assessed, the chief officer must carry out a risk assessment and keep a record.

Example of risk assessments

Refer the below risk matrix along with the two examples provided;

Risk matrix

<table>
<tr><th colspan="10">Risk matrix</th></tr>
<tr><td colspan="5" rowspan="3"></td><td colspan="5">Increasing frequency</td></tr>
<tr><td>Remote</td><td>Not likely</td><td>Possible</td><td>Possibility of isolated incidents</td><td>Probable</td></tr>
<tr><td>Industry

Not happened within last 5 yrs</td><td>Company
Could happen

Industry
Has happened within last 5yrs</td><td>Company
Has already happened

Industry
Happens more than 1 per year</td><td>Company
Could happen 1 per year

Vessel
Once in lifetime of vessel</td><td>Company
Could happen more than 1 per month

Vessel
Once per year</td></tr>
<tr><td rowspan="5">Increasing consequences</td><td>Health & safety</td><td>Environmental impact</td><td>Public impact</td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Maximum First aid</td><td>Minimal or no impact</td><td>N/A</td><td>A</td><td>A1</td><td>A2</td><td>A3</td><td>A4</td><td>A5</td></tr>
<tr><td>Medical treatment</td><td>Minor impact for short duration</td><td>Impact on part of the community in the area</td><td>B</td><td>B1</td><td>B2</td><td>B3</td><td>B4</td><td>B5</td></tr>
<tr><td>Life threatening or long term effect 1 person</td><td>Serious impact</td><td>Impact on small community</td><td>C</td><td>C1</td><td>C2</td><td>C3</td><td>C4</td><td>C5</td></tr>
<tr><td>More than 1 person</td><td>Very serious impact</td><td>Impact on large on large community</td><td>D</td><td>D1</td><td>D2</td><td>D3</td><td>D4</td><td>D5</td></tr>
</table>

Example – 1 (Risk assessment in anchoring. In both the below examples, the column number 7 is to be completed by the risk assessor at the time of carrying out the risk assessment)

Risk assessment							
Job	Anchoring						
Assessor in company	DPA						
Assessor onboard	Master						
Date							
What are the sources of harm	**What can go wrong**	**What happens if it goes wrong**	**Risk rank**	**Preventive measures**	**Risk after preventive measures**	**Vessel specific measures (if applicable)**	**What has to be done if it goes wrong**
Anchor, chain, windless, stopper	Defective equipment or bad practices	Grounding, collision, pollution, loss of anchor, injury	**D3**	Training in anchor handling, proper maintenances, use of checklists, correct orders	**C3**		Use of contingency plans
Bad weather	Chain damage, anchor dragging	Grounding, collision, pollution, loss of anchor, injury	**D3**	Training in anchor handling, use of checklists, correct orders	**C3**		Use of contingency plans, use of quick release mechanism
Lack of knowledge on sea bottom	Foul anchor	Loss of anchor/chain & damage to under water obstructions, pollution	**D3**	Good voyage planning, refer all available information	**C2**		Slipping the cable on deck
Noise	Persons handling anchor are exposed to noise	Deafness	**B4**	Use of ear protection	**B2**		
Rust & other particles	Emission of rust & particles when chain is moving	Eye/skin injury, dust inhalation	**C4**	Proper maintenance of anchoring equipment, use of correct PPE	**B2**		
Guillotine & devil's claws	In correct seamanship techniques	Back pain, injuries to fingers	**C4**	Proper training & situational awareness	**B2**		
Additional comments							
							Signature

Example – 2 (Risk assessment in ballasting)

Risk assessment							
Job	Ballasting						
Assessor in company	DPA						
Assessor onboard	Chief officer						
Date							
What are the sources of harm	**What can go wrong**	**What happens if it goes wrong**	**Risk rank**	**Preventive measures**	**Risk after preventive measures**	**Vessel specific measures (if applicable)**	**What has to be done if it goes wrong**
Defective pump, valves, lines	Ballast system may not work, overflow, air suction, filling or emptying wrong tank	Impact on stability, structural damage	**B4**	Maintenance of ballast system, compliance with BWMP, familiarization & training	**B2**		Report of notification
Bad practices	Overflow, discharge in prohibited area	Pollution, detention	**B4**	Familiarization, training, compliance with BWMP & local regulations	**B2**		
Defective treatment system	Introduction of invasive species	Pollution	**B4**	Maintenance of the system, proper monitoring	**B3**		
Additional comments							
							Signature

CARGO OPERATIONS

1) Cargo operations onboard GENERAL CARGO SHIPS

Information required from the shipper

- Weight, volume and the stowage factor of the cargoes;
- Type of cargo (glass in crates, steel billets, steel coils, cement in bags etc.);
- In case of IMDG goods, the Class & UN number of the cargo (handling of IMDG is explained separately below);
- Port of discharge and loading / discharging port rotation;
- Ventilation requirements;
- Whether any special stowage, segregation of lashing arrangements are required and
- Any other information which are inherent to the proposed cargoes.

Precautions to take

- Clean the holds according to the requirements of the shipper and make sure the bilge wells are clean, dry and cargo holds are properly illuminated;
- Make sure the access to the cargo working areas are clean and in good order with proper illumination;
- If the ship's cargo gears to be used, make sure they are in good working condition;
- If cargo ventilation is required, make sure they are in working order;
- Consider the following points when preparing the stowage plan:
  - ✓ Load density of the stowage area, weight, volume and stowage factor of the cargo;
  - ✓ Available lashing points and number, sizes and types of lashing materials available onboard;
  - ✓ Dunnage requirements and certification for dunnage;
  - ✓ Viability of loading one type of cargo above another type (example – steel billets can not be loaded over fragile cargoes);
  - ✓ Possibility of closing cargo holds after loading;
  - ✓ If the cargo to be loaded on deck, consider the visibility range from the bridge and possibility of securing cargo gears after the completion of loading;
  - ✓ Port rotation;
  - ✓ Cargo segregation requirements to avoid damage to cargo (Example – tainting damage to food products when carried with rubber products) and
  - ✓ If it is possible, it is always better to load heavy weights on the tank top of the cargo hold.

- Refer the shipper's instructions as well as the industry publications such as Thomas Stowage for any special precautions to be taken;
- Ensure to order sufficient lashing materials and dunnage;
- Brocken stowage shall be reduced as much as possible to increase the cargo carrying capacity;
- Duty officers must ensure the SWL of the cargo gears are not exceeded;
- Be very careful and vigilant while unlashing the cargoes at the discharging port, as the cargo may fall on cargo workers;
- Do not allow the cargo workers to use hooks on the cargoes in paper bags as this may increase the damage to cargoes. Refer the picture below;

Hook used by stevedores during cargo operations onboard[44]

- Cargo workers have a practice of swinging the cargo which is hanging on the runner wire to reach corners of the hold. This shall not be allowed as it may over stress the cargo gear; and
- Give proper instructions to duty officers and deck watch keepers with regards to cargo stowage and cargo lashing.

Cargo stowage plan on a general cargo vessel

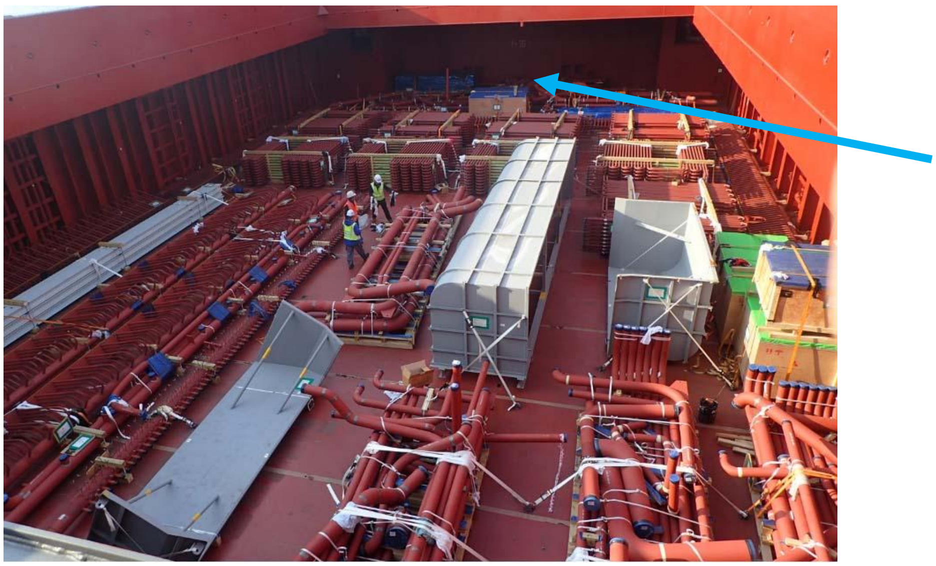
Cargo stowage plans are essential to identify the positions of cargo onboard, and these shall be given to the duty officer so that he knows exactly where to load the cargo, amounts of cargo, types of cargo and the ports that will be discharged.

Chief officer needs to consider about the following factors when making a cargo stowage plan:

- Discharging port rotation;
- IMDG requirements if loading any such cargoes;
- Possibility of tainting damage;
- Possibility of ventilating if a particular cargo is required to be ventilated;
- Viability of opening tween deck pontoons for the purpose of discharging under deck cargoes;

[44] https://en.wikipedia.org/wiki/Hook_(hand_tool) (Last visited 31/05/2026)

- Accessibility of cargo for lashing, unlashing and discharging;
- In the case of loading containers, stack weight, size and type of container;
- Load density, broken stowage and the stowage factor; and
- Viability of stowing heavier cargoes at the edges of a cargo hold. The runner wire of a crane/derrick does not reach the corners of a cargo hold because the hold opening is smaller than the tank top area. In that case, need to stow such cargoes directly below the hatch opening. Refer the picture below:



Un accessible areas in a cargo hold by cargo gears[45]

The below sample stowage plan is prepared to explain how to make such a plan but, without considering the load densities, stowage factor and broken stowage.

Apart from the diagrammatic illustration of the positions of the cargo, it also should contain the port of loading, date of loading, voyage number, colour code, departure draughts etc.

Port rotation and the colour code are as below:

i) Bombay

ii) Colombo

iii) Port Kelang

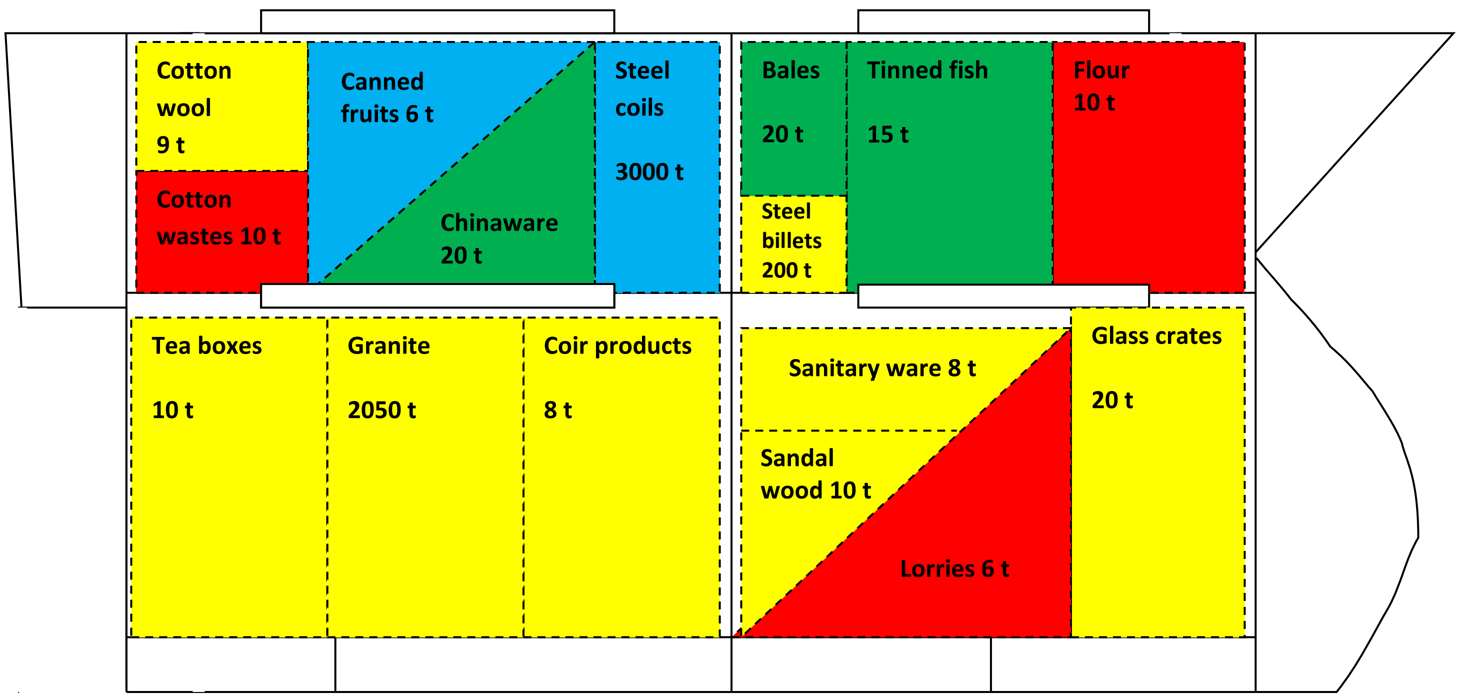
iv) Singapore

[45] https://www.molturkiye.com/shipping-services/general-cargo-and-project-heavy.html#images-2 (Last visited 31/05/2026)

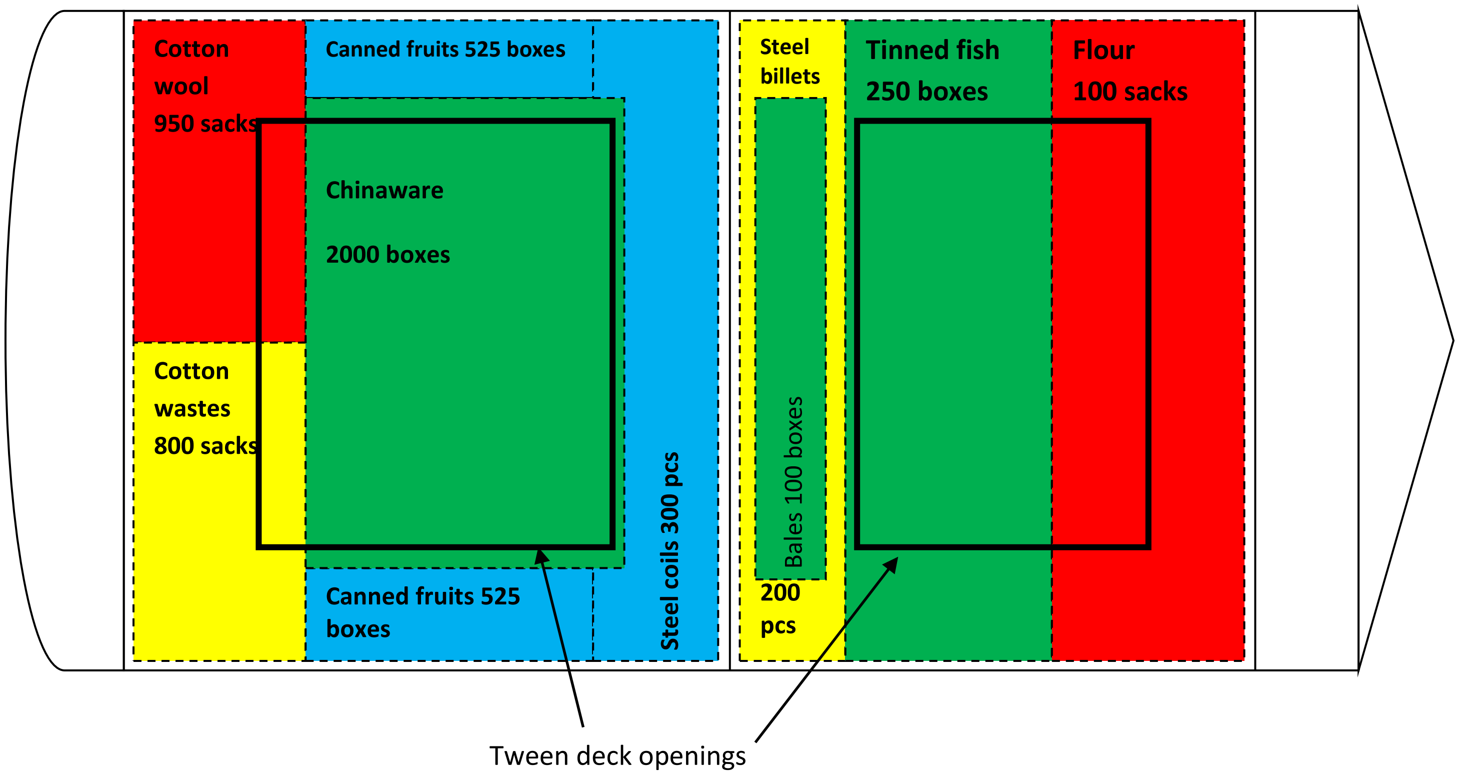
With the aid of the below stowage plans, self-study (refer the upper & lower hold stowage plans along with the longitudinal stowage plan) following points;

- the information provided on a stowage plan;
- how the cargoes on the starboard side and port side are marked;
- how the cargoes at the centre are marked; and
- how to mark when different types of cargoes that are loaded on top of each other.

Longitudinal view



Upper hold



Lower hold

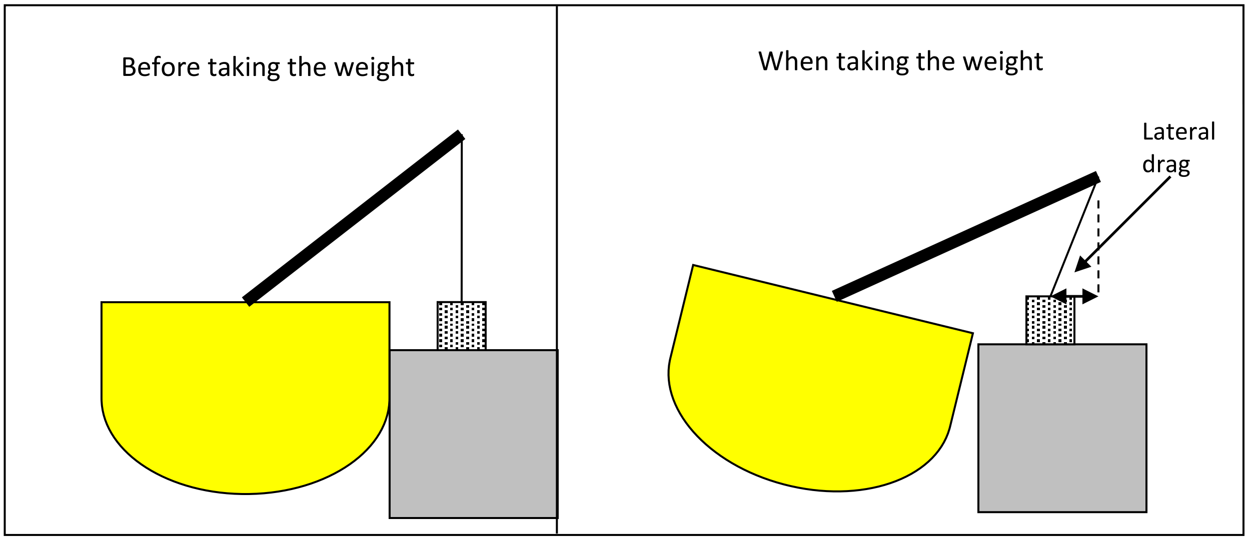
2) Loading of heavy lifts

Precautions to be taken:

- Check the weight of the cargo and make sure the load density will not be exceeded. If the cargoes to be stowed with heavy pallets, take the weight of the pallets also into account to ensure the load densities are not exceeded;
- If a spreader is used in heaving up the cargo, take the weight of the spreader also into account to ensure the SWL of the ship's cargo gears are not exceeded;
- If the load density is insufficient, check the viability of using dunnage;
- Select an appropriate place with sufficient lashing points. Ensure the securing points are strong enough for lashing the cargo;
- Calculate GM;
  - ✓ just after the weight is taken by the derrick while loading;
  - ✓ when the derrick head is at the highest position during the operation; and
  - ✓ after loading and make sure it is positive always.

- Check the maximum list during the operation and take actions to reduce it, if excessive;
- Minimize free surface effect by emptying or filling the tanks completely;
- Ensure the vessel is upright prior to the commencement of the operation;
- Stop all other cargo operations;
- Inform heads of departments;
- Un-authorized persons are not to be allowed onboard;
- Ensure the gangway is up and the moorings are tight;
- Cast off barges if moored alongside;
- Beware of the "lateral drag". Refer the explanation below;
- Lash all loose items;
- Attach steadying lines (guide ropes) to the weight to control the swing of the cargo and
- Just after the weight is taken by the derrick, check the cargo slings and wires.

Lateral drag



As the above figure shows, the horizontal movement of the cargo due to listing of the vessel is known as the lateral drag. This could happen while loading as well as discharging. When loading, the drag is away from the ship and when discharging it is towards the vessel. The dangers involving lateral drag includes:

- The heavy cargo may start swinging violently while loading.
- The momentum of swing may impede the SWL of derrick and it's components.
- If the cargo is on a lorry or supposed to load on to a lorry, it could turn over or damage.
- The cargo and the ship's hull may be damaged.
- Possibility of injuring the people around.

Lateral drag can be reduced by maintaining the position of the derrick head above the weight throughout the operation.

- While discharging, the runner and the topping lift should be lowered quickly as soon as possible after the weight touches the ground.
- While loading, the topping lift shall be lowered as the vessel heels to keep the derrick head above the cargo and the load must be taken slowly and also, it is advisable to use steadying lines.

Dunnage

Materials for Dunnage[46]

The nature of the materials used must ensure that the packages or the cargo transport units are adequately protected. The materials themselves must not be wet, moist, odour tainted or contaminated. The quality of the material must determined for each individual case by assessing the value and susceptibility to damage of the load, the means of transport, the intended protection and other similar factors. The special properties of the particular type of dunnage used must be taken into account.

Common dunnage materials used for packages are:

- **Solid plastics –** This kind of dunnage is used mostly in industrial, high-value shipping. Solid plastics are more expensive than other dunnage types but are worth the cost for high-value products that need protection.
- **Bubble wrap –** Bubble wrap is one of the most common ways of shipping glass and other fragile products. It can be reused repeatedly as long as the bubbles do not pop.
- **Wood –** Wood can be used to create barriers between items, usually used for strong and heavy goods. Since, in Mumbai Port, this type of dunnage is often used, hence detailed information about quality of wood is given in the next section.
- **Air pillows –** Air pillows can be deployed inside packages in order to keep items from sliding. These are often used as a gap filler to fill in missing space.
- **Foam –** Foam is often used to pad electronics, medical equipment, sensitive items, and fragile or sharp pieces.
- **Steel –** Steel is one of the most expensive dunnage options, which is typically used for high value shipping. If your products are heavy, steel is a good dunnage option because it can prevent heavier products from damaging lighter products.
- **Corrugated paper –** Corrugated paper is another popular dunnage choice. Its high-tech construction ensures the material can carry a wide range of weights, protects against moisture, and provides sustainable packaging options.
- **Custom dunnage solutions –** Custom dunnage is needed sometimes when you have fragile materials that have very specific dimensions. You can work with dunnage providers to help you design the dunnage needed to protect your product/cargo.

[46] Mumbai Port Authority, Standard Operations for dunnage cargo, Circular No. 12, https://mumbaiport.gov.in/WriteReadData/RTF1984/1723025979.pdf, (Last visited : 14/04/2026)

Placing of Dunnage[47]

How to lay dunnage most appropriately and what materials are to be used depends on the stowage plan, space, the structural design of the cargo transport unit and the restrictions anticipated during transport. These include the climatic zones through which the cargo will travel changes in weather, storage duration and anticipated mechanical, climatic stresses, etc.

- Bottom Dunnage

  If a good distribution of load forces is the primary consideration, the wood at the bottom must be laid out in such a way that as many load-bearing components of the cargo transport unit are covered as possible.

  If the main aim is to dissipate moisture or damp, the wood at the bottom must be laid in such a way that water and other fluids are conducted along the quickest route outside or to any available discharge outlets and do not produce any accumulation of damp.

  If the most important consideration is to protect against mechanical damage, it is essential that potential shifting or movement resulting from transportation stresses.

- Top dunnage

  It is laid to protect from the effect of moisture or damp penetration, contamination or chemical reaction, bad weather, mechanical damage by vertical loads etc., which could damage a particular cargo or the cargo transport unit and its components.

- Interlayer dunnage

  Variously has the functions of floor dunnage, side dunnage or top dunnage, depending on how it is arranged. It is laid between two different tiers of cargo to help to secure the load by increasing friction, improving the distribution of load forces or improving the stability of the load. Wooden dunnage boards are used to create a level packing surface of the load be able to bear the load packed on top of it.

[47] Mumbai Port Authority, Standard Operations for dunnage cargo, Circular No. 12, https://mumbaiport.gov.in/WriteReadData/RTF1984/1723025979.pdf, (Last visited : 14/04/2026)

Quality of Wooden dunnage[48]

Wooden dunnage made of squared lumber, planks, boards, slats and battens are very suitable for distributing pressure, bridging or lining cavities and gaps, creating air channels and enhancing friction.

Since wood can be infested by pests, only wood which has been impregnated against insects or fumigated may be used on certain trade routes. To distinguish such treated wood from normal wood, it must be appropriately stained or marked in some other way.

The timber shall be free from objectionable knots, centre heart (pitch), insect attack, any kind of decay, warping, splits and any other defect which may reduce the strength or usefulness of the pallet.

The materials themselves must not be wet, moist, odour- tainted or contaminated.

The quality of the material must determine for each individual case by assessing the value and susceptibility to damage of the load, the means of transport, the intended protection and other similar factors.

The special properties of the particular type of dunnage used must be taken into account.

Dunnage sizes and permissible load per dunnage unit[49]

Thickness (inch)	Width (inch)	Length (inch)	Permissible Load (Metric Tons)
2	8	60	4.8
2	6	60	3.6
2	4	60	2.4
3	3	60	4.05
4	4	60	9.6

[48] Mumbai Port Authority, Standard Operations for dunnage cargo, Circular No. 12, https://mumbaiport.gov.in/WriteReadData/RTF1984/1723025979.pdf, (Last visited : 14/04/2026)
[49] Ibid

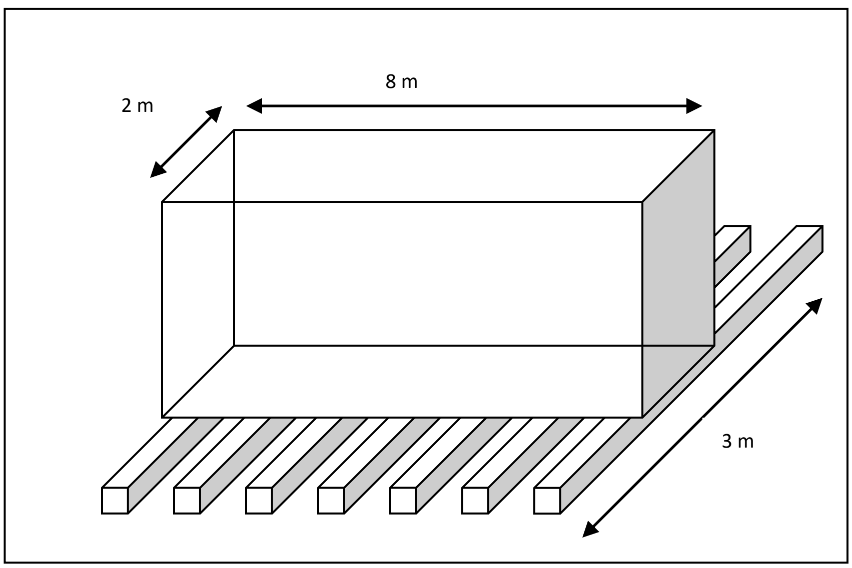
Cargo specific dunnage

Refer the charterers and shippers instructions to identify the dunnages, laying requirements and sizes of dunnages required for the particular cargo.

At the same time, such information could be obtained from trade specific documents (such as documents available in the steel trade) and from Thomas Stowage.

Calculation of length of dunnage

In calculating the length of dunnages, we will use an example of 120 t of weight having a base area of 8 x 2 m² to be loaded in a hatch of having a load density of 5 t per m².



The weight per m² of the present load = 120 / (8 x 2) = 7.5 t per m²
Therefore, the load density exceeds.
Dunnages to be laid throughout the length of the cargo. Therefore, the final length of the cargo area is 8 m. We will assume the breadth of the final cargo area as ‘Y’,
Therefore,
120 / (8 x Y) = 5
Y = 3 m.

Therefore at least 3 m long dunnages must be used. Always make sure that the;
Weight ÷ Final area is less than or equal to the load density.

If the cargo to be loaded on a pontoon, ensure the dunnages are long enough to reach the hatch coamings, so that the weights will be taken by the ends of the pontoons.

Dunnage certificate

Ensure that the dunnage is certified for ship's use, that is, dunnage with a plant quarantine stamp. In some ports, officials will want to inspect dunnage certificates[50]. This ensures that the dunnages are treated or fumigated to avoid the spread of pests. Refer to the sample certificate below for better understanding:

[50] Standard Club, A Master's Guide to : The Carriage of Steel Cargo, https://safety4sea.com/wp-content/uploads/2020/11/Standard-Club-A-Master%E2%80%99s-Guide-to-the-Carriage-of-Steel-Cargo-2020_11.pdf (Last visited : 14/04/2026)

FUMIGATION CERTIFICATE

[redacted]	Treatment Certificate Number : [redacted] Date of issue : 26/03/2025

*This is to certify that the goods described below were treated in accordance with the fumigation treatment requirements of importing country **(USA)** and declared that the consignment has been verified free of impervious surfaces/layers such as plastic wrapping or laminated plastic films, lacquered or painted surfaces, aluminium foil, tarred or waxed paper etc. that may adversely affect the penetration of the fumigant, prior to fumigation.*

The Certificate is valid for the consignments shipped within 21 days from the date of completion of fumigation

Details of Treatment	
Name of Fumigant	METHYL BROMIDE
Date of fumigation	25/03/2025
Place of fumigation	AJIT IMPEX SAW MILL, GANDHIDHAM
Dosage of Fumigant (Gm/M^3)	48 $Grams/M^3$
Duration of Fumigation (hours)	24 HOURS.
Average ambient temperature during fumigation ($^{\circ}C$)	$23^{0}C$
Fumigation performed under gastight sheets	Yes / ~~No~~
If containers are not fumigated under gastight sheets, pressure decay value (from 200-100 Pascal's) in seconds	N.A.
Description of Goods	
Container Number (or numerical link)/ Seal Number	NA
Name & Address Of Exporter	[redacted]
Name & Address Of Importer	--
Notify Party	--
Type and description of cargo	Dunnage wood (Pine wood)
Quantity (MTs)/ No of packages/ No of pieces	40 CBM
Description of packaging material	---
Shipping mark or brand	---
Name of the Vessel / Ship	[redacted]
Port & Country of Loading	KANDLA PORT, INDIA
Decleared Port of Entry	GALVESTON, USA
Additional Declaration	FUMIGATION AS PER ISPM -15 COMPLIED
Name & Signature of Accredited Fumigation Operator with seal & date/ Accreditation Number	

3) OIL TANKER cargo operations

a) Information required (for crude oils) from the shipper

- API or the density of the cargo;
- Correct loading temperature;
- Approximate discharging port temperature;
- Manifold connection size;
- Number of connections;
- Loading quantity;
- Grade of cargo;
- If different grades to be loaded, the segregation requirements (double valve segregation or single valve segregation);
- Whether heating is required and
- H_2S content of the cargo.

b) Documents required

- Safety Data Sheet (SDS);
- Dedicated Clean Ballast Tank Operation Manual;
- Crude Oil Washing Operation and Equipment Manual (COW Manual);
- Oil record book – Part II;
- Evidence for passing vetting inspections;
- Ship / shore safety checklist and other check lists;
- Approved STS operations plan and record book (only for STS operations);
- VOC Management plan and the record book, if applicable;
- Empty tank certificate (issued by a surveyor confirming that all the cargo is discharged);
- OBQ (On Board Quantity) certificate (verification of cargo tank content including slop tanks before the commencement of loading);
- List of last three cargoes;
- Pumping log – (signed by C/O and terminal which indicate the manifold pressure during discharging);
- ROB / Dry tank certificate (issued by a terminal representative from the terminal specifying the volume of cargo left onboard as unpumpable, if any, after discharging);
- Loading/discharging/ballasting/de-ballasting sequence plans and
- International Safety Guide for Oil Tankers and Terminals (ISGOTT).

c) **Safety precautions to be observed before, during & after cargo handling**

- Ensure the applicable checklists (pre-entry, COW wash, ship / shore safety checklists etc.) are completed correctly;
- Pre-arrival tests such as trying out inert systems, cargo pumps, testing of high-level alarms, emergency stops etc. to be completed before going for the port;
- Make a de-ballasting/ ballasting sequence plan and a loading/discharging sequence plan;
- Purge tanks with inert gas until the O_2 content of the tanks are less than 08% and have a positive pressure;
- Make sure the pump room blowers are working in order, bilges are cleaned, and bilge alarms are working in order;
- Pre-arrival meeting to be held;
- Upon arrival:
  - ✓ ship/shore meeting to be held;
  - ✓ necessary information like, loading / discharging plan, rate of loading/discharging, starting rate, topping-off rate, emergency communications etc. to be agreed with the terminal;
  - ✓ complete the ship/shore safety check list with the terminal representative and signed by both parties;
  - ✓ plug scuppers and dip trays;
  - ✓ following notices to be posted;
    - No smoking
    - No naked lights
    - No unauthorized persons

  - ✓ connect manifolds and
  - ✓ two fire hoses to be rigged, one on the fwd of the manifold and the other on the aft of the manifold. If fire monitors are used, they should be pointed towards the manifold and ready for immediate use. Other FFA appliances also shall be readily available.

- OBQ and contents of the slop tanks will be checked at the port of loading;
- Put the auto tensioning winches on manual mode;
- Rig emergency towing wires fwd & aft (fire wires);
- Bravo flag to be hoisted or the red lighted to be switched on;
- Torches, walky-talkies and mobile phones used on deck must be intrinsically safe;
- Hot work must not be carried out on board and on the terminal;

- ISGOTT[51] states that significant energy is radiated during medium and high frequency radio transmission (300 kHz — 30 MHz). This energy can travel 500 metres from the transmitting antenna and can induce an electrical potential in unearthed equipment, e.g. cranes, derricks, rigging, mast stays etc., that can produce an incentive spark. Therefore, it is recommended:
  - ✓ All stays, derricks, and fittings should be earthed.
  - ✓ Transmissions should not be allowed when flammable gas is likely in the region of the transmitting antenna or if the antenna comes within the terminal hazardous area.
  - ✓ Main transmitting antenna should be earthed or isolated whilst the tanker is alongside the berth.

- If the tanker's radio transmitter needs to be operated in port for servicing, the tanker and terminal should agree on procedures to ensure safety in the pre-transfer conference[52];
- Permanently and correctly installed VHF and UHF equipment are safe to use when the tanker is at the terminal, but it is recommended that the transmission is set to low power (1 watt or less)[53];
- The use of portable VHF/UHF radios in a terminal or on board a tanker presents no hazards if the equipment is certified and kept intrinsically safe and the power output is one watt or less[54];
- Satellite communications equipment normally operates at 1.6GHz and the power generated is not sufficient to present an ignition hazard[55];
- LRIT systems are normally integrated into satellite communication systems and also do not present an ignition hazard[56];
- Radar sets, operating on 3cm and 10cm wavelengths, are designed with a peak power output of 30 kW. If they are properly sited, they do not present a radio ignition hazard due to induced currents. However, it is good practice to consult with the terminal before testing radar equipment during cargo operations[57].
- Most mobile phones and pagers are not intrinsically safe and are only considered safe for use in non-hazardous areas. Mobile phones should only be used onboard a tanker or in the terminal as permitted by the applicable SMS[58];

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[51] International Chamber of Shipping, OCIMF, IAPH, International Safety Guide for Oil Tankers and Terminals, 6th edition, Witherby Publishing Group Ltd
[52] Ibid
[53] Ibid
[54] Ibid
[55] Ibid
[56] Ibid
[57] Ibid
[58] Ibid

- Ensure the junior officers, pumpman and others who are involved in cargo operations are well aware of their individual duties of the loading/discharging/ballasting/de-ballasting plan that the chief officer has made;
- Pump room ventilating systems shall be switched on at least 10 mins before the commencement of the cargo operations and the emergency escape systems must be readily available;
- Double check whether the correct valves are open;
- Start loading or discharging at the agreed slow rate;
- Ensure no leaks (at the manifold, on the lines), and cargo is going to or discharging from the correct tank;
- When everything is in order, may increase the loading or the discharging rate to the agreed maximum;
- Maintain a positive pressure with a O_2 concentration of 8% (5% or less in the IG system) or less inside the tanks during cargo operations or COW operations;
- Accommodation openings to be kept closed during cargo operations;
- Continuous deck and pump room rounds to be carried out;
- Cargo manifold to be maned during the cargo operations, monitor the pressure at the manifold and it shall be entered on the **pumping log**;
- If applicable, comply with the Volatile Organic Compound (VOC) emission requirements;
- No soot blowing to be carried out;
- Ullages to be checked at frequent intervals. Frequency to be increased when topping-up and when about to finish the cargo;
- When closing valves, should be closed slowly to avoid pressure surges during cargo operations (known as water hammer or liquid hammer);
- In case of product tankers may have to take samples, therefore, need to have sampling procedures;
- After the completion of loading, calculate the amount of cargo onboard (ship's figure) by means of temperature, density and ullage;
- While discharging, if the master is expecting to carryout COW, an advanced notice to be given to the terminal and authorization should be received;
- When closer to end of discharge, adjust the trim to enable stripping of the cargo;
- After the completion of discharging obtain a "Empty tank certificate" from a cargo surveyor;
- During the loaded passage:
  - ✓ ensure the required positive pressure is maintained;
  - ✓ O_2 content of the tanks are less than or equal to 8%;
  - ✓ Temperature of the cargo is maintained as required by the charterer; and
  - ✓ No hot work to be carried out on deck.

4) CHEMICAL TANKER cargo operations

a) Information required from the shipper

Cargo to be refused if sufficient information required as mentioned below, are not available:

- Amount and the grade of the cargo;
- A full description of the physical and chemical properties of the cargo;
- Venting requirements;
- Safety precautions applicable for the expected cargo;
- Density and the temperature of the cargo;
- Loading/discharging rates and maximum allowable pressure during the loading/discharging operations;
- Whether purging with Nitrogen is required or not;
- Whether the cargo requires addition of inhibitors and
- Compatibility with other materials.

b) Documents required

- Cargo record book;
- Procedures and Arrangements Manual (P & A Manual);
- Shipboard Marine Pollution Emergency Plan for Noxious Liquid Substances (SMPEP);
- Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk or International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk;
- Shipping document as required by the Annex to the IBC Code (optional);
- IBC Code and national regulations;
- If the cargo is a mixture, an analysis indicating the dangerous components contributing significantly to the total hazard of the product shall be provided. Such analysis shall be certified by the manufacturer or by an independent expert acceptable to the Administration;
- Tank dry & fitness certificate (issued at the port of loading, before start loading);
- Onboard quantity document (after the completion of discharge);
- If applicable, manufacturer's inhibition certificate. Certain cargoes required to be inhibited for the easy and safe handling. In that case, the manufacturer of the inhibiter is required to issue a certificate stating following information related to the added inhibitor:

- ✓ Name & amount added;
- ✓ Date added and the effective duration;
- ✓ Applicable temperature limitations and
- ✓ Actions to be taken if voyage duration exceeds the effective duration of the inhibitor.

- Cargo shall be refused, if this inhabitation certificate is not available (if inhibitor is added). A copy of this certificate shall be retained onboard. If no inhibitors added and if there is a possibility of losing the effectiveness of the cargo before the cargo is discharged, issue a letter of protest.

c) Safety precautions to be observed before, during & after cargo handling

- The SDS (Safety Data Sheet) shall be supplied to the master;
- Ensure the cargo is compatible with the coating, lines in the tanks and pump;
- Make sure the nominated cargo is compatible with the adjacent cargoes;
- If heating or cooling is required, make sure such facilities are in working order;
- Need to clean the tanks as per the requirements of the charterers;
- Check what are the special safety precautions to be taken in handling the nominated cargo (Eg – use of protective clothing, breathing apparatus etc.);
- Make sure the venting systems, PV valves, vapour return valves etc. are in good working order;
- Ensure the portable vapour detection instruments are available for the type of cargo;
- Ensure the safety alarms fitted in pump room are working in order;
- Ensure the gauges and alarms in the cargo system are working in order;
- Rig two towing wires (fire wires) fore and aft;
- No soot blowing during cargo operations;
- No hot work onboard and also on the terminal;
- Following warning signs to be displayed on deck:
  - ✓ No naked lights;
  - ✓ No smoking and
  - ✓ No unauthorized persons

- Ensure the red flag or the red light is on;
- Start the pump room blowers at least 15 minutes before the cargo operations and continues throughout the operations;
- Check whether the product name of the cargo is on the "certificate of fitness for the carriage of noxious liquid substances in bulk" and ensure that the quantity and

characteristics of each product to be loaded are within the limits indicated in the same certificate. The certificate of fitness also contains tanks suitable for the carriage of each cargo allowed and also a tank arrangement plan;

- Cargo shall not be accepted without a certificate of inhibitor (if added);
- Adhere to the safety procedures and practices provided in the IBC Code, SMS, procedures and arrangements manual (P & A manual) and industry safe practices:
  - ✓ Check whether the product name is listed in chapter 17 or 18 of the IBC Code or the latest edition of MEPC.2/Circular on "PROVISIONAL CATEGORIZATION OF LIQUID SUBSTANCES IN ACCORDANCE WITH MARPOL ANNEX II AND THE IBC CODE";
  - ✓ The requirements of the IBC Code do not apply, if the product name is listed on Chapter 18 and
  - ✓ Refer the Appendix – 1 of the IBC Code which provides few flow charts for loading and handling of cargoes

- FFA & SMPEP equipment shall be ready for immediate use;
- No cargo operations to be conducted if lightning at the near vicinity;
- The portable electrical equipment shall be intrinsically safe;
- Scuppers and dip trays are plugged;
- All the personnel protective equipment shall be ready for immediate use;
- Ensure the manifold is correctly connected and manned during the operation;
- Pre-cargo operations meeting to be held with the terminal representatives and ensure measures and procedures for the following are agreed with the terminal:
  - ✓ loading/discharging sequences, maximum, initial, topping off rates;
  - ✓ points of contacts (to be used in case of an emergency);
  - ✓ receiving nitrogen for inerting, purging or line cleaning (if applicable);
  - ✓ emergency signals and communication procedures;
  - ✓ emergency stopping procedures and complete the ship/shore safety checklist;
  - ✓ emergency spill procedures;
  - ✓ whether cargo lines require pigging. Pigging means use of another liquid in draining the lines during loading;
  - ✓ agree with the cargo sampling procedures.

- Cargo vapour may be vented or collected depending upon the local regulations;
- Ensure the tank cleaning is carried out in accordance with the approved (P & A Manual);
- Close cargo related valves slowly to avoid pressure surges during cargo operations (known as water hammer or liquid hammer);
- Crew and the officers must be aware of the hazards involve with the particular cargo;
- Ensure all the checklists are complied with as appropriate;

- If nitrogen is used from ashore (for inerting or purging), need to agree the receiving pressure/rate with the terminal and other safety practices are followed;
- Before the commencement of loading tanks will be inspected and 'tank dry certificate' will be used;
- In the case of heated cargoes, if the temperature of the cargo is less or more than specified, stop loading and inform charterers. Loading to be continued only with the charterer's approval;
- If the cargo is not at the specified loading temperatures and if there are reasons to believe that the cargo may cause damage to ship structure or the paint condition of the cargo tank, need to issue a letter of protest;
- Ensure to take samples of each grade of cargo with a terminal representative;
- Maintain the required pressure in the tanks;
- Start loading/discharging at the agreed lower rate. Make sure cargo is loaded/discharged to or from the correct tank. Make sure no leakages. Then increase the rate to the agreed level slowly;
- Check the ullages and tank pressure throughout the operation and record them;
- Check the vapour concentrations on deck during the cargo operations and log them. If the concentrations rise beyond the permitted values, may have to stop cargo operations and the deck personal may have to use breathing apparatuses until the concentration is lesser;
- After the completion of loading/discharging blow through the lines before disconnecting the manifold. Have a good communication with the terminal during blow through process. For some cargoes Nitrogen gas must be used instead of deck air for blowing though;
- During the voyage:
  - ✓ If nitrogen from the terminal is used, ensure sufficient nitrogen is available onboard to comply with the inerting requirements and
  - ✓ Check the levels, pressures and temperatures of cargo tanks daily

- Before the commencement of unloading, check the temperatures and ullages, calculate the amount of cargo onboard and compare with the load port figures;
- When discharging different grades of cargoes, label the manifold pipes to indicate which pipe will be used to discharge which grade;
- When there are different grades of cargoes to be discharged refer the charterers instructions when making the discharging sequence plan;
- After the completion of discharging, all the cargo tanks to be checked with a terminal representative to ensure all the cargoes are well drained, and onboard quantity certificate has to be signed by the chief officer and the surveyor;
- Follow the SMS in stripping the tanks;

- During discharging, if it is required to enter into the tank for ‘squeegeeing’ (some cargoes are required to be pushed towards the suction pipe when the tank in about to empty), follow safety practices; and
- Remember, whatever mentioned above are only general actions/precautions/instructions. Therefore, need to refer P & A manual, SMS, charterers instructions, IBC Code etc. for further details of individual cargoes.

5) GAS TANKER cargo operations

a) Information required from the shipper

- Correct technical name of the cargo;
- A full description of the physical and chemical properties necessary for the safe containment of the cargo;
- Actions to be taken in the event of spills or leaks;
- Counter-measures against accidental personal contacts with the cargo;
- Fire-fighting procedures and fire-extinguishing agents;
- Procedures for cargo transfer, gas freeing, ballasting, tank cleaning and changing of cargoes;
- Special equipment needed for the safe handling of the particular cargo;
- Minimum inner hull steel temperatures;
- Emergency procedures;
- Compatibility and
- Details of the maximum filling limits allowed for each cargo that may be carried at each loading temperature, the maximum reference temperature and the set pressure for each relief valve.
- Inhibitor certificate for carrying special cargoes such as Butadiene or Vinyl Chloride Monomer (VCM), which are unstable or prone to polymerization.

b) Documents required

- Certificate of Fitness for the Carriage of Liquefied Gases in Bulk or International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk;
- IGC Code and national legislations;
- MFAG;
- Procedures and Arrangements Manual (this provides ship specific instructions for cargo related operations);

- Certificate of Quality (provides the product specification and quality in terms of physical characteristics and component constituents and it is issued by the loading terminal);
- Certificate of Origin (this is a document issued by the manufacturer or shipper, countersigned by the customs authorities and attesting to the country in which the cargo was produced);
- Time Sheet (this records all timing details of the ship's movements and operations from the ships entry to its final departure from the port. This is usually prepared by the vessel's agents and is countersigned by the Master. It's purpose is to provide an agreed statement of facts relating to timing of events and any delays);
- Certificate of Tank Fitness (this is issued by an independent surveyor with regards to particular tank conditions prior loading); and
- Certificate of inhibitor added (certain gases require an inhibitor added for transportation and the certificate shall include the following:
  - ✓ Name and the quantity added;
  - ✓ The date added and duration of effectiveness;
  - ✓ Any temperature limitation and
  - ✓ Actions to be taken if the voyage duration exceeds the effective time period of the inhibitor.

c) Safety precautions to be observed before, during & after cargo handling

- Complete ship shore check list;
- Connect the earth grounding cable (Bonding wire) to stop static electricity sparks;
- Make sure fire system, water sprinkler system, Emergency Shut Down (ESD) system, operation of actuator valves, compressor and pump room cut outs are in working order;
- Ensure Safety Relief Valves (Pilot Valves) are set and tested for operation;
- Two towing wires to be rigged fore and aft;
- No soot blowing during cargo operations;
- No hot work onboard and also on the terminal;
- Warning signs to be displayed;
- Ensure the red flag or the red light is on;
- Start the pump room and compressor room blowers at least 10 minutes before the cargo operations and continues throughout the operations;
- Ensure the safety alarms fitted in pump room and the compressor room are working in order;
- Crew and the officers must be aware of the hazards involve with the particular cargo;

- Check whether the technical name of the cargo is on the "certificate of fitness for the carriage of liquefied gases in bulk" and ensure that the quantity and characteristics of each product to be loaded are within the limits indicated in the same certificate. The certificate of fitness also contains tanks suitable for the carriage of each cargo allowed and also a tank arrangement plan;
- Cargo shall not be accepted without a certificate of inhibitor (if added);
- Adhere to the safety procedures and practices provided in the IGC Code (the Chapter 19 provides a list of gasses that can be carried in liquefied form, technical detains and special requirements) procedures and arrangements manual and industry safe practices;
- FFA equipment shall be ready for immediate use;
- The portable electrical equipment shall be intrinsically safe;
- Cargo tanks, pipelines and pumps to be cleaned and dried;
- Piping systems should be thoroughly blown through with adequate quantities of compressed air followed by nitrogen;
- The emergency shut down systems, operation of actuator valves, compressor and pump room cut outs are in working order;
- Ensure the pipelines are aligned;
- Personal protective equipment shall be ready for immediate use;
- The gas detection equipment for the cargo is calibrated and is in working order;
- Ensure the following are agreed with the terminal:
  - ✓ Signals to be used for standby, start, slow down and to stop operations;
  - ✓ Pumping rates;
  - ✓ Discharging or loading sequence;
  - ✓ Actions to be taken in case of emergencies; and
  - ✓ Emergency shutdown procedures.

- Ensure to close cargo related valves during cargo operations slowly to avoid pressure urges (shock pressures or liquid hammers);
- Ensure the hold and inter-barrier spaces are properly inerted or filled with dry air as applicable;
- The oxygen content in inert gas shall not be more than 5% and also it shall not react with the cargo. Further lower levels of oxygen may be required for cargoes which may react with oxygen;
- Shall not use ship generated inert gas with certain types of cargoes as it may contaminate the cargo (due to high CO_2 concentration in inert gas);
- Cool down of tanks and pipelines to be undertaken to control thermal stresses and loading rates should be restricted during cool down;
- Complete the safety check lists;

- No cargo operations to be conducted if lightning in the immediate vicinity;
- Monitor the tank pressures and temperatures during cargo operations as well as during the passage;
- Ensure the re-liquefaction and boil-off control systems are in order to reduce cargo loss during the passage;
- As the LNG (mainly methane) cargo cannot be re-liquefied (as it requires complex refrigeration cycle requiring considerable power), it may be vented or burned, to maintain tank pressures at required levels. Local regulations may prohibit venting of cargo. It may also be used as fuel and this is the only cargo that may be used as fuel;
- During discharging (in addition to above):
  - ✓ Cargo pumps are normally started with the discharge valve shut or fractionally open to reduce both the starting load and pressure surge. It may also be necessary to re-circulate to adjust pressures and cool deck lines;
  - ✓ The tank pressure will tend to fall as cargo is removed. If the discharge rate is high there may be insufficient boil-off to maintain positive pressure in the tank, and vapour should be added to prevent a vacuum. The vapour may come from the shore or can be generated aboard by diverting some cargo liquid to a vaporiser. Tank pressures should be monitored throughout the discharge;
  - ✓ Discharge can cause pressure changes in the hold or inter-barrier spaces, the rate of change depending upon the cargo system design. Pressures in such spaces should be watched during discharge and any necessary actions to be taken; and
  - ✓ On completion of discharge, liquid lines and cargo hoses or loading arms should be drained, purged and depressurised using the facilities provided. The isolating valves should then be closed, and the ship-shore connections can then be dismantled. Bonding wires, if fitted, should not be disconnected until after the hoses have been disconnected.

Refer the IGC Code for further details.

6) Cargo operations on CONTAINER SHIPS

a) Information required from the shipper

- Number of high cubes and normal cubes;
- Number of 20 feet containers, 40 feet containers, 45 feet containers etc. containers to be loaded;
- Number of reefer containers;
- Number of fan containers;
- Information on IMDG goods (handling of IMDG goods are discussed separately);

- Number of oversized goods (over height, over width, over length cargoes stowed in open top containers and / or flat tracks). Referred as OOG (Out Of Guage) Cargoes.
- Port rotation and the destination of each container;
- Verified gross mass; and
- Tentative stowage plan.

b) Documents required for cargo operations

- Documents related to IMDG goods (handling of IMDG goods are discussed separately);
- Stowage plan (usually, this is sent to the ship before arrival at the port of loading) and also a soft copy of the final loading plan will be provided by the planner after berthing. The chief officer shall ensure that it is complying with the ship's requirements;
- Bay plans;
- Cargo manifest;
- Verified gross mass of containers to be provided preferably by means of Electronic Data Interchange (EDI) or Electronic Data Processing (EDP) by the shipper;
- Cargo securing manual and cargo securing plan;
- Reefer manifest (if reefers are to be loaded); and
- Cargo Safe Access Plan (CSAP) – for specially designed container ships only.

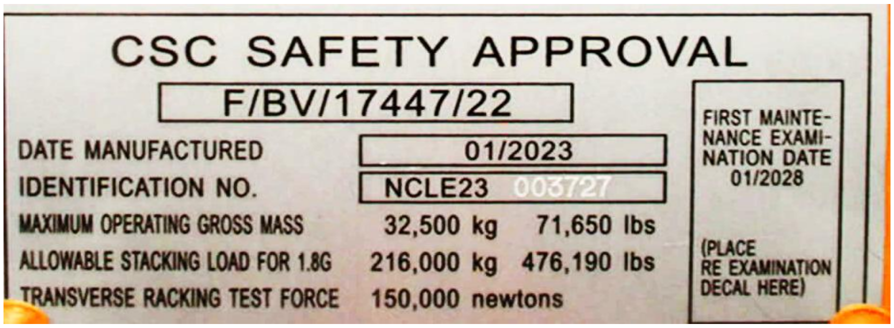
c) Safety precautions to be observed before, during & after cargo handling

- Make sure the navigational visibility is not affected by the heights of the container tiers. This can be identified by the ship's stability computer and also container stacking plans;
- Ensure the tier heights do not affect the closing of the cargo holds and the securing of cargo gears. This can be identified by the ship's stability computer and also container stacking plans;
- A 40 feet container can be loaded on top two 20 feet containers. But two 20 feet containers can not be loaded on top of a 40 feet container. Similarly, when loading 45 feet containers, the usual practice is to load on deck and from the second tier onwards. Refer the figure below:

45 feet container stowage[59]

- Make sure the stack weight [maximum weight that can be loaded. This is similar to the load density but, the load density is provided per m^2. The stack weight is provided per container unit area (example - for 20 footers, 40 footers etc.). It is given in stability book and remember that the stack weight on deck and holds may not be the same] is not exceeded;
- NOTE – the "ALLOWABLE STACKING WEIGHT FOR 1.8 G" given on CSC plate (refer the CSC plate below) on containers refers to a different 'stacking weight' than mentioned above. It refers to the total load that can be loaded on top of that container. Therefore, make sure not to exceed the allowable 'stacking weight' as well. "1.8 G" means when accelerated vertically 1.8 times the force of gravity. When a vessel is not moving, the only the weights of the containers which are loaded on top of each container will be acting on the bottom containers, but, when a vessel is pushed upwards by waves, a higher weight will be acting on the containers than the total masses of the containers loaded on top. That is why the "Allowable Stacking Weight/load" is calculated for a vertical acceleration of 1.8 times the force of gravity;

[59] https://shipsbusiness.com/45stowage.html (Last visited 05/08/2026)



CSC Plate[60]

- Try to avoid isolated stacks of containers in holds or on deck. When possible, containers shall be evenly distributed;
- Try to avoid loading heavy containers above light containers and at the top of a stack, unless the stowage arrangement is found satisfactory when checked using the approved loading computer. This will affect the vessel's GM and the lashings both;
- Make a lashing arrangement plan referring to the cargo securing manual or loadicator (if lashing software is included);
- Make sure the IMDG cargoes are positioned in correct places (explained in detail below);
- Make sure the reefer containers and fan containers are loaded in correct positions as they need ship's power supply;
- Make sure sufficient extension cables to pull in reefers are available and an inventory is maintained (These extension cables are provided by charterers so that it can be used to plug the reefers when the length of the cable on the reefer is not long enough).
- Most of the container ships uses lashing bins (refer the picture below) for collecting twist locks. When a vessel is berthed, lashing bins will be taken onto the pier by means of gantry cranes ashore or ship's cargo gears. These lashing bins can be secured on top of a 20-footer container. Need to make a space for the lashing bin.

Lashing bins used onboard[61]

[60] International CSC Convention for Safe Containers (last visited 03/06/2026)
[61] http://shipsbusiness.com/gearbox.html (last visited 03/06/2026)

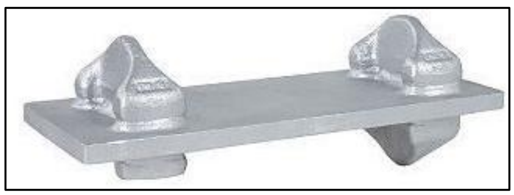
- Container spreaders are used when handling containers by means of ship's cranes and derricks. There are 20-footer spreaders for 20-footer containers and 40-footer spreaders for 40-footer containers. Spreaders are used on ships visiting ports where shore gantry crane facilities are not available. Spreaders can be secured on top of an equivalent size container. Therefore, need to allocate positions for securing spreaders. Refer the picture below;

Spreader used by ships[62]

- During cargo operations:
  - ✓ Before the loading commences make sure the final loading plan (soft copy) provided by the planner complies with the ship's requirements;
  - ✓ Unlike of other ship's cargo operations, on container ships the cargo operations are very fast, having few gantries at one time depending upon the length of the vessel. Therefore, ensure the vessel is having sufficient stability throughout the cargo operations by calculating the stability for few worst-case scenarios;
  - ✓ Keep the anti-heeling pump on. Container ships experiences list due to asymmetrical loading/discharging very often. Therefore, on container ships there are two side tanks (one on port side and the other on the stbd side) which are known as anti-heeling tanks and 50% of the tanks are full of ballast water. The anti-heeling pump automatically detects the list and transfer ballast water between these two tanks in order to keep the vessel upright. This pump shall be switched off before the vessel proceeds to sea;
  - ✓ Do not allow the cargo workers to drop lashing materials on deck as it may damage ship's deck as well as the lashing material itself;
  - ✓ Prepare damage reports for the damaged containers loaded (of course, they shall not be allowed to load if they are severely damaged);

[62] https://www.tradekorea.com/product/detail/P716440/semi-automatic-container-spreader-lifting-frame-BANGDING-.html (last visited 03/06/2026)

- ✓ Make sure to make damage reports if the vessel's structure is damaged by the cargo workers;
- ✓ Ensure all the containers loaded are sealed;
- ✓ Plug/un-plug after loading and before discharging reefer containers. If possible, the motors of the reefer containers to be loaded facing aft to avoid damages by sea spray and severe winds;
- ✓ Ensure the duty officers are complying with the stowage and lashing plans provided to them;
- ✓ Duty officers shall ensure that only the containers that are to be discharged are discharged to prevent over carriage or under carriage of cargoes;
- ✓ If possible, note down the date and time on the reefer temperature records at the time of loading and before discharging. Temperatures of the reefers at the time of loading and discharging shall be recorded by the duty officer or the electrical officer and checked against the set temperature;
- ✓ Be careful when using double stacking cones between containers which needs to be discharged at different ports; and



Double stacking cone[63]

- ✓ Reject if any leaking containers are received.

- Make sure to take the lashing bins and spreaders on board before the completion of cargo operations;
- During the voyage:
  - ✓ Need to carry out lashing inspections daily.
  - ✓ No hot works to be carried out close to IMDG goods.
  - ✓ With regards to reefer containers ensure:
    - that the temperatures are within the set temperatures. The set temperatures can be obtained by the reefer manifest, or it will be written on the partlow chart (explained below) or indicated digitally on the reefer container;
    - to comply with the reporting requirements of the charterers if there are no remote monitoring mechanism.
    - that no alarms are activated. If any alarms are on, inform the electrical engineer and try to rectify it. In case of malfunctioning of a reefer unit:

[63] https://www.nauticexpo.com/prod/sec-bremen/product-31607-342450.html (last visited 03/06/2026)

- Use the reefer repair kits provided to repair the reefer unit. Remember, if there are cargoes owned by two or more parties, use the repair kits provided by the appropriate party for repairs. (As an example, if the vessel is carrying cargoes belongs to Hapag-Lloyd and CMA CGM, to repair reefers belongs to CMA CGM need to use repair kits provided by CMA CGM);
- If you do not have an appropriate repair kit on board, you can use a repair kit provided by another party but with their approval;
- If you do not have repair kits at all, may use spare parts from an empty reefer container belonging to the same party but with their approval. But manufacturer of both the containers must be the same.

✓ If found any IMDG cargo leaking, refer the IMDG code and give instructions to crew to take safety precautions. Inform the shipper, charterer, ship owner and P & I club and take required safety precautions.

d) Further information with regards to reefer containers

Reefer manifest

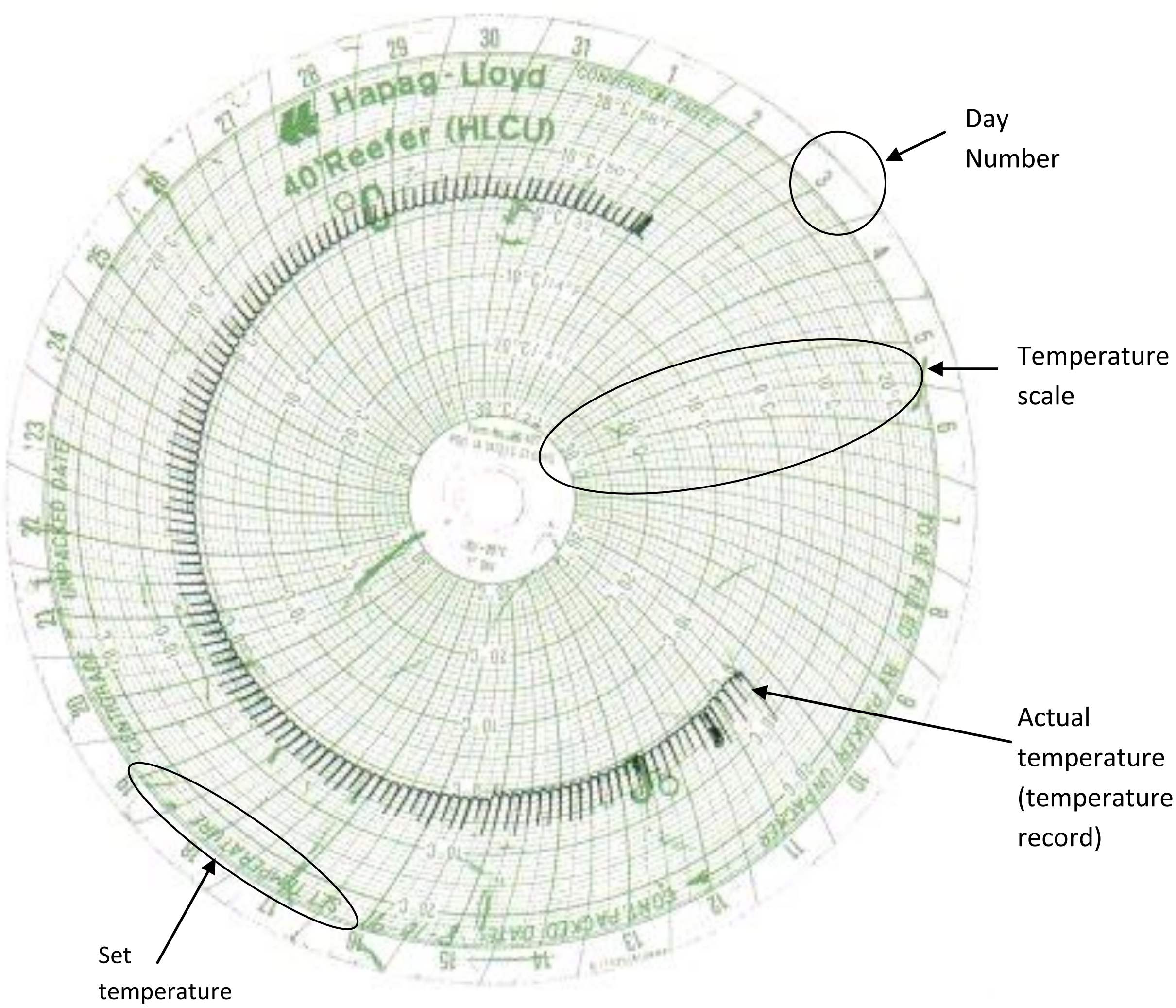
Refer the below sample reefer manifest;

Name of the vessel:......... Voyage No.:............. Date:.............. Port of loading:..............

Container number	Container type			Commodity	Shipper	Consignee	Position onboard	Set temperature	Ventilation	Gross weight	Place of delivery	Remark (B/L No.)
	20’	40’	Other									

Partlow chart (temperature recording card)

Some older refrigerated containers may be encountered where the temperature data is recorded on a circular paper card, often referred to as a Partlow Chart. The chart usually records 31 days' information, although weekly charts may be encountered[64]. This is illustrated below as older containers may still use it.



Partlow chart[65]

Now there are various digital methods available to monitor and record data of reefer units. As an example, REFCON uses the reefer container's own power cable to transmit data between the container and the computer monitoring system on the vessel or in a container terminal[66].

In fact, monitoring of reefers is feasible from ashore in case of smart containers. A smart container is a standard shipping container equipped with IoT (Internet of Things)

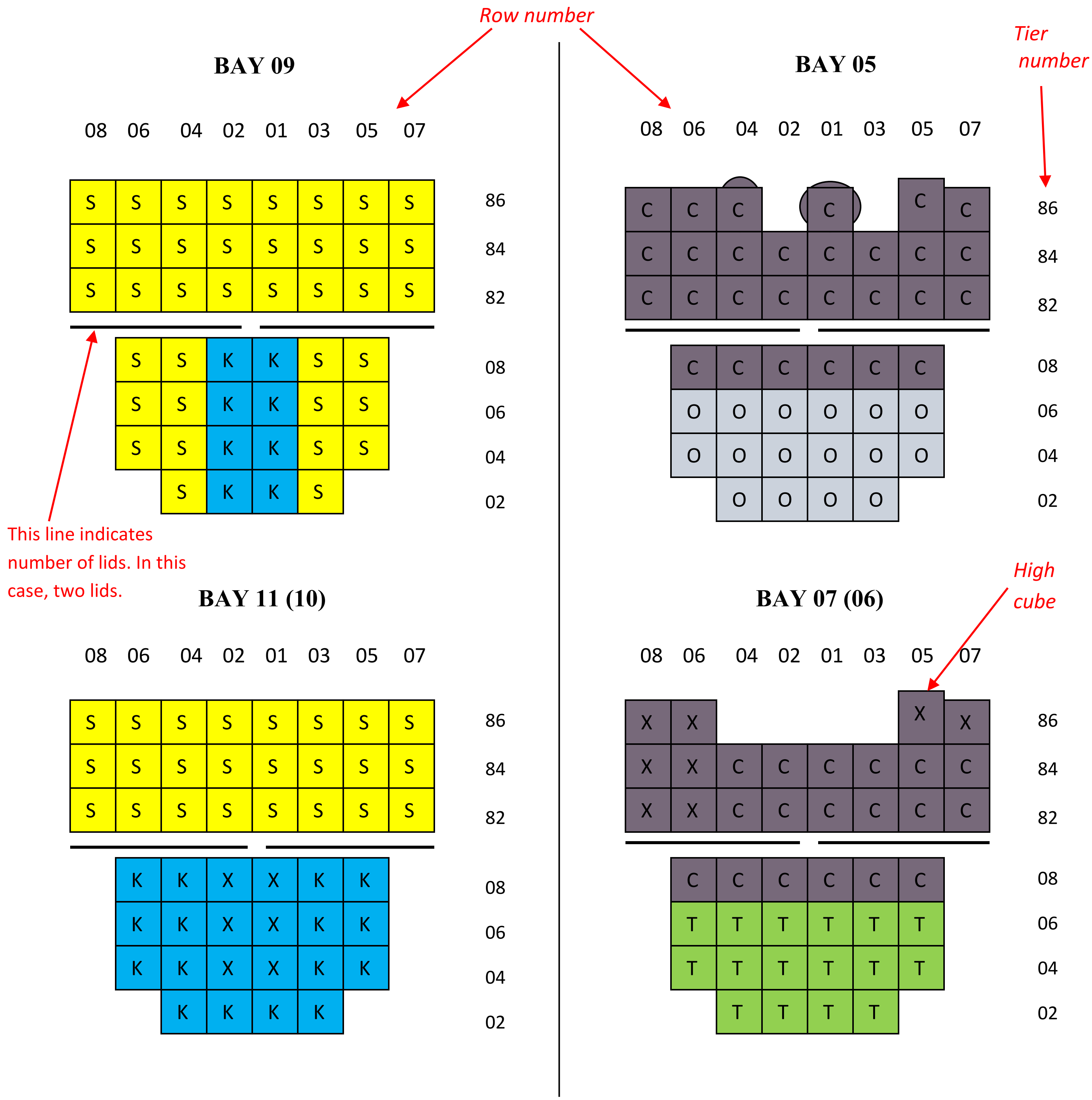
[64] https://britanniapandi.com/2022/04/refrigerated-container-cargo-claims/ (Last visited 05/08/2026)
[65] Container Handbook (last visited 03/06/2026)
[66] https://www.wartsila.com/encyclopedia/term/refcon-system (Last visited 06/08/2026)

technology: Sensors transmit real-time data, for example about the container's location, temperature, humidity, and other key cargo parameters[67].

e) Container stowage plan

On container ships there are two plans used related to container stowage, i.e. stowage plan and the bay plans. The stowage plan illustrates athwart ship cross sections of each bay, refer the figure below:

[67] https://www.hapag-lloyd.com/en/online-business/digital-insights-dock/insights/2024/05/smart-shipping--internet-of-things-and-sensor-technology-in-ship.html (Last visited 05/08/2026)



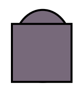
Apart from the diagrammatic illustration as shown in above, a container stowage plan will include:

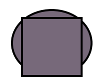
- Port of loading

- Date of loading
- Voyage number
- IMDG Class
- Colour code
- Port rotation
- Departure draughts etc.

Different colours are used to indicate different discharging ports. English alphabetical letters in capital are used to indicate the name of the port. There are no internationally accepted codes or colour codes for this purpose. It can be decided by the user of the loading software. In the above container stowage plan;

S - Singapore
K - Kobe
C - Colombo
O - Osaka
T - Tokyo

 - Over height container

 - Over height & over width container

X - 40-footer container

Apart from the above abbreviations and symbols there are various symbols and abbreviations used to identify reefers containers, empty containers, containers with over length cargoes, containers carrying IMDG etc.

The above plan is prepared for a vessel having the below mentioned port rotation:

Colombo
Singapore
Kobe
Osaka
Tokyo

Carefully study the above plan by keeping the port rotation in your mind. The cargo to be discharged in the last port is loaded at the bottom most areas. Port rotation shall be considered when planning 40 footers on top of 20 footers as well.

Bay numbering

A bay means a container length (20-footer or 40-footer) area when looking through a bird's eye. When numbering bays, odd numbers represent 20-footer slots and even numbers represent 40-footer slots. In accordance with the above stowage plan, bay number 06 means 40-footer slots consisting of bay number 05 and 07. The 'X' mark indicates the 40 footers. In bay 06 there are 06 forty-footer containers on port side (on deck) and 2 forty-footer containers on stbd (on deck) and no forty footers under deck in bay 06.

Row numbering

Odd numbers are used on the starboard side and even numbers are used on the port side in numbering rows. Numbering starts from the athwart ship centre line of the vessel. In the case of the above stowage plan, the number of starboard side slots equal to the number of port side slots (i.e. no centre most tier). If there is a centre most container tier, it will be numbered as row '00' and the rest will be numbered as usual.

Tier numbering

Different tier numbering systems are used for under deck and on deck container slots, but, in both cases, even numbers are used. In the case of under deck, numbering starts from '02' and in the case of on deck slots, its starts from '82'.

Container positions onboard

Any container can be identified by bay, row and the tier number. Refer the below example:

A container in position "06 05 86" means the bay number is 06, row number is 05 and the tier number is 86. That means the high cube in the above diagram.

Number '05 04 86' refers to the over height container in the above diagram

Bay plan

A bay plan will include detailed information about each container in a particular bay. This information includes:

- Port of loading
- Port of discharge
- Serial number of the each container
- Row and the tier number

- Information with regard to nature of the cargo (such as reefer or IMDG)

Refer the below bay plan made for the underdeck containers of the bay number 11(10) of the above container stowage plan:

Loaded/discharge port

Row and tier numbers

Tier number

Total weight of the tier

MUM/Kobe Container No. 15 t 06 08	MUM/Kobe Container No. 15 t 04 08	MUM/Kobe Container No. 30 t 02 08	MUM/Kobe Container No. 30 t 01 08	MUM/Kobe Container No. 15 t 03 08	MUM/Kobe Container No. 15 t 05 08	08	120
MUM/Kobe Container No. 15 t 06 06	MUM/Kobe Container No. 15 t 04 06	MUM/Kobe Container No. 30 t 02 06	MUM/Kobe Container No. 30 t 01 06	MUM/Kobe Container No. 15 t 03 06	MUM/Kobe Container No. 15 t 05 06	06	120
MUM/Kobe Container No. 15 t 06 04	MUM/Kobe Container No. 15 t 04 04	MUM/Kobe Container No. 30 t 02 04	MUM/Kobe Container No. 30 t 01 04	MUM/Kobe Container No. 15 t 03 04	MUM/Kobe Container No. 15 t 05 04	04	120
	MUM/Kobe Container No. 15 t 04 02	MUM/Kobe Container No. 30 t 02 02	MUM/Kobe Container No. 30 t 01 02	MUM/Kobe Container No. 15 t 03 02		02	90

105	150	150	150	150	105	Permissible weight (t)
45	45	120	120	45	45	Max weight (t)
06	04	02	01	03	05	Row number

f) Homogeneous loading on container ships

This may arise when a vessel is being chartered by new charterers. They may ask for the maximum carrying capacity of twenty-footer containers for different dock water densities and given weights per container. The homogeneous loading calculation is normally optimized to maximize cargo intake while remaining within all approved limits, drafts even keel to slight aft trim condition.

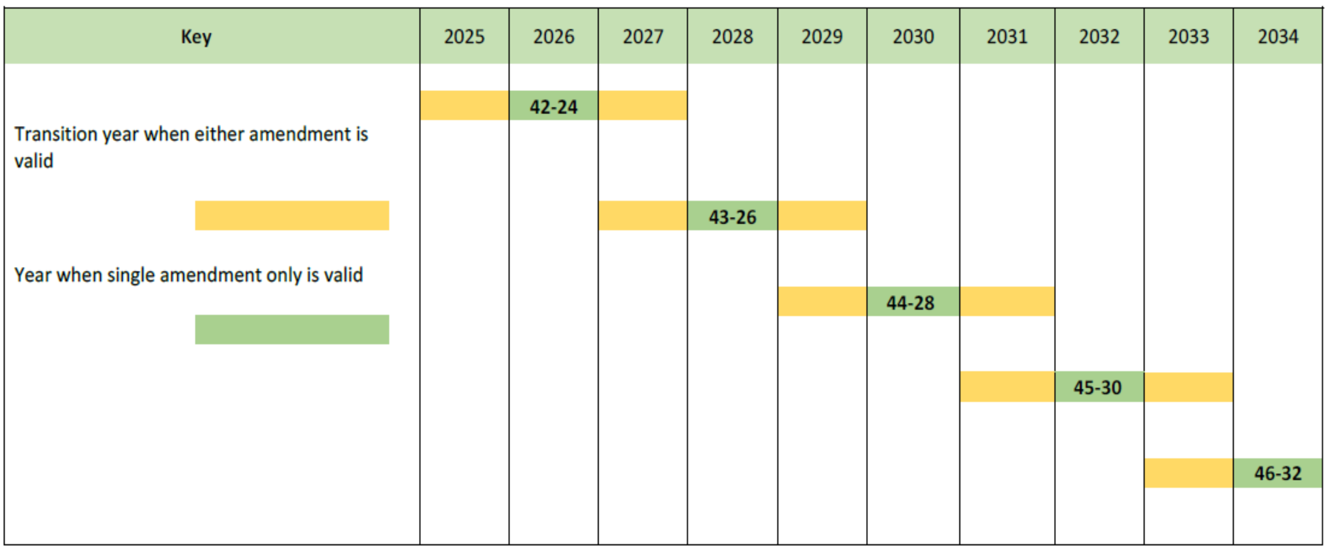
As an example;

What is the maximum carrying capacity of TEUs with a weight of 15 t each in dock water density of 1.020 tm^{-3}?

What you need to do is check the maximum number of twenty-footer containers (having a weight of 15 t each) that can be loaded for the given density of 1.020 tm^{-3} with zero or slight trim without violating load lines, ship's stability criteria, stresses, visibility range, load densities and etc. with the aid on the loadicator.

7) IMDG cargoes

a) Amendment cycle of the IMDG Code[68]



- Each amendment is valid for a period of 03 years
- Take the edition 42-24 as an example. From 1st of January 2025, it can be used voluntarily. From 1st of January 2026, it is mandatory. From 1st of January 2027, either the edition 42-24 or 43-26 edition could be used.

b) How to refer the IMDG Code

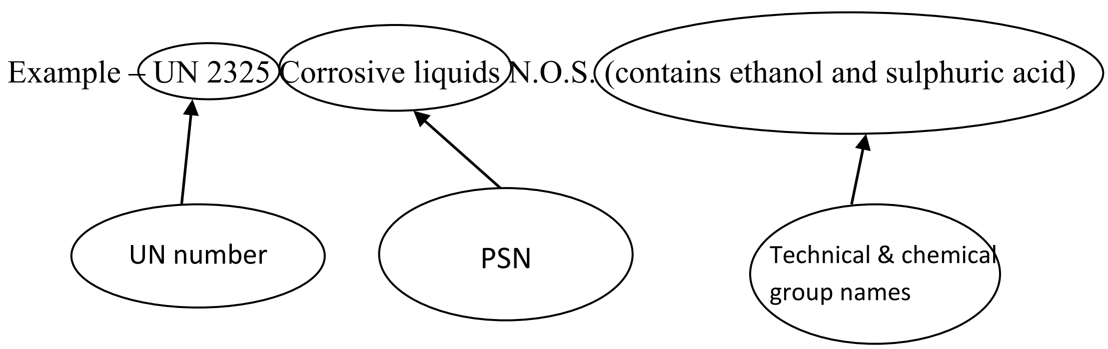
The code is to be referred against the UN number provided by the shipper in the dangerous cargo declaration and the UN numbers are listed in the dangerous goods list

68 https://wwwcdn.imo.org/localresources/en/publications/Documents/IMDG%20Code/IMDG%20Code%20Amendment%20Cycle%20-%202025-2034.pdf (Last visited 13/06/2026)

(DGL) in the numerical order. But, if the UN number is not provided by the shipper, but if the proper shipping name is provided, UN number can be obtained from the index page of volume 2 (refer the back of the Volume 2), because the proper shipping names are provided in the alphabetical order along with the UN number.

c) Generic or "Not Otherwise Specified" (N.O.S.)

Sometimes goods that may be considered as dangerous goods (but, not listed in the IMDG Code) or mixtures of dangerous goods may be received for shipment. Before packing into a container, these types of substances are tested to determine the nature of danger involved. Once the nature of danger is identified, a proper shipping name (PSN) and an UN number (the UN number will be allocated in accordance with the nature of danger) will be allocated. Remember, these substances do not have a specific "proper shipping name" even though they are listed in the same column. That means, the name in the DGL which most equivalently describes the substance or article is used as the PSN.



The main generic entries & all the N.O.S. entries given in the DGL are listed in Appendix A of Volume – 2 of the IMDG Code.

d) Subsidiary risk (Sub-risks)

This means that a particular cargo has a "sub-risk" in addition to the main risk. On a shipper's declaration, it is indicated **within brackets** after the class if applicable. [example - **(5.1)**]
The subsidiary risks cannot be identified by referring to the IMDG label on a container, but only by referring the column 4 of the DGL or by the shipper's declaration.

e) Packing group

IMDG cargoes (not all of them) are group into three groups known as "packing group", depending upon the degree of the danger. The PG I has the greatest danger and the PG III has the least danger. On a shipper's declaration this is given in **BOLD CAPITOL** letters. (Example - "**PG II**").

f) Limited quantities

Certain classes of dangerous goods can be transported if they are packed in small containers protected by an outer packing. Refer the Column 7a of the DGL & chapter 3.4 of volume 2 when carrying such cargoes in limited quantities.

Column 7a of the DGL provides the maximum quantity per inner packaging for transporting dangerous goods in limited quantities. If "0" is given in this column for a particular dangerous good, that cargo cannot be transported in by using provisions under limited quantities.

On a shipper's declaration this is indicated as "**LIMITED QUANTITIES**" or "**LTD QTY**" or "**GOODS SHIPPED IN LIMITED QUANTITIES**".

Stowage of goods when carrying in limited quantities

When carrying dangerous goods in limited quantities the *Stowage Category A* to be used and other towage provisions given in the column 16a of the DGL are not applicable.

Segregation of goods when carrying in limited quantities

The segregation provisions of chapters 7.2 to 7.7 of the volume – 1 and the column 16b of the DGL are not applicable, and dangerous goods of division 1.4 compatibility group S shall not be stowed in the same compartment or hold with dangerous goods of class – I of compatibility groups A & L.

g) Excepted quantities

"Excepted quantities" are very similar to "Limited quantities" but the maximum inner and outer packages are smaller. That means, the amount of dangerous goods carried is smaller than that under the provisions of limited quantity. Because the dangerous goods are packed in small containers and the outer package weight is limited, there are some exemptions from the rules.

On a shipper's declaration this is indicated as "**Dangerous goods in excepted quantities**".

Column 7b of the DGL contains an alpha-numeric code which indicates the maximum quantity for inner & outer packaging. Refer the table in chapter 3.5 of the IMDG Code to identify the meaning of alpha-numeric codes.

Stowage of dangerous goods of excepted quantities

Requirements of Stowage Category A to be complied with when carrying dangerous goods in excepted quantities. The provisions in column 16a of the DGL are not required to be complied with.

Segregation of dangerous goods of excepted quantities

Provisions given in chapters 7.2 to 7.7 and the column 16b of the DGL are not required to comply.

h) Segregation

The column 16b of the DGL provides segregation codes prefixed with "SG". Need to refer the Volume 1 of the IMDG Code for the detailed segregation requirements for each dangerous cargo and these specific requirements are provided under the heading of "Segregation codes".

At the same time, a summary of segregation methods between classes are provided under the heading of "segregation table" in chapter 7.2.4 of the Volume 1. This table provides only the **general provisions** for segregation between various classes of dangerous goods. Therefore, in the case of conflicting provisions between "segregation table" and the DGL, the DGL takes precedence over the "segregation table".

i) Loading of IMDG

Information required

- Proper shipping name;
- Class;
- UN Number;
- Packing group (if applicable);
- Sub-risk (if applicable);
- Flashpoint (if applicable);
- Marine pollutant (if applicable);
- EMS schedule; and
- Whether it is in limited or excepted quantity.

Documents required

- IMDG Code and the supplement;
- Document of Compliance (DOC contains which classes of IMDG may be stored on different cargo areas of a ship and also it contains a list of equipment that need to have on board to carry IMDG) – issued by flag state;
- Shipper's declaration (declaring that proper shipping name, class, UN number, and the cargo is properly packed, marked, labelled and ready for shipment) – issued by the shipper;
- Packing certificate (declaring that the container is packed in accordance with the applicable regulations) – issued by the packer [this is not required for tank containers];
- Dangerous goods manifest; and
- Copy of the competent authority's approval for each consignment when carrying vehicles having metal hydride storage systems (refer UN number 3166)

Document of Compliance[69]

Chief Officers are required to have a good knowledge about the Document of Compliance (DOC) with regards to the loading of IMDG cargoes. Refer the below DOC and study it thoroughly to get a good idea.

The second page of a DOC (see the below DOC) refers to the loading of IMDG goods under deck and on deck. Read the end notes provided on the same page.

The last page of the appendix provides a list of equipment the vessel is supposed to have in order to carry IMDG cargoes.

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69 https://www.wanhai.com/FileView;jsessionid=EFB0B5695A41C842993E31FA5B92C028?file_num=12345&file_name=CJJIDGCERT.pdf&file_path=tw_vsl (Last visited 13/06/2026)

(Compiler's note – This is a 6-page document. Pages 1, 3 & 6 are shown below)

DNV·GL

DOCUMENT OF COMPLIANCE FOR THE CARRIAGE OF DANGEROUS GOODS

G130073
Date of issue:
2017-11-08

Issued in pursuance of the requirement of regulation II-2/54.3 of the International Convention for Safety of Life at Sea, 1974, as amended
under the authority of the Government of

THE REPUBLIC OF LIBERIA

by **DNV GL**

Particulars of Ship

Name of Ship:	**CIMBRIA**
Distinctive Number or Letters:	**90902**
Port of Registry:	**MONROVIA**
Type of Ship:	**Container ship**
Date on \ d	**2002-04-22**
IMO Number:	**9241190**

This is to certify:

1. That the construction and equipment of the above mentioned ship was found to comply with the provisions of regulation II-2/19.3 as applicable according to II-2/1.2.4 of the International Convention for the Safety of Life at Sea, 1974, as amended.

2. That the ship is suitable for the carriage of those classes of dangerous goods specified in the appendix hereto, subject to any provisions in the IMDG Code for individual substances, materials or articles also being complied with.

This document is valid until **2022-10-16**.

Issued at **Shanghai, China** on **2017-11-08**

for **DNV GL**

This document is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication can be obtained from trust.dnvgl.com by using the Unique Tracking Number (UTN): n1066714-fud and ID: G130073

Xin Jian Amon Mo
Surveyor

There are no special requirements in the above-mentioned regulation II-2/19 for the carriage or dangerous goods of classes 6.2 and 7, and for the carriage of dangerous goods in limited quantities, as required in chapter 3.4 of the IMDG Code, and excepted quantities, as required in chapter 3.5 of the IMDG Code.

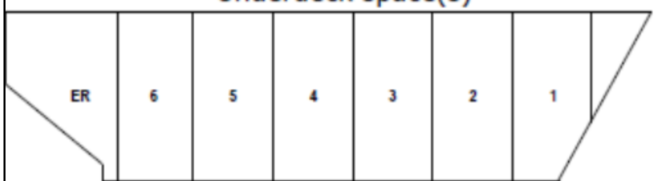
APPENDIX

DNV GL Id No: **G130073**
Date of issue: **2017-11-08**

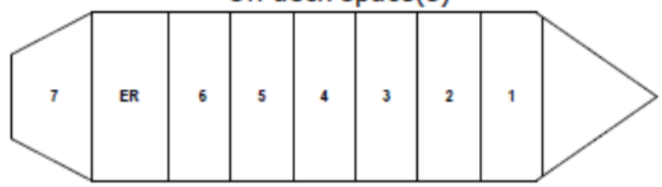
Sketch of the vessel

Cargo spaces indicated in the sketch are corresponding with the table(s) hereafter

Underdeck space(s)



On deck space(s)



Packaged goods

	Underdeck space(s)						On deck space(s)			
Class	**1, 2**	**3 to 6**					**ER [1]**	**1 to 6**	**7**	
1.1 to 1.6	**P [1]**	**X**					**X**	**P**	**X**	
1.4S	**P**	**P**					**P**	**P**	**P**	
2.1 hydrogen and hydrogen mixtures exclusively	**X**	**X**					**X**	**P**	**P**	
2.1 other than hydrogen and hydrogen mixtures	**P [1]**	**C [1]**					**X**	**P**	**P**	
2.2	**P**	**P**					**X**	**P**	**P**	
2.3 flammable	**X**	**X**					**X**	**P**	**P**	
2.3 non-flammable	**X**	**X**					**X**	**P**	**P**	
3 FP < 23°C	**P [1]**	**C [1]**					**X**	**P**	**P**	
3 23°C ≤ FP ≤ 60°C	**P**	**P**					**X**	**P**	**P**	
4.1	**P**	**P [2]**					**X**	**P**	**P**	
4.2	**P**	**P [2]**					**X**	**P**	**P**	
4.3 liquids	**P [3]**	**C [3]**					**X**	**P**	**P**	
4.3 solids	**P**	**C**					**X**	**P**	**P**	
5.1	**P**	**P [2]**					**P [2]**	**P**	**P**	
5.2	**X**	**X**					**X**	**P**	**P**	
6.1 liquids FP < 23°C	**P [1]**	**C [1]**					**X**	**P**	**P**	
6.1 liquids 23°C ≤ FP ≤ 60°C	**P**	**C**					**X**	**P**	**P**	
6.1 liquids FP > 60°C	**P**	**P**					**P**	**P**	**P**	
6.1 solids	**P**	**P [2]**					**P**	**P**	**P**	
8 liquids FP < 23°C	**P [1]**	**C [1]**					**X**	**P**	**P**	
8 liquids 23°C ≤ FP ≤ 60°C	**P**	**C**					**X**	**P**	**P**	
8 liquids FP > 60°C	**P**	**P**					**P**	**P**	**P**	
8 solids	**P**	**P**					**P**	**P**	**P**	
9 goods evolving flammable vapour exclusively	**P [1]**	**C [1]**					**P**	**P**	**P**	
9 other than goods evolving flammable vapour	**P**	**P [2]**					**P**	**P**	**P**	

P Indicates PACKAGED GOODS PERMITTED
C Indicates IN CLOSED FREIGHT CONTAINERS OR PORTABLE TANKS PERMITTED
X Indicates NOT PERMITTED

APPENDIX

DNV GL Id No: **G130073**
Date of issue: **2017-11-08**

List of equipment

According to the provisions of regulation 19.3 as applicable according to II-2/1.2.4

Para	Requirement	Equipment provided		
1.1	Compliance with reg. 10.7.2	**Hold 1 to 6: Fixed CO_2 system**		
3.1.1	Immediate supply of water	**Remote start of the main fire pumps from the navigation bridge**		
3.1.2	Quantity of water and arrangement of hydrants	**Provided**		
3.1.3	Water cooling	**Hold 1, 2: Fixed water-spraying system of 5 l/min per m²**		
3.1.4	Cargo hold flooding	**Not provided**		
3.2	Sources of ignition	**Explosion protection of electrical equipment in**		
		Hold 1, 2:	**at least**	**IIB T5, IP65**
		Hold 3 to 6:	**at least**	**IIB T4, IP55**
		Electrical equipment is capable of being isolated in		
		Hold 1 to 6:	**lighting**	**non-ex.-proof**
		Hold 1 to 6:	**reefer container sockets**	**non-ex.-proof**
		Hold 1 to 6:	**reefer monitoring system**	**non-ex.-proof**
3.3	Detection system	**Hold 1 to 6: Sample extraction smoke detection and alarm system**		
3.4.1	Mechanical ventilation	**Hold 1, 2: Six air changes/h (Exhaust from upper and lower part)** **Hold 3 to 6: Two air changes/h (Exhaust from upper and lower part)**		
3.4.2.1	Safety of fans	**Hold 1 to 6: Provided**		
3.4.2.2	Wire mesh guards	**Hold 1 to 6: Provided**		
3.4.3	Natural ventilation	**Not applicable**		
3.5	Bilge pumping	**Hold 1 to 6: Additional bilge system, isolating valve with locking device and warning signs**		
3.6.1	Full protective clothing	**Four sets**		
3.6.2	Additional self-contained breathing apparatuses	**Two sets in addition to fire-fighter's outfits**		
3.7	Portable fire extinguishers	**Additional total of 12 kg dry powder**		
3.8	Insulation of machinery space boundaries	**Underdeck holds: Not applicable** **On deck space between frame no. 11 and 28: Located above engine room (deck(s) not insulated)**		
3.9	Water spraying system	**Not applicable**		
3.10	Separation of ro-ro spaces	**Not applicable**		

Sample of a Shipper's declaration

MULTIMODAL DANGEROUS GOODS FORM

1 Shipper/Consignor/Sender
Oil Field Services
K16B Platform
Continental Shelf
The Netherlands

2 Transport document number
QRG-12

3 Page 1 of 1 pages

4 Shipper's reference

5 Freight forwarder's reference

6 Consignee
Peterson SBS Den Helder BV
Paleiskade 43
1781 AN Den Helder

7 Carrier (to be completed by the carrier)
SNS Pool

8 This shipment is within the limitations prescribed for:
(Delete non-applicable)

~~PASSENGER AND CARGO AIRCRAFT~~ | ~~CARGO AIRCRAFT ONLY~~

SHIPPER'S DECLARATION
I hereby declare that the contens of this consignment are fully and accurately described below by the Proper Shipping Name, and are classified, packaged, marked and labelled/ placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations.

10 Vessel/flight No and date
POOL VESSEL

11 Port/place of loading
K16B

9 Additional handling information
24 hour emergency response telephone number: (USA 011)++31-223-763456231

12 Port/place of discharge
DEN HELDER

13 Destination
Den Helder

UN	Proper shipping name	Class	PG	Flashp	EMS	# of pkg - type of packing	NET	GROSS	NEQ	Remarks
UN 1066	NITROGEN, COMPRESSED	2.2			F-C, S-V	4 Cylinders in gasrack CP-231	40 kg	200 kg		
UN 1072	OXYGEN, COMPRESSED	2.2 (5.1)			F-C, S-W	2 Cylinders in gasrack CP-231	22 kg	150 kg		
UN 1992	WASTE, FLAMMABLE LIQUID, TOXIC, N.O.S. (CONTAINS METHANOL, GAS CONDENSATE AND SLUDGE)	3 (6.1)	II	20 °C	F-E, S-D	1 Tank container THSA 796	2200 L	4600 kg		MARINE POLLUTANT
UN 2990	LIFE-SAVING APPLIANCES, SELF-INFLATING	9			F-A, S-V	4 life rafts, unpacked, loaded in basket GSA 342	380 kg	1246 kg		
UN 1268	PETROLEUM PRODUCTS, N.O.S.	3	II	2 °C	F-E, S-E	1 plywood box loaded in container HT-297	4 L	12 kg		LTD QTY

15 Container identification No./ vehicle registration No.
see above

16 Seal number(s)
n/a

17 Container/vehicle size &type

18 Tare mass (kg)

19 Total gross mass (including tare) (kg)
-

CONTAINER/VEHICLE PACKING CERTIFICATE
I hereby declare that the goods described above have been packed/loaded into the container/vehicle identified above in accordance with the applicable provisions.

MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/LOADING

21 RECIEVING ORGANISATION RECEIPT
Recieved the above number of packages/containers/trailers in apparent good order and condition, unless stated hereon: RECIEVING ORGANISATION REMARKS:

20 Name of company
Nederlandse Aardolie Maatschappij

Name/status of declarant
John Loosakker, MATCO

Place and date
K16B, 02 jul 2012

Signature of declarant

Haulier's name

Vehicle reg. no.

Signature and date

DRIVER'S SIGNATURE

22 Name of company (OF SHIPPER PREPARING THIS NOTE)
Oil Field Services

Name/status of declarant
John Loosakker, MATCO

Place and date
K16B, 02 jul 2012

Signature of declarant

Dangerous goods manifest

This is a document that is required to be submitted to the port before arrival and also before departure when carrying packaged dangerous goods (IMDG). This also comes under the IMO list of FAL forms. Refer the below form for further guidance

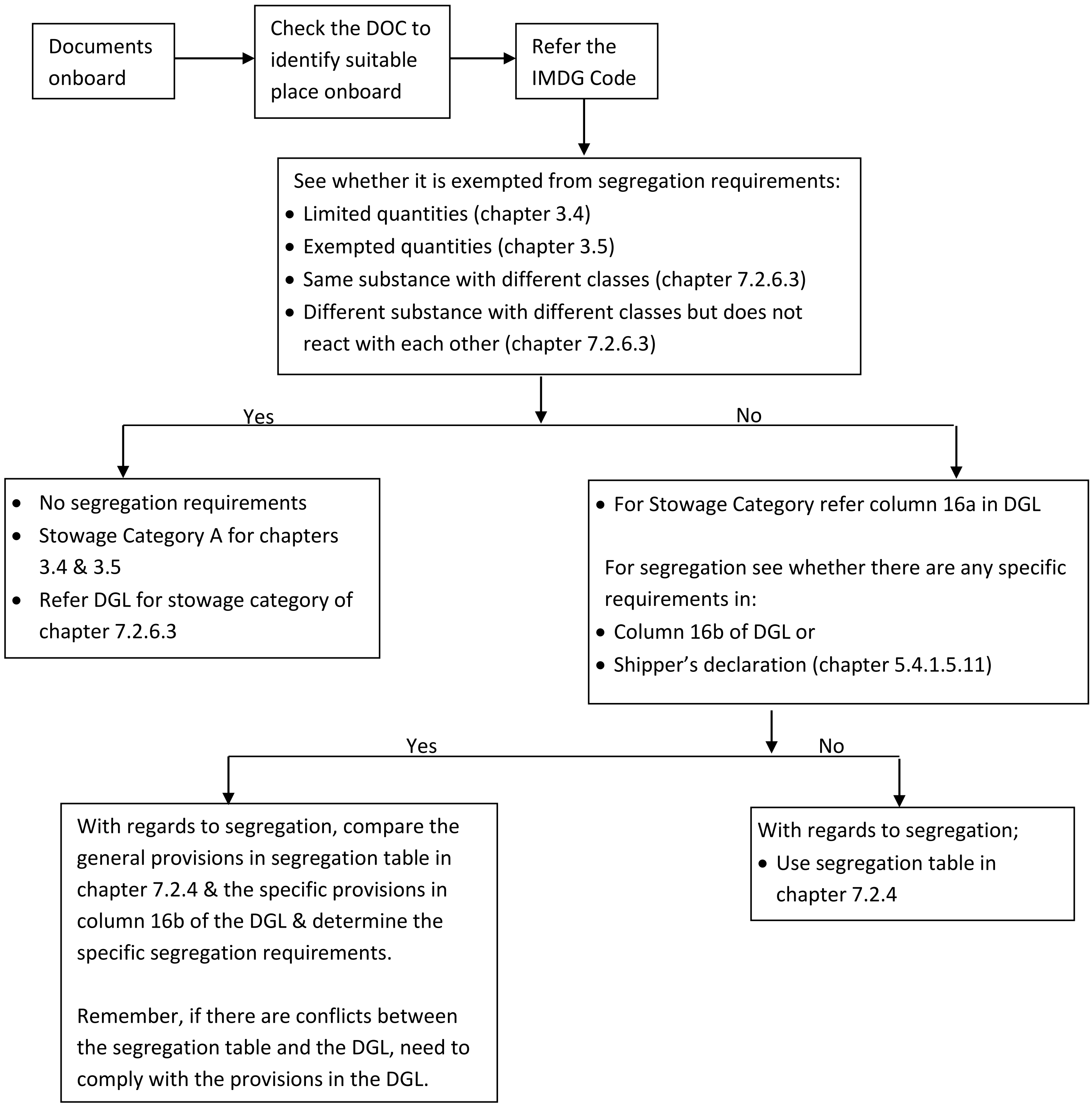
DANGEROUS GOODS MANIFEST

(IMO FAL Form 7)

(As required by SOLAS 74, chapter VII, regulations 4.2 and 7-2.2, MARPOL, Annex III, regulation 4.2 and chapter 5.4, paragraph 5.4.3.1 of the IMDG Code)

													Page Number	
1.1 Name of ship				1.2 IMO number					1.3 Call sign					
1.4 Voyage number			2. Flag State of ship			3. Port of loading				4. Port of discharge				
5. Stowage Position	6. Reference Number	7. Marks & Numbers - Freight container Identification No(s) - Vehicle registration No(s).	8. UN Number	9. Proper Shipping Name/(Technical Specifications)	10. Class/ (Subsidiary Risk(s))	11. Packing Group	12. Additional Information/Marine Pollutant/Flash point/etc.	13. Number and kind of packages	14. Mass (kg) or Volume (L)	15.EmS				
16. Shipping Agent														
16.1 Place and date														
Signature of Agent														

Loading procedure of IMDG cargoes[70]



[70] Modified version of the Segregation table in chapter 7.2.8 of Volume – 1 of the IMDG Code

- Ensure the containers are not leaking, and they are labelled correctly at the time of loading (do not forget the other usual precautions).
- Identify the emergency procedures from the Supplement, make a summary of IMDG cargoes onboard against their relevant emergency procedures and make it available on the bridge.
- The loading information provided on a Document of Compliance is also integrated into the ship's stability computer. Therefore, while planning using the stability computer, if a DG container is placed in a wrong location, it will be highlighted on the screen with a warning sign.
- Information (relevant to segregation) provided in the IMDG Code also available in the stability computer. At the same time, the segregation information in the stability computer may not be updated in accordance with the latest amendments to the IMDG Code. Therefore, do not forget to refer the IMDG Code, when segregating between IMDGs.

Note: Take couple of examples of IMDG cargoes and refer the code & the supplement, to become more familiar with the code

Transport of vehicles by sea

- The IMDG code classifies vehicles as;
  - ✓ **UN 3166:** Vehicles powered by flammable liquid/gas or fuel cells, including internal combustion/battery hybrids;
  - ✓ **UN 3556:** Vehicle, lithium-ion battery powered;
  - ✓ **UN 3557:** Vehicle, lithium-metal battery powered; and
  - ✓ **UN 3558:** Vehicle, sodium-ion battery powered.

- If any fuel tanks or battery of vehicle found leaking do not accept onboard.
- Carriage of vehicles by sea are not subjected to the requirements of the IMDG Code, if vehicles are stowed on the special category and ro-ro spaces or on the weather deck of a ro-ro ship or a cargo space designated by the Administration in accordance with the SOLAS 74, chapter II-2, regulation 20 as specially designed and approved for the carriage of vehicles, and when there are no signs of leakage from the battery, engine, fuel cell, compressed gas cylinder or accumulator, or fuel tank when applicable.
- In cargo ships constructed on or after 1st January 2026, vehicle spaces, special category spaces and ro-ro spaces shall be provided with a fixed fire detection and fire alarm system complying with the requirements of the Fire Safety Systems Code. The fixed fire detection system shall be capable of rapidly detecting the onset of fire[71].

[71] Refer Resolution MSC.550(108) of IMO or the latest for further details

8) Carriage of BULK CARGOES

a) How to refer the IMSBC Code

Each cargo in the code is assigned a Bulk Cargo Shipping Name (BCSN). The BCSN will be supplemented by the UN number (IMDG Code) if the cargo is a dangerous good. Individual schedules of solid bulk cargoes in the IMSBC Code are given in the alphabetical order of the BCSN.

b) Angle of repose

This is the maximum angle between the horizontal plane and the cone slop of a free-flowing granular material. This can be measured by:

- Laboratory testing (tilting box method); and
- Onboard test method

Method of testing the angle of repose onboard:

- Fill a 3-litre conical flask with the cargo;
- Pour about 2/3 of that on to a rough paper so as to produce a starting cone;
- Then pour the rest of the cargo from a height of a few millimetres on top of the cone carefully;
- Rotate the flask around the cone while pouring to make the cone symmetrical;
- Using a protractor measure the angle without hitting the cone;
- The angle should be measured at four places, about 90º apart; and
- Repeat the same thing for another two samples.

c) Flow moisture point (FMP)

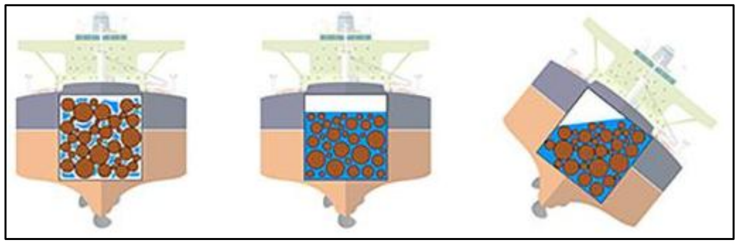
This is the percentage moisture content (wet mass basis) at which a flow state will develop.

d) Transportable moisture limit (TML)

This is the maximum moisture content of a Group A cargo deemed safe for carriage by sea in ships other than specially designed ships. Cargoes having the moisture content higher than the TML shall only be transported on specially designed ships.

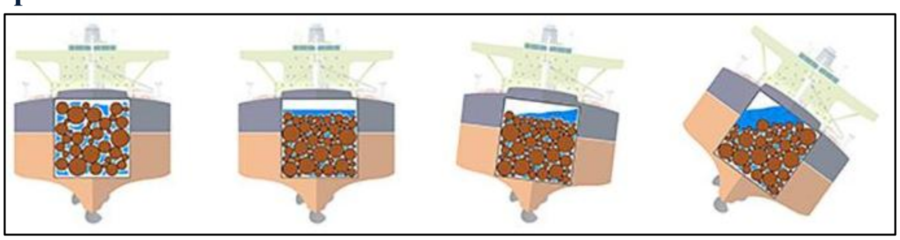
e) Cargo liquefaction and dynamic separation

In cargoes containing more fine particles, there may be insufficient drainage channels for excess moisture to escape. As the volume of the voids decreases due to consolidation/compaction, the water which cannot escape from the void spaces will ultimately push the solid particles apart. When the solid particles lose contact with each other, the cargo will lose strength and will behave as a liquid, affecting the ship's stability. This phenomenon is called **liquefaction**[72].



Cargo liquefaction[73]

If the water can escape from some of the void spaces but cannot drain completely, it may migrate upwards from the area of high pressure to the area of low pressure, ultimately collecting on the surface of the cargo forming a liquid slurry (consisting of water and fine solids). This slurry, moving with the motion of the vessel, can impair the ship's stability. This phenomenon is called **dynamic separation**[74].



Dynamic separation[75]

f) Measuring of moisture content onboard

Laboratory tests are required to be carried out to measure the moisture content accurately. The below mentioned method can be used to see whether the cargo contains substantial amount of moisture. Based on the results of the onboard test, if you suspect the moisture

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[72] https://britanniapandi.com/en_gb/guidance/loss-prevention-guidance-understanding-liquefaction-and-dynamic-separation-in-solid-bulk-cargoes/ (Last visited 21/08/2026)
[73] https://www.amsa.gov.au/vessels-operators/cargoes-and-dangerous-goods/dynamic-separation-cargoes (Last visited 21/08/2026)
[74] https://britanniapandi.com/en_gb/guidance/loss-prevention-guidance-understanding-liquefaction-and-dynamic-separation-in-solid-bulk-cargoes/ (Last visited 21/08/2026)
[75] https://www.amsa.gov.au/vessels-operators/cargoes-and-dangerous-goods/dynamic-separation-cargoes (Last visited 21/08/2026)

content given in the cargo declaration is wrong, you can request a new laboratory test certificate.

Half fill a cylindrical can (0.5 to 1 litre) with the cargo. Take the can in one hand and bring it down sharply to strike a hard surface (table) from a height of about 20 cm. Repeat this for about 25 times at one to two seconds intervals. Check the surface of the can for moisture or fluid conditions. If free moisture or a fluid condition appears, prepare arrangements to have additional laboratory tests, before loading.

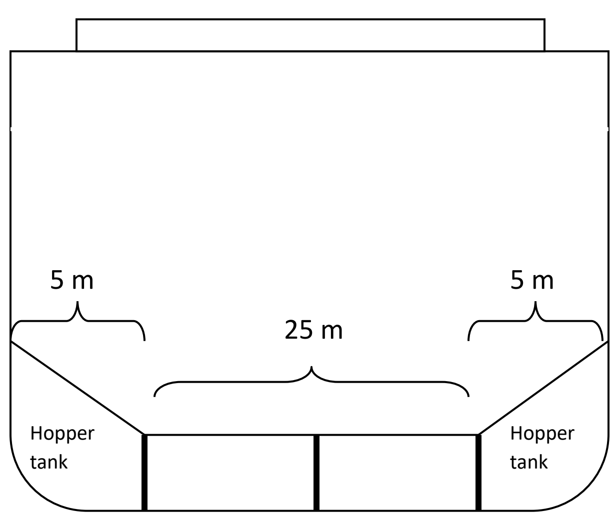
g) Cargo groups as defined in the IMSBC

- **Group A**
  Include cargoes which may **liquefy** or **dynamically separated** if shipped at moisture content in excess of their TML.

- **Group B**
  Include cargoes which possess a **chemical hazard** which could give rise to a dangerous situation onboard. Group B cargoes include;
  - ✓ Dangerous goods in solid form in bulk having the same UN numbers as given in the IMDG Code and
  - ✓ Materials hazardous only in bulk (MHB)

- **Group C**
  Include cargoes which are neither come under Group A nor Group B.

h) Calculation of amount of cargo to be loaded



With reference to the figure above, assume that the;

Length of the hold	= 40 m
Breadth of the tank top	= 25 m
Horizontal width of one hopper tank	= 5 m
Load density of the hold	= 15 tm^{-2}
Volume of the cargo space	= 25000 m^3
Stowage factor of the cargo to be loaded	= 1.5 m^3t^{-1}

Calculation

Cargo area on the tank top = 40 x 25 = 1000 m^2
Weight of the cargo to be loaded on tank top = 1000 x 15 = 15000 t

Therefore, volume of the cargo on tank top = 15000 x 1.5 = 22500 m^3
Height of the cargo on tank top = 22500 / (40 x 25) = 22.5 m

Now, need to consider about the cargo that can be loaded on the hopper tanks as well. But, remember DO NOT INCREASE HEIGHT OF THE CARGO VOLUME MORE THAN 22.5 m.

The weight that can be loaded on one hopper tank can be calculated by the following formula:

Weight= 0.5 x length x horizontal width x load density
Therefore:
Weight on one hopper tank = 0.5 x 40 x 5 x 15 = 1500 t
Weight on both hopper tanks = 2 x 1500 = 3000 t
Volume on both hopper tanks = 3000 x 1.5 = 4500 m^3

Therefore:
Total cargo to be loaded = 3000 + 15000 = 18000 t
Total volume of the cargo = 22500 + 4500 = 27000 m^3

Therefore:
Volume of the cargo that can be loaded = 25000 m^3 (maximum cargo space)

In this case the KG of the cargo will be the VCG provided in the stability book for this cargo space.

If the hold space is more than 27000 m^3, then of course the KG of the cargo would be = 22.5 / 2 = 11.25 m

i) Loading of bulk cargoes

Information required

- BCSN (Bulk Cargo Shipping Name);
- Cargo group;
- Stowage factor;
- Angle of repose;
- Trimming procedures;
- Chemical properties (IMO class, UN number, whether the cargo is a 'Material Hazardous only in Bulk');
- Moisture content;
- Transportable moisture limit; and
- Any other information relevant to the cargo.

Note: Refer Appendix 5 of the BLU Code or Section 4 of the IMSBC for further details

Documents required

- Enhanced survey report file;
- For carriage of grain:
  - ✓ Document of authorization;
  - ✓ Grain loading manual; and
  - ✓ Grain code.

- Shipper's declarations (refer the IMSBC Code for a sample form);
- Bulk Carrier Booklet/loading manual;
- Document of compliance – Special requirements for ships carrying dangerous goods (This lists down the cargoes that can be carried on board. Refer below for further clarification);
- A list or manifest setting forth the dangerous goods on board and the location thereof;
- Certificate of moisture content and transportable moisture limit;
- Weathering certificate (this is a certificate, which states that the cargo was stored under cover but exposed to open air for not less than certain number of days. It is

required only when the IMSBC Code says so. As examples refer Ferrosilicon & Silicomanganese in the Code. This is issued by the shipper) – if required;

- Exemption certificate (exempting a substance or material from the provisions of the IMSBC Code, provided similar precautions are obtained. This to be issued by a competent authority) – if applicable;
- Certificate of fumigation (if applicable);
- IMSBC Code;
- IMDG Code (This is required when carrying dangerous goods in package form. The table in Chapter 9.3.3 of the IMSBC to be referred when carrying Group B cargoes and dangerous goods in package form, but need to refer the IMDG Code as well for additional requirements with regards to stowage segregation of package dangerous goods);
- Medical First Aid Guide (MFAG);
- BLU Code (included in the supplement to the IMSBC);
- BLU Manual (included in the supplement to the IMSBC);
- Hold inspection certificate (pre-loading certificate) (this is issued by a surveyor after inspecting the holds to ensure that the holds are in a suitable condition to load the intended cargo);
- Load/discharge sequence plan;
- Ballasting/de-ballasting sequence plan; and
- Ship/shore safety check list.

Document of compliance

Chief Officers are required to have a good knowledge about the Document of Compliance (DOC) with regards to the loading of dangerous goods in bulk. Refer the below DOC and study it thoroughly to get a good idea. Remember this DOC is issued to a general cargo ship covering IMDG and IMSBC cargoes both.

The Appendix - I cover loading of solid dangerous goods in bulk. The categories of solid dangerous bulk cargoes that can be loaded in different holds are provided in the Appendix - I. Refer the page 6 of the DOC for a detailed reference for the 'Type' which is provided in the column two.

The information with regards to the loading of IMDG cargoes under deck and on deck ('weather deck' as stated in the DOC) are provided in the 3rd and the 4th pages (Appendix - II).

Carefully read through the general notes provided in the page number 7 on handling of dangerous goods.

Certificate no:
Page 1 of 9

Document of Compliance

Special Requirements for Ships Carrying Dangerous Goods

Issued in the pursuance of the requirements of regulation II-2/19.4 of the International Convention for Safety of Life at Sea, 1974, as amended under the authority of the Government of the Hong Kong Special Administrative Region of the People's Republic of China by .

Particulars of ship

Name of ship	
Distinctive number or letters	
Port of registry	**HONG KONG**
Ship type	**General Cargo**
Gross tonnage	**14,859**
IMO number	
Date on which keel laid	**22 November 2010**

This is to certify:

1. that the construction and equipment of the above mentioned ship was found to comply with the provisions of regulation II-2/19 of the International Convention of Safety of Life at Sea, 1974 as amended; and

2. that the ship is suitable for the carriage of those classes of dangerous goods as specified in the appendix attached hereto, subject to any provisions in the International Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code for individual substances also being complied with.

Important:

Possession of this Document does not absolve the Master from his responsibility to comply with safe operational procedures including those laid down in the International Maritime Dangerous Goods Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code

This Document is valid until **11 March 2017**

Date of completion of the survey on which this Document of Compliance is based **12 March 2012**

Issued at **Nanjing** on **12 March 2012**

Surveyor

Note: There are no special requirements in the above-mentioned regulation II-2/19 for the carriage of dangerous goods of classes 6.2 and 7, or for the carriage of dangerous goods in limited quantities as defined in chapter 3.4 of the IMDG Code.

Appendix I

Cargo spaces carrying Solid Dangerous Goods in bulk

Name of cargo space	Type*	Classes of Dangerous Goods permitted to be carried	
Cargo Hold 1, 2, 3 (Bulk)	**4**	**4.1**	**Flammable solids(readily combustible solids and solids which may cause fire through friction)**
		4.2	**Substances liable to spontaneous combustion**
		5.1	**Oxidising substances (agents)**
		6.1	**Toxic Substances (solids)**
		8	**Corrosives (solids)**
		9	**Miscellaneous Dangerous Substances and Articles**

* *Type of cargo space, regulation 19.2.2 (see notes)*

Form 1599a (2012.01)

Appendix II

Cargo spaces carrying Dangerous Goods except Solid Dangerous Goods in bulk

Name of cargo space	Type*	Classes of Dangerous Goods permitted to be carried	
Cargo Hold 1 (Packaged)	**1**	**1.1-1.6**	**Explosives**
		1.4S	**Explosives, Division 1.4 Compatability group 'S'**
		2.1	**Flammable Gases**
		2.2	**Non Flammable, Non Toxic Gases**
		2.3	**Toxic Gases Non Flammable**
		3	**Flammable liquids - low and intermediate flashpoint, less than 23 C**
		3	**Flammable liquids - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		4.1	**Flammable solids, self-reactive substances and solid desensitized explosives**
		4.2	**Substances liable to spontaneous combustion**
		4.3	**Substances which, in contact with water, emit flammable gases (liquids)**
		4.3	**Substances which, in contact with water, emit flammable gases**
		5.1	**Oxidising substances (agents)**
		6.1	**Toxic Substances (liquids) - low and intermediate flashpoint, less than 23 C**
		6.1	**Toxic Substances (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		6.1	**Toxic Substances (liquids) - non flammable**
		6.1	**Toxic Substances (solids)**
		8	**Corrosives (liquids) - low and intermediate flashpoint, less than 23 C**
		8	**Corrosives (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		8	**Corrosives (liquids) - non flammable**
		8	**Corrosives (solids)**
		9	**Miscellaneous Dangerous Substances and Articles**
Cargo Hold 2 & 3 (Packaged)	**1**	**1.4S**	**Explosives, Division 1.4 Compatability group 'S'**
		2.1	**Flammable Gases**
		2.2	**Non Flammable, Non Toxic Gases**
		2.3	**Toxic Gases Non Flammable**
		3	**Flammable liquids - low and intermediate flashpoint, less than 23 C**
		3	**Flammable liquids - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		4.1	**Flammable solids, self-reactive substances and solid desensitized explosives**
		4.2	**Substances liable to spontaneous combustion**
		4.3	**Substances which, in contact with water, emit flammable gases (liquids)**
		4.3	**Substances which, in contact with water, emit flammable gases (solids)**
		5.1	**Oxidising substances (agents)**
		6.1	**Toxic Substances (liquids) - low and intermediate flashpoint, less than 23 C**
		6.1	**Toxic Substances (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		6.1	**Toxic Substances (liquids) - non flammable**
		6.1	**Toxic Substances (solids)**
		8	**Corrosives (liquids) - low and intermediate flashpoint, less than 23 C**
		8	**Corrosives (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		8	**Corrosives (liquids) - non flammable**
		8	**Corrosives (solids)**
		9	**Miscellaneous Dangerous Substances and Articles**
Weather Deck	**6**	**1.1-1.6**	**Explosives**
		1.4S	**Explosives, Division 1.4 Compatability group 'S'**
		2.1	**Flammable Gases**
		2.2	**Non Flammable, Non Toxic Gases**
		2.3	**Toxic Gases (flammable)**
		2.3	**Toxic Gases (non-flammable)**
		3	**Flammable liquids - low and intermediate flashpoint, less than 23 C**
		3	**Flammable liquids - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		4.1	**Flammable solids, self-reactive substances and solid desensitized explosives**
		4.2	**Substances liable to spontaneous combustion**
		4.3	**Substances which, in contact with water, emit flammable gases (liquids)**
		4.3	**Substances which, in contact with water, emit flammable gases (solids)**
		5.1	**Oxidising substances (agents)**
		5.2	**Organic Peroxides**
		6.1	**Toxic Substances (liquids) - low and intermediate flashpoint, less than 23 C**
		6.1	**Toxic Substances (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		6.1	**Toxic Substances (liquids) - non flammable**
		6.1	**Toxic Substances (solids)**
		8	**Corrosives (liquids) - low and intermediate flashpoint, less than 23 C**
		8	**Corrosives (liquids) - high flashpoint, greater than or equal to 23 C but less than or equal to 60 C**
		8	**Corrosives (liquids) - non flammable**
		8	**Corrosives (solids)**

**Type of cargo space, regulation 19.2.2 (see notes)*

Appendix II (continued)

Cargo spaces carrying Dangerous Goods except Solid Dangerous Goods in bulk

Name of cargo space	Type*	Classes of Dangerous Goods permitted to be carried	
Weather Deck	**6**	**9**	**Miscellaneous Dangerous Substances and Articles**

Type of cargo space, regulation 19.2.2 (see notes)

Form 1599a (2012.01)

Appendix II (continued)

Cargo spaces carrying Dangerous Goods except Solid Dangerous Goods in bulk

Name of cargo space	Type*	Classes of Dangerous Goods permitted to be carried

Type of cargo space, regulation 19.2.2 (see notes)

Form 1599a (2012.01)

Space Type Definitions

The Space Types listed in Appendices I and/or II of this Document of Compliance refer to the following types of cargo space in which dangerous goods may be carried:

1 Ships and cargo spaces not specifically designed for the carriage of freight containers but intended for the carriage of dangerous goods in packaged form including goods in freight containers and portable tanks.

2A Purpose-built container ships and cargo spaces intended for the carriage of dangerous goods in freight containers and portable tanks (Open and closed freight containers).

2B Purpose-built container ships and cargo spaces intended for the carriage of dangerous goods in freight containers and portable tanks (Closed freight containers and portable tanks only).

3A Ro-ro ships and ro-ro cargo spaces intended for the carriage of dangerous goods (Closed ro-ro cargo spaces not capable of being sealed).

3B Ro-ro ships and ro-ro cargo spaces intended for the carriage of dangerous goods (Closed ro-ro cargo spaces capable of being sealed).

3C Ro-ro ships and ro-ro cargo spaces intended for the carriage of dangerous goods (Open ro-ro cargo spaces).

4 Ships and cargo spaces intended for the carriage of solid dangerous goods in bulk.

5 Ships and cargo spaces intended for the carriage of dangerous goods other than liquids and gases in bulk in shipborne barges.

6 Weather decks, space types 1 to 5 inclusive.

General Notes

A Goods of Class 1 should not be stowed within a horizontal distance of 6 metres from any fire, machinery exhausts, galley uptakes, lockers used for combustible stores or other potential sources of ignition and not less than a horizontal distance of 8 metres from the bridge, living quarters and life saving appliances. Classs 1.1 to 1.6 Dangerous Goods are to be stowed 3m from the machinery space boundary in all cases.

Class 1.1 to 1.6 (except division 1.4, compatibility group 'S'), 2.1, 2.3 flammable and Class 3, 4.3, 6.1 & 8 liquids with flash point under 23 C dangerous goods are not to be carried in a hold at the same time as reefer containers.

D Stowage and segregation of freight containers of different classes of dangerous goods in the hold and on the upper deck in compliance with the applicable requirements of the IMDG Code remain the responsibility of the Master.

F The Special Requirements for each product, as stated in the International Maritime Solid Bulk Cargoes Code (IMSBC Code), should also be complied with.

G There are no special requirements in regulation II-2 for the carriage of Class 7 (Radioactive Materials) dangerous goods.

As per the IMDG Code carriage of Class 5.2 Dangerous Goods, underdeck is prohibited.

Dangerous goods of class 8 with a subsidiary risk category of 6.1, as per the IMDG Code, not to be carried underdeck.

Goods of class 4.3 which, according to the IMDG Code having a flash point of less than 23 C not to be carried in packaged form underdeck.

Class 1 cargoes (excluding class 1.4S) cannot be carried in Cargo Holds at the same time as: Class 6 liquids and Class 3 & 8 liquids with flash point under 23 C.

Dangerous goods requiring electrical equipment of a standard greater than IIC/T5 in hold 1 and IIC/T4 in holds 2 & 3 should not be carried underdeck.

Certificate no:
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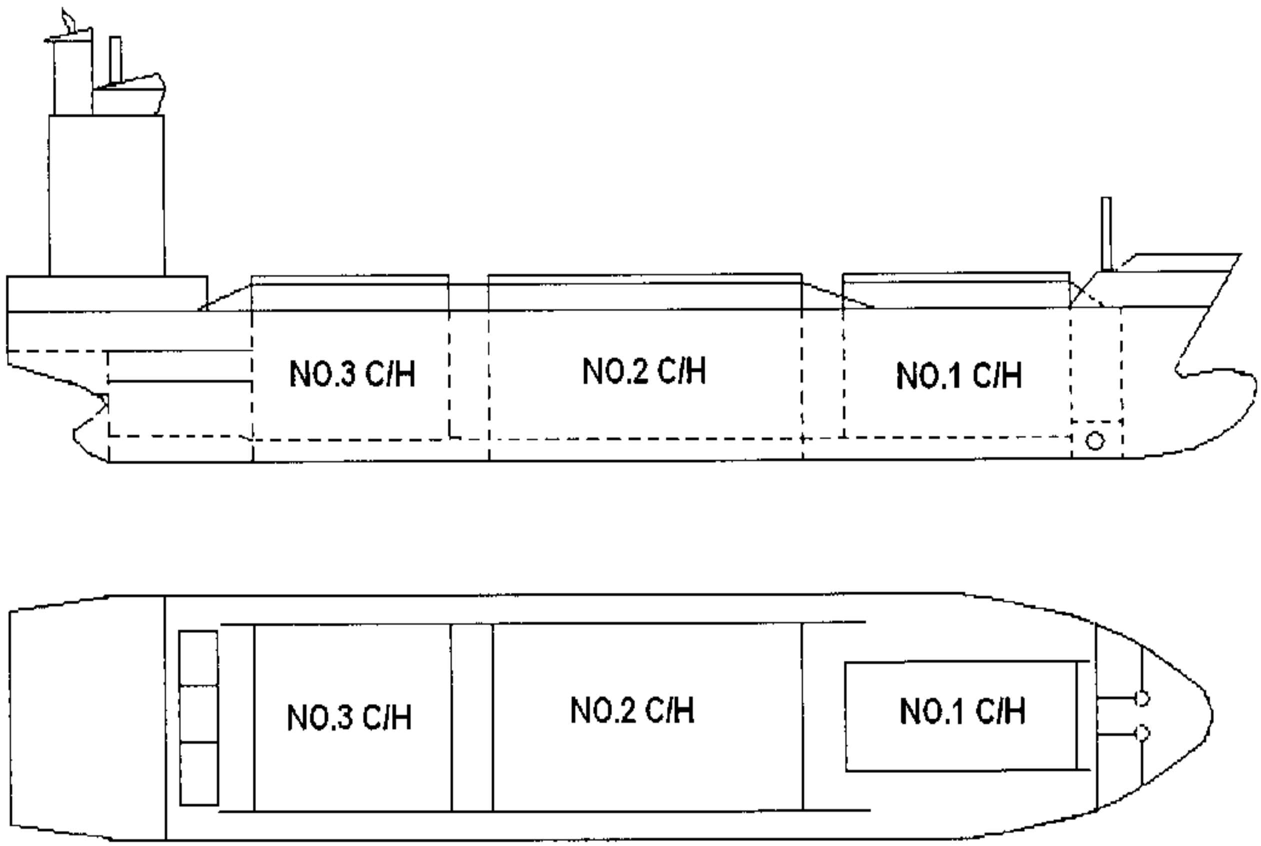
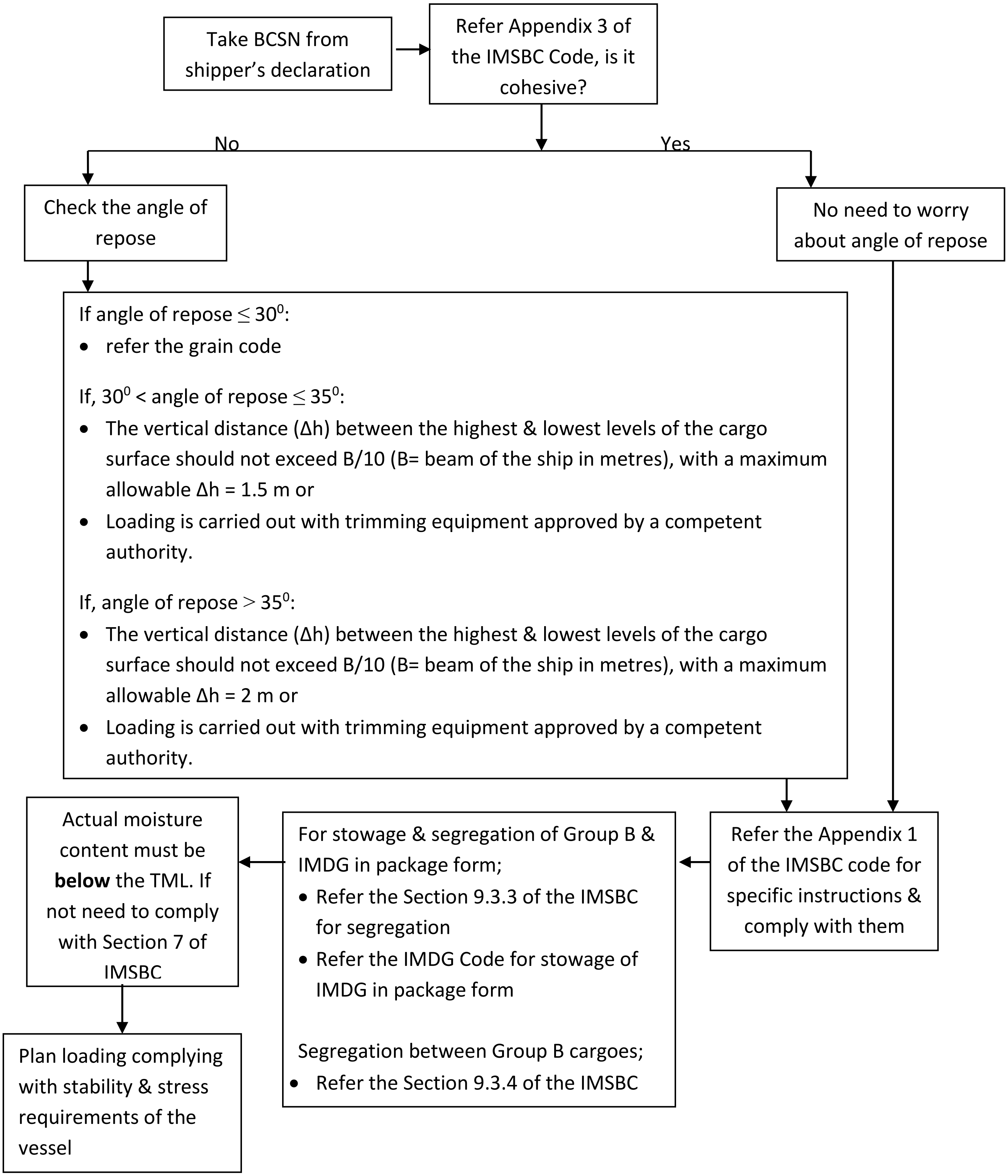
Ship Layout



Cargo planning procedure



- If the cargo is a dangerous good (Group B cargo):
  - ✓ Refer the table “Segregation between solid bulk cargoes possessing chemical hazards” (in section 9.3.4 of the IMSBC code) for the purpose of segregating different types of dangerous goods;
  - ✓ If dangerous goods in bulk and IMDG to be carried, refer the table “Segregation between bulk materials possessing chemical hazards and dangerous goods in package form” (in section 9.3.3 of the IMSBC code) for segregation; and
  - ✓ Refer the “special requirements” (in section 9.3.2 of the IMSBC code) if it is applicable for the cargo.

- If the BCSN is not in the Appendix 1 of the IMSBC Code:
  - ✓ Master may accept cargoes, provided that[76]:
    - The shipper shall seek the acceptability of the cargo for shipment through the competent authority at the port of loading. After the assessment, if it present hazards similar to Group A or B, advice to sought from the competent authorities of the port of unloading and the flag state. The three competent authorities will set the preliminary suitable conditions for the safe carriage.
    - If no hazards found after the assessment by the competent authority at the port of loading, carriage of the cargo shall be authorized. This shall be notified to the competent authority at the port of discharge and the flag state.

- Refer the Appendix 2 of the BLU Code for a sample loading & unloading plan and worked examples.

Note: To become more competent, refer the IMSBC CODE, BLU Code and BLU Manual.

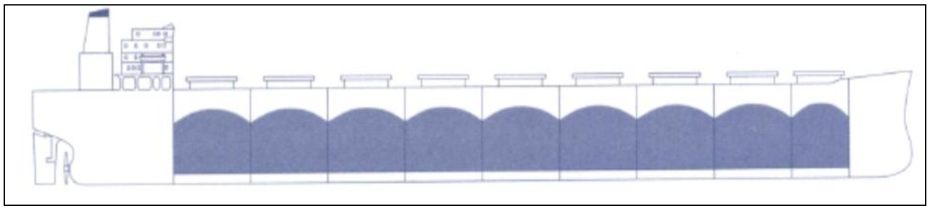
j) Selection of the holds[77]

Homogeneous hold loading

Distribution of cargo evenly in all cargo holds is known as homogeneous hold loading. This is a very common system in carrying low density cargoes such as grain, coal etc. Refer the diagram below:

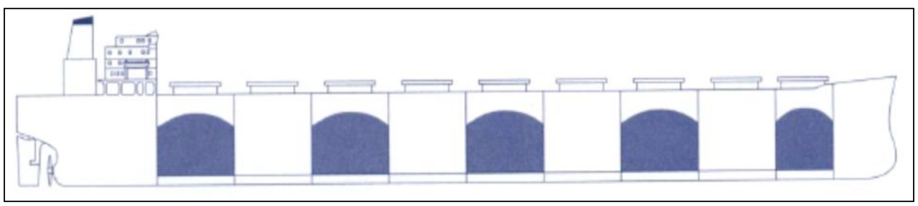
[76] IMSBC Code

[77] Bulk carriers - Guidance and Information on Bulk Cargo Loading and Discharging to Reduce the Likelihood of Over-stressing the Hull Structure, IACS, https://safety4sea.com/wp-content/uploads/2018/09/IACS-Guidance-on-Bulk-Cargo-loading-and-discharging-2018_07.pdf (Last visited 14/06/2026)



Alternate loading

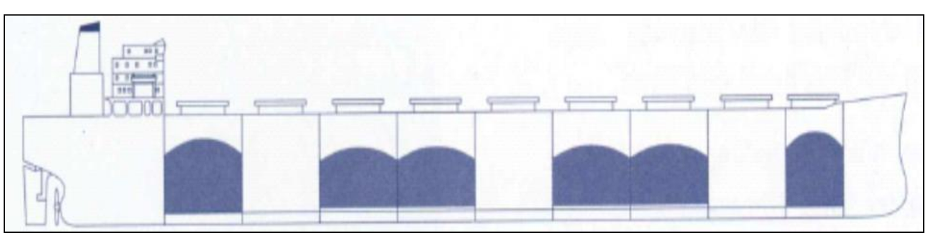
This method of loading is helpful in reducing the GM while carrying high density cargoes, because without loading small amounts of cargoes in every hold, same volume of cargoes can be loaded in alternate hold. **Class approval is required for alternate loading**. This is mostly used on large bulk carriers when carrying high density cargoes. Refer the diagram below:



Compiler's note - Remember you cannot change the sequence of approved alternate hold loading. As an example, if alternate hold loading is approved for cargo holds 1, 3, 5 and 7, you shall not use holds 2, 4 and 6.

Block hold loading and part loaded conditions

This method is also helpful to improve the GM, to a certain extent. This method is usually used when the ship is to be partly loaded. Refer the diagram below:



Part loaded and block hold loading conditions are not usually described in the ship's loading manual unless they are specially requested to be considered in the design of the ship.

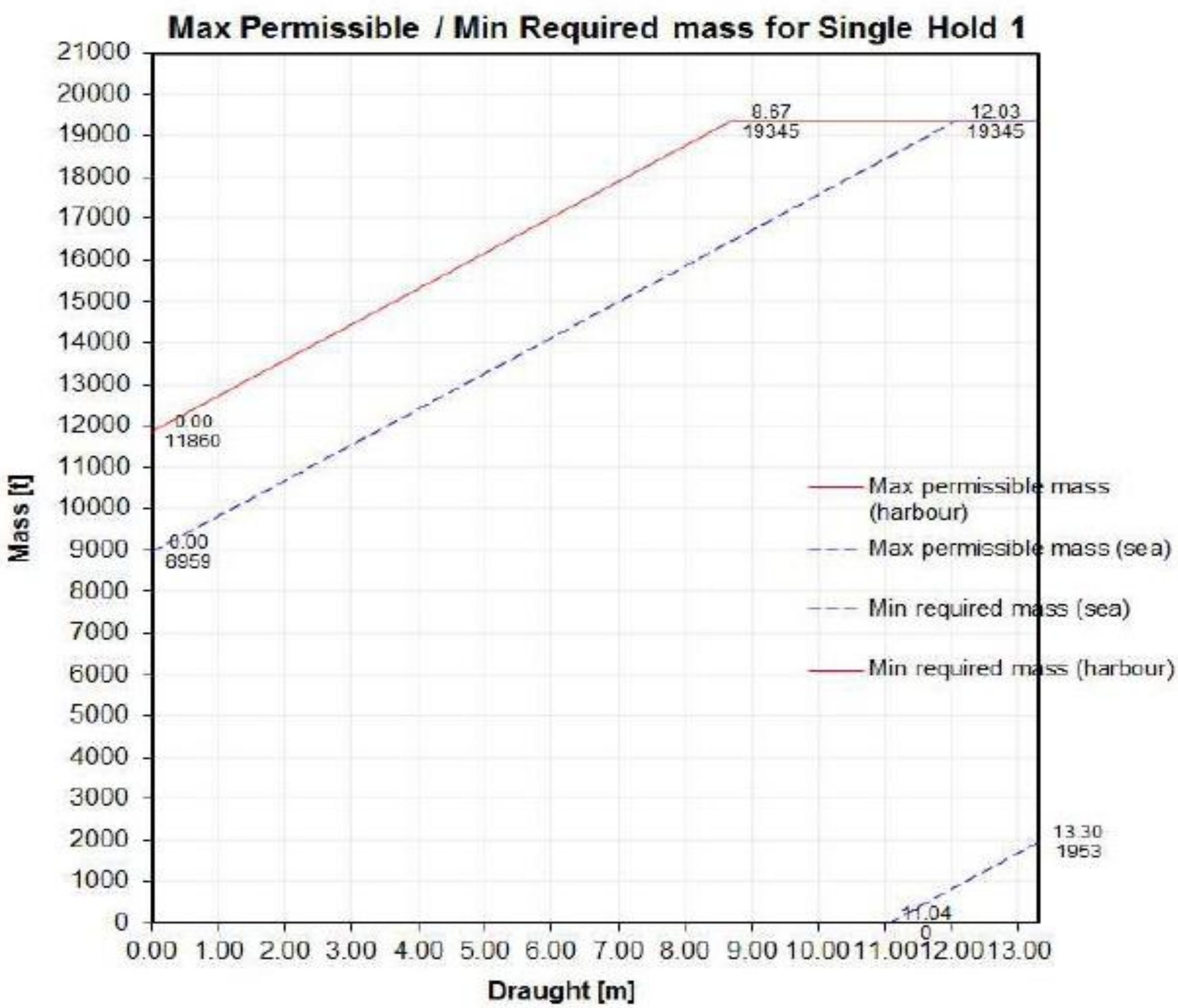
Allowable loading configurations in holds against the draught

To enhance safety and flexibility, all bulk carriers of 150 m in length and above are provided with local loading criteria which define the maximum allowable cargo weight in each cargo hold, and each pair of adjacent cargo holds (i.e. block hold loading condition), for various ship draught conditions. The local loading criteria is normally provided in tabular and diagrammatic form (hold mass curves).

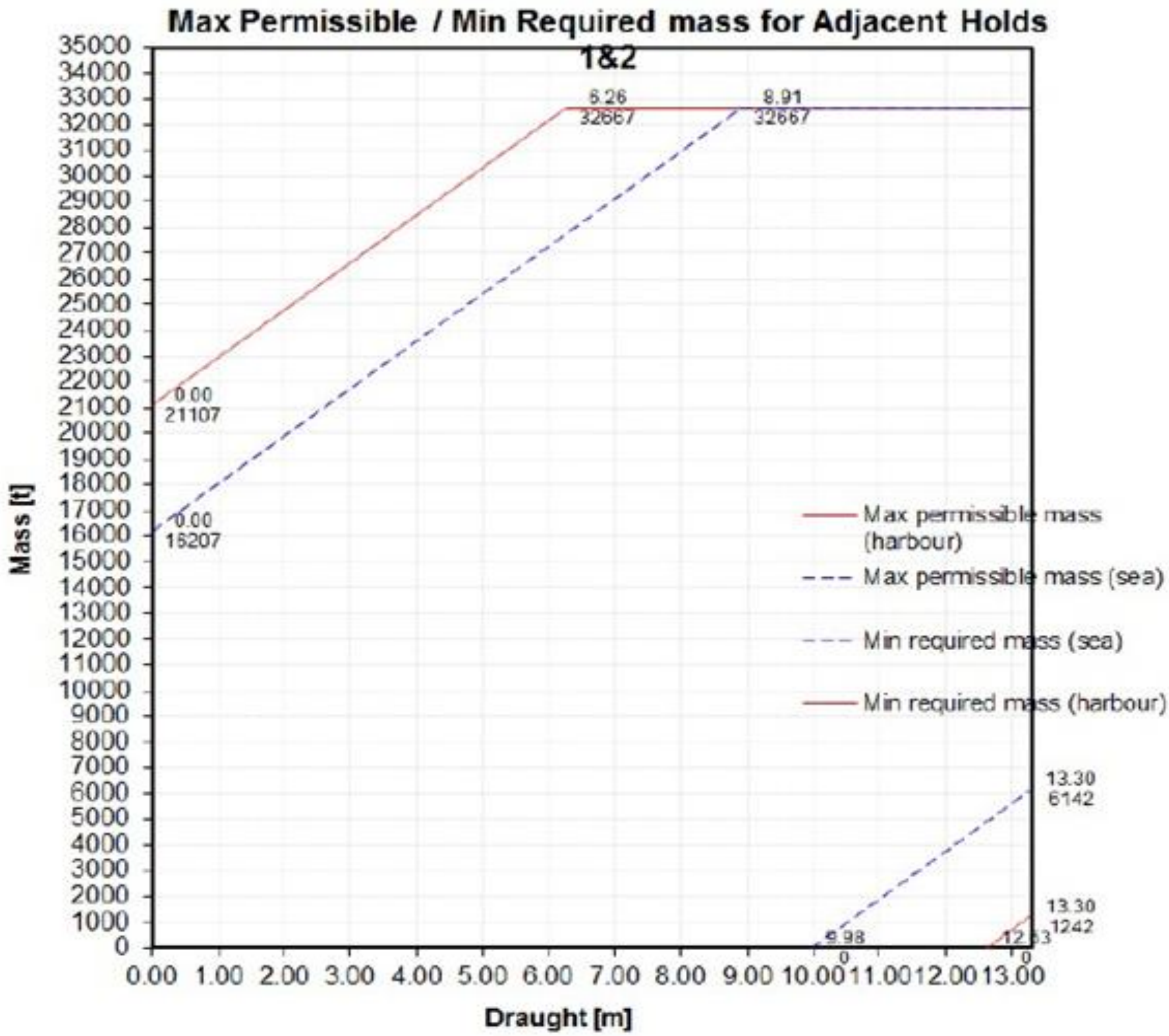
There are two sets of local loading criteria depending upon the cargo load distribution namely, **individual hold loading** or **two adjacent hold loading**.

In the case of **individual hold loading**, each cargo hold will have local loading criteria provided against the mean draught in way of the cargo hold(s). In the case of a single cargo hold, the ship draught at the mid-length of the hold should be used.

Refer the graph below for an example for an individual hold loading, which shows the maximum and minimum permissible weights that can be loaded in to hold number 1 against draft.



In the case of **two adjacent hold loading**, a vessel will be provided with local loading criteria for each pair of adjacent cargo holds against mean draught. With regards to **two adjacent hold loading,** mean draught is the average of the draught in the mid-length of each cargo hold. Refer the below graph for a sample two adjacent hold loading.



A hold and the adjacent holds shall not be loaded beyond the limits specified for the respective draught.

The above allowable cargo limits may include the weight of water ballast in the double bottom tanks and hopper tanks directly in way of the cargo hold. Therefore, if the water ballast also to be carried in such tanks the maximum cargo to be carried to be obtained by deducting the weight of water ballast to be carried.

Block hold or part loading shall be carried out only when:

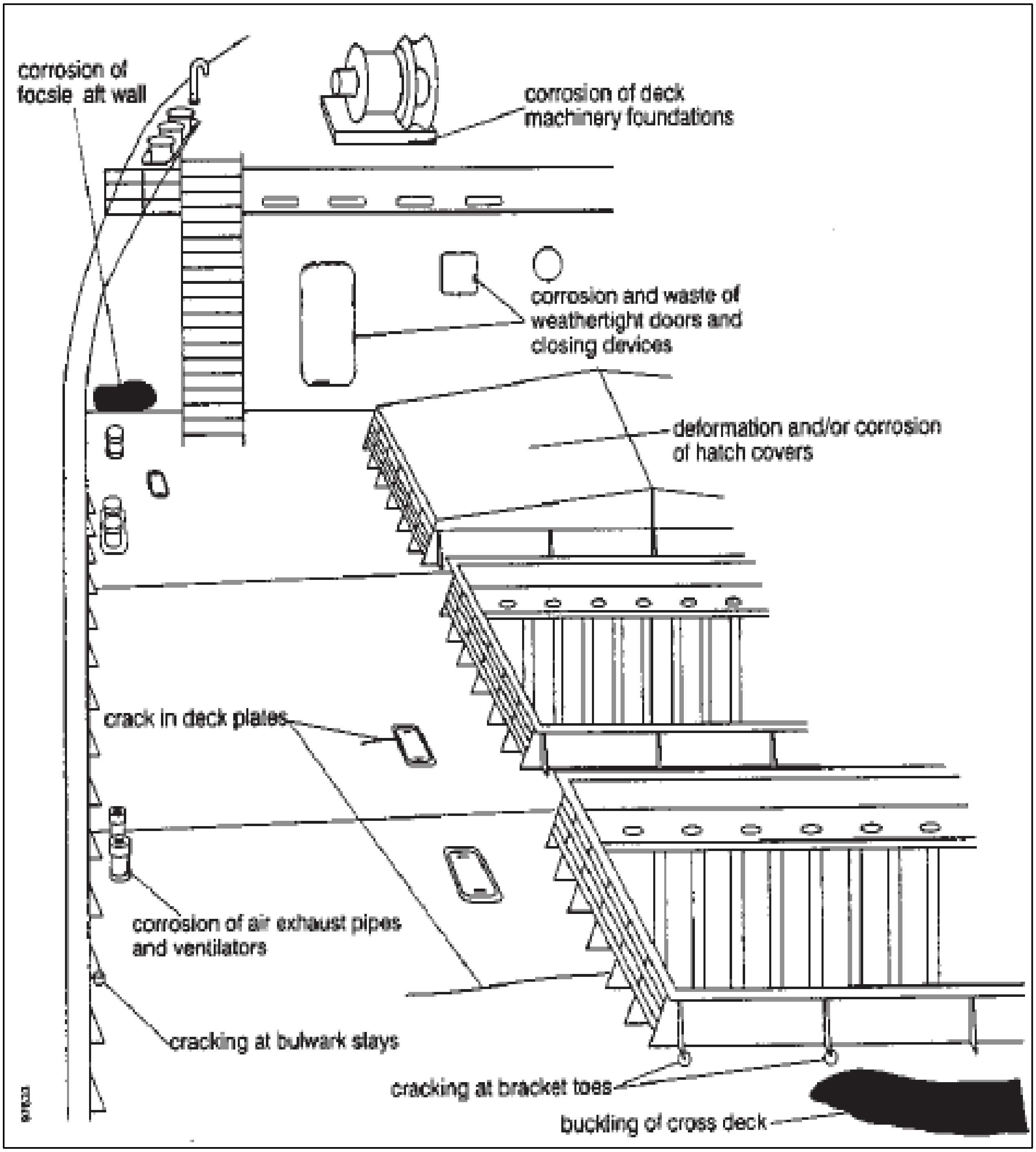
- The loading distributions are described in the ship's loading manual **OR**
- The ship is provided with a set of approved local loading criteria which define the maximum cargo weight limit as a function of ship's mean draught for each cargo hold and block of cargo hold(s). In this case, it is necessary to ensure that the amount of cargo carried in each hold satisfies the cargo weight and draught limits specified by the local loading criteria and the hull girder SWSF and SWBM values are within their permissible limits.

Finally, loading cargo in a shallow draught condition can impose high stresses in the double bottom, cross deck and transverse bulkhead structures if the cargo in the hold is not adequately supported by the buoyancy force. If applicable, the cargo weight limits for each cargo hold, and two adjacent cargo holds, as a function of draught, (the local loading criteria) are not to be exceeded.

k) Hold preparation (in general)

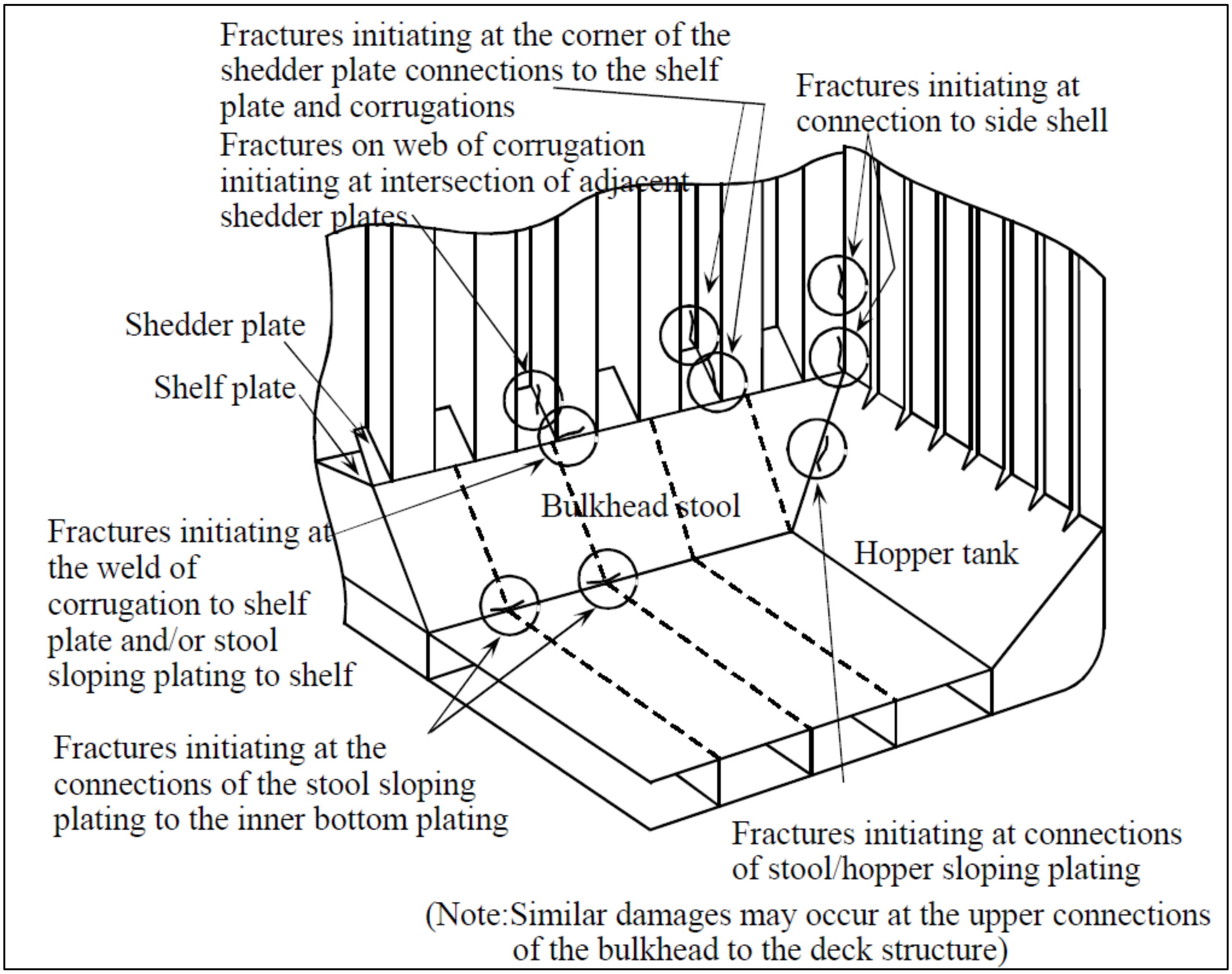
- Hatch covers to be in good condition including the rubber beadings;
- Hatch coamings to be cleaned;
- Make sure the drain valves at the hatch coamings are in order (hatches to be weather tight);
- Make sure the cleats are in order;
- Check the watertight integrity and easy opening of booby hatches to the holds;
- CO_2 systems (if fitted) must be working in order;
- Make sure the access ladders & the handrails are clean & safe for use;
- Holds to be clear of previous cargo residues and washed water;
- Check for grab, bulldozer damages and other damages caused due to corrosion and age of the vessel. The following two diagrams illustrate the most prone areas for damages on bulk carriers:

The deck areas[78]



[78] Refer MGN 107 (M), MCA, UK or the latest for further details

Under deck areas[79]



- If tank top manholes were opened for inspection purposes, ensure they are closed watertight;
- Ensure no damages on sounding pipes, vent pipes etc;
- If fixed lightings or wirings available in the holds, ensure that they are in order (these to be isolated before commence loading);
- Check the bilge wells, bilge covers, strum boxes, including non-return valves;
- Try out the bilge system;
- Ensure the bilge high water alarms are in order;
- Check for cracks;
- Clean the holds as required by the trade/charterparty;
- Holds to be totally dry including the bilges;

[79] IACS Guidelines for Surveys, Assessment and Repair of Hull Structure – Bulk Carriers, https://maritimeexpert.wordpress.com/wp-content/uploads/2016/08/iacs-guidelines-for-surveys-assessment-and.pdf (Last visited 14/06/2026)

- Holds to be odourless when carrying certain types of cargoes;
- No insects, bugs (dead or alive) etc. when carrying certain types of cargoes; and
- Cleaning requirements may vary according to the previous cargo. If coal, petcoke (petroleum coke) etc. are carried, detergents are required to clean the holds.

l) Use of lime wash (calcium hydroxide)

This is a type of a "prewash" which creates a barrier between the cargo and the vessel's steel structure. Therefore, this reduces cargo clinnage on bulkheads/tank tops, reduces corrosion and also makes the cargo hold cleaning easy after discharging.

Lime wash is frequently used when loading bulk salt and sulphur to reduce corrosion effects. This is not transparent and little difficult to remove after discharging the cargo. Better the paint condition of the hold, less lime is required.

This will not eliminate the corrosion totally. It will only delay the corrosion. Therefore, if the bare metal is exposed, paint them first. The lime wash act as a physical barrier between the cargo and the ship's structure and also it acts as an acid neutralising agent. If the cargo has acidic elements this neutralising effect will decay the lime wash, which may cause the cargo to touch the bare metal after a certain period. One layer of lime wash will remain for about 30 days. Ensure the applied lime wash is totally dry before loading the cargo. Lime wash can be prepared by adding the following into a 200 litre drum & mix it well:

- 50/75 Kg of lime
- 2.5 Kg of sugar
- Warm fresh water

A lime wash may be applied by a roller brush or spray gun and bare metal should not be visible after applying. Apply a second coat if required.

Need to use high pressured water and caustic or citric acid cleaning chemicals to remove lime wash after discharging the cargo.

m) How to prepare stowage plan and a loading plan on a bulk carrier

'Stowage plan' means a plan showing the final loaded condition of a vessel. 'Loading plan' or a 'loading sequence plan' means a plan which shows intermediate steps of loading.

In case of loading, chief officer must complete the stowage plan first. This is to be completed by spreading the expected amount of cargo to be loaded, between the cargo holds. A chief officer may have to shuffle the cargo between holds few times until the following conditions are complied with:

- Complied with the stability criterion;
- GM_f is within the comfortable range (not stiff and not tender);
- Required draughts attained and upright;
- Load density is not exceeded;
- The estimated final weight of cargo can be accommodated in the respective holds after considering the stowage factor & load density; and
- SF and BM are within the safe limits for the 'Sea' condition.

Ensure the above criteria also complies with, at the time of arrival at the port of destination and also at any other critical stages of the voyage by adjusting the bunker, fresh water and other consumables as appropriate to the respective stages of the voyage. If so, the stowage plan can be finalized.

After preparing the stowage plan, the chief officer has to make a loading plan along with a de-ballasting sequence plan. Calculate the amount of cargo to be loaded in each hold and the amount of ballast to be discharged from the tanks for each pour number. At the end of each pour number, make sure that:

- Has a sufficiently positive fluid GM;
- SF and BM are within the safe limits for 'Harbour' condition; and
- Vessel is upright.

The loading plan is very important to ensure the vessel is not over stressed at any stage during the loading operation. In case of discharging operation, needs to have a 'discharging plan' to ensure the vessel is not over stressed at any stage of the discharging process. A cargo loading/discharging plan may have:

- Amount of cargo to be loaded/discharged at each stage along with the hold number. This is called as 'Pour'. The exact definition of 'Pour' is the quantity of cargo poured through one hatch opening as one step in the loading plan, i.e. from the time the spout is positioned over a hatch opening until it is moved to another hatch opening (in the stability computers used on board bulk carriers, amount of cargoes to be loaded or discharged can be calculated by using pour numbers.);
- Amount of ballast to be taken in or pumped out along with corresponding tank numbers;
- Ship's draughts and trim at the end of each stage;
- Calculated values of SF and BM at the end of each stage;

- Estimated time for completion of each stage of the cargo operation;
- Expected rate of loading/discharging and de-ballasting/ballasting;
- Time periods required to stop cargo operations for the purpose of completing ballasting or de-ballasting when cargo handling and the ballast water handling rates are not equal.
- Stoppages for trimming and draught surveys; and
- Bunkering (if applicable).

Refer the samples of loading and unloading plans shown below[80]

[80] IMO, IMSBC Code

Example Loading/~~Unloading~~ Plan

The loading or unloading plan should be prepared in a form such as shown below.
A different form may be used provided it contains the essential information enclosed in the heavy line box.

LOADING OR ~~UNLOADING~~ PLAN Version No. 1	Date 96-03-24	Vessel BARBICAN	Voyage No. 044
Load/~~Unload~~ Port BOCA GRANDE	Cargo(es) IRON ORE	Assumed stowage factor of cargo(es) FINES 14 cft/t, LUMP 14 cft/t; Ballast pumping rate 4000 t/hr; Dock water density 1.025; Max draught available (HW) 17.88 m	Max air draught in berth N/A
To/~~From~~ Port JAPAN F.O.	Last cargo IRON ORE & COAL	No. of loaders/~~dischargers~~ 1; Load/~~discharge~~ rate 4500 t/hr; Min draught available (LW) 9.42 m	Max sailing/~~arrival~~ draught 17.88 m

	11	10	9	8	7	6	5	4	3	2	1
Tonnes			14756	17000	17382	16382	16382	16900	15382	15766	13050
Grade			FINES	LUMP	LUMP	LUMP	LUMP	FINES	LUMP	LUMP	FINES

Totals: Grade: FINES = 44706 Tonnes; Grade: LUMP = 98294 Tonnes; Grade: Tonnes; Total: 143000 Tonnes

Pour No.	Cargo Hold No.	Cargo Tonnes	Ballast operations	Time required (hours)	Comments	Calculated values Draught Fwd	Draught Aft	Maximum BM*	Maximum SF*	Air draught	Draught mid	Trim	Observed Values Draught Fwd	Aft	Mid
1	4	10000	GO 1&3 UWT's	2.22	FINES	9.99	10.77	73	49		10.38	0.78			
2	1	7000	GO Upper Fore Peak PO 2 hold	1.56	FINES changeover 2 Hold	10.14	10.48	66	53		10.31	0.34			
3	9	8000	GO 5 UWT's PO Aft peak	1.78	FINES	9.42	12.15	63	59		10.79	2.73			
4	4	6900	PO 1DB's	1.53	FINES	10.12	12.50	80	43		11.31	2.38			
5	9	6756	PO 5DB's	1.50	FINES	9.56	13.74	80	45		11.65	4.18			
6	1	6050	PO Lower FP GO 2 UWT's	1.36	FINES	9.61	13.57	75	49		11.59	3.96			
					Change grade to LUMP										
7	7	10000	GO 6 Hold to 50%	2.22	LUMP	8.94	14.38	-58	55		11.66	5.43			
8	5	10000	PO 6 Hold	2.22	LUMP	9.63	13.63	-67	49		11.63	4.00			
9	7	7382	Educt 6 Hold	1.64	LUMP changeover 6 Hold	9.57	15.24	-64	47		12.41	5.67			
10	3	10000	PO 2&3 DB's	2.22	LUMP	10.41	14.65	-49	38		12.53	4.24			
11	8	10000	GO 4 UWT's	2.22	LUMP	9.58	16.66	-50	43		13.12	7.08			
12	5	6382	PO 4 DB's	1.42	LUMP	10.28	16.24	58	37		13.26	5.96			
13	8	6000	Educt as required	1.33	LUMP	9.90	17.88	53	38		13.89	7.98			
14	2	8000	Educt as required	1.78	LUMP	12.51	16.68	-65	46		14.60	4.17			
15	6	9000	Educt as required	2.00	LUMP	13.14	17.80	42	-21		15.47	4.66			
16	2	6000	Educt as required	1.33	LUMP	15.06	16.98	33	-14		16.02	1.92			
17	6	7382	Educt ballast lines	1.64	LUMP	15.59	17.88	48	-30		16.74	2.29			
18	3	5382	Shut down ballast	1.20	LUMP	16.95	17.54	44	-27		17.02	0.59			
					Trim check										
19	8	1000		0.22	LUMP	16.94	17.72	49	-30		17.33	0.79			
20	2	1766		0.39	LUMP	17.51	17.51	46	-27		17.51	0.00			
			DRAUGHT SURVEY		SEAGOING CONDITION	17.51	17.51	62	-36		17.51	0.00			
	TOTAL	143000													

Signed Terminal *Goldstein*

Signed Ship *A. Smith*

NO DEVIATION FROM ABOVE PLAN WITHOUT PRIOR APPROVAL OF CHIEF MATE
Pours to be numbered 1A, 1B, 2A, 2B, etc when using two loaders
Abbreviations: PI – Pump In GI – Gravitate In F – Full PO – Pump Out GO – Gravitate Out MT – Empty
All entries within the box must be completed as far as possible. The entries outside the box are optional.

*Bending moments (BM) & shear forces (SF) are to be expressed as a percentage of maximum permitted in-port values for intermediate stages, and of maximum permitted at-sea values for the final stage. Every step in the loading/unloading plan must remain within the allowable limits for hull girder shear forces, bending moments and tonnage per hold, where applicable. Loading/unloading operations may have to be paused to allow for ballasting/deballasting in order to keep actual values within limits.

Example ~~Loading~~/Unloading Plan

The loading or unloading plan should be prepared in a form such as shown below.
A different form may be used provided it contains the essential information enclosed in the heavy line box.

~~LOADING OR~~ UNLOADING PLAN Version No. 1	Date 96-05-15	Vessel BARBICAN			Voyage No. 044
~~Load~~/Unload Port CHIBA	Cargo(es) IRON ORE	Assumed stowage factor of cargo(es) FINES 16 cft/t LUMP 16 cft/t	Ballast pumping rate 6000 t/hr	Dock water density 1.025	Max draught available (HW) 17.35m
~~To~~/from Port BOCA GRANDE	Last cargo IRON ORE & COAL	No. of ~~loaders/~~ dischargers 2	~~Load/~~ discharge rate 1250 t/hr per grab	Min draught available (LW) 7.59m	Max air draught in berth 60m; Max ~~sailing~~/ arrival draught 17m

Hold	11	10	9	8	7	6	5	4	3	2	1
Tonnes			14756	16910	17382	16382	16382	16900	15382	15470	13050
Grade			FINES	LUMP	LUMP	LUMP	LUMP	FINES	LUMP	LUMP	FINES

Totals: Grade: FINES = 44706 Tonnes   Grade: LUMP = 97908 Tonnes   Grade: ——— Tonnes   Total 142614 Tonnes

Pour No.	Cargo: Hold No.	Cargo: Tonnes	Ballast operations	Time required (hours)	Comments	Calculated values: Draught Fwd	Draught Aft	Maximum BM*	Maximum SF*	Air draught	Draught mid	Trim	Observed Values: Draught Fwd	Aft	Mid
1A	2	15470	GI 1&2 DB's PI 2UWT's	13.2	LUMP 2&6 Holds MT	13.82	16.29	-72	48			2.47			
1B	6	16382													
2A	5	10000	GI 4DB's PI 4 UWT's	8.0	LUMP	13.44	14.54	71	56			1.10			
2B	8	10000													
3A	3	9000	GI 3DB's	7.2	LUMP	12.19	13.68	77	78			1.49			
3B	7	9000													
4A	5	6382	GI 5DB's	5.5	LUMP 5&8 Holds MT	12.67	15.22	68	38			2.55			
4B	8	6910	PI 6Hold to 0.5m ullage												
5A	3	6382		6.7	LUMP 3&7 Holds MT	11.05	13.96	-91	59			2.89			
5B	7	8382													
			Draught survey and change grade to FINES												
6A	1	6000	PI 1&5 UWT's	4.8	FINES	9.75	14.01	83	42			4.26			
6B	9	6000													
7A	4	8756		7.0	FINES	9.38	10.64	80	52			1.26			
7B	9	8756													
8A	1	7050	GI & PI Lower Forepeak	6.5	FINES	7.59	11.30	84	-82			3.71			
8B	4	8164	PI Upper Forepeak & 3UWT's												
					SEAGOING CONDITION	7.59	11.30	84	-82			3.31			
	TOTAL	142614													

Instructions ① Please empty No.6 Hold and leave as clean as possible. This will then be used for ballast during stage 4.
② Grab and bulldozer blades must not be allowed to strike the ship's structure. Please instruct drivers to take special care.
③ Please note there are bilge and edutor plates in the after corners of each hold. Care required in these areas.
④ All damage to be reported. Holds to be surveyed on cargo completion.

Signed Terminal [signature]

Signed Ship A.Smith

NO DEVIATION FROM ABOVE PLAN WITHOUT PRIOR APPROVAL OF CHIEF MATE
Pours to be numbered 1A, 1B, 2A, 2B, etc when using two loaders
Abbreviations: PI = Pump In GI = Gravitate In F = Full PO = Pump Out GO = Gravitate Out MT = Empty
All entries within the box must be completed as far as possible. The entries outside the box are optional.

*Bending moments (BM) & shear forces (SF) are to be expressed as a percentage of maximum permitted in-port values for intermediate stages, and of maximum permitted at-sea values for the final stage. Every step in the loading/unloading plan must remain within the allowable limits for hull girder shear forces, bending moments and tonnage per hold, where applicable. Loading/unloading operations may have to be paused to allow for ballasting/deballasting in order to keep actual values within limits.

While making a loading plan also, the chief mate will have to shuffle the amounts of cargoes to be loaded and amounts of ballast to be de-ballasted few times during each pour to ensure the vessel is stable.

Bulk carriers are provided with 'loading & discharging sequences manuals' which includes amount of cargoes to load, amount of ballast water to be discharged, estimated draughts at the end of each pour for couple of loading conditions. Select a loading condition similar to your cargo weight to be loaded & apply similar stages for each pour.

In the case of discharging cargo, need to have a discharging plan along with a ballasting sequence plan. Same as during loading, the chief officer has to ensure the vessel is stable at the end of each pour number.

A former loading plan or a discharging plan may be used as a guidance in making a loading or a discharging plan but ensure that the vessel is stable at the end of each pour number. The best option is to refer the loading & discharging sequences manual, select sequence similar to the required loading / discharging amount at present, prepare a loading or discharging sequence plan manually and input the figures into the stability computer to ensure everything is in order.

n) Carriage of ballast in bulk carriers

Bulk carriers are required to have ballast water in **ballast tanks only** during the ballast passages to ensure a better fuel efficiency, propeller immersion, maintain a proper visibility from the bridge, maintain stability and stresses. This is known as **light ballast condition**.

Sometimes, ships may require carrying ballast water in **cargo holds** in addition to the ballast water tanks during a ballast passage. This is usually known as **heavy ballast condition** and used when bad weather is expected or when required to reduce the air draught. Usually this is achieved by filling the centre most cargo hold. You need to refer the **loading conditions** provided in the ship's stability book as well as the ship's ballast water management manual to identify the cargo hold that is allowed to ballast and also to see whether the cargo hold to be ballasted fully or partly.

No ballast water to be taken to cargo holds unless allowed by the loading manual.

Sailing with partially filled **ballast holds** shall be avoided unless the approved loading manual allows such practices. Cargo holds which are designed for taking ballast partially in harbours for the purpose of reducing the ship's air draught are not to contain any water ballast while at sea.

Where a ship has been specially designed for partially filled ballast tanks and/or hold(s) whilst at sea, the filling levels specified in the ship's loading manual are to be followed.

Ballasting procedure of a **cargo hold (taking heavy ballast)** depends upon the system onboard the vessel, but generally the below procedure to be followed:

- Make sure the vessel complies with the stability criteria and the stresses are withing limits;
- Ensure the cargo hold is sufficiently clean and no cargo residues which may block the de-ballasting lines while de-ballasting;
- Open the ventilators of the cargo hold;
- Bilge suction to be sealed to avoid accidental water leaking through the bilge line;
- Open the cover plate of the filling line in the cargo hold;
- Seal the CO_2 line to the hold (if available);
- Open the pad lock used in securing the ballast valve in the engine room. This valve is kept sealed in the closed position by means of a pad lock during the loaded passage to avoid accidental opening of the line;
- Once the pipelines are set, the ballast pump can be started; and
- Adhere to the ship's ballast water management plan.

9) Hazards and safety precautions to be observed when carrying certain types of solid bulk cargoes

a) Carriage of GRAIN cargoes

Grain cargoes include non-cohesive bulk cargoes having an angle of repose less than or equal to 30^0. Therefore, the grain cargoes are liable to shift during the carriage making the vessel unstable. Whether the holds are partly full or 100% full, if the vessel is complying with the grain stability criteria provided in the ship's loading manual or stability book no physical methods are required to avoid shift of grain. Below mentioned methods may be used to avoid shift of grain if the vessel is not complying with the grain stability criteria provided.

Methods available to reduce the shift of grain in filled compartments

- By means of longitudinal subdivisions;

- Using saucers; and
- The wings & ends of the compartments are to be tightly stowed with bagged grain.

Methods available to reduce the shift of grain in partially filled compartments

- By means of longitudinal subdivisions;
- Over stow with bagged grain;
- Use of saucers;
- Bundling; and
- By covering the surface of grain with a tarpaulin and a timber platform, then secure with lashings.

b) Carriage of COAL

- The dangers involved with coal includes:
  - ✓ Some types of coals emit methane in considerable amounts;
  - ✓ Some types of coals are liable to spontaneous heating;
  - ✓ Some types of coals are liable for spontaneous heating as well as emission of methane;
  - ✓ Some types of coals contain sulphuric acid ("Pond-Coal");
  - ✓ Cargo liquefaction ("fine-particle coal" and "coal slurry"); and
  - ✓ Some types of coal emit carbon monoxide.

- Don't use mechanical blowers as it may create sparks;
- Natural ventilation is recommended and never carryout through ventilation;
- As per the IMSBC Code, ventilate continuously for 24 hrs after departure from port. It should be stopped when the methane concentration is considerably law. In fine weather conditions hatches could be left open, but don't open at once, as the sudden ingress of oxygen may lead to dangerous situations;
- If methane is mixed in a proportion of 5% - 16% by volume with air, it constitutes an explosive atmosphere which may be ignited by a spark. Therefore, surface ventilation must be carried out, if the methane concentration is closer to the above limit;
- While loading, arrange means to take the temperatures during the passage;
- The electrical cabling in cargo and adjacent spaces to be free from defects;
- If the temperature exceeds 55º C and is rising rapidly, seal ventilation, start boundary cooling and seek for expert advice. Do not use water directly on the cargo. Consider about diverting the vessel to a port of refuge;

- Check the pH value of hold bilges before pumping out. If it is acidic, it will increase corrosion;
  - ✓ pH is a scale in which water is neutral, with a property of 7. A pH of less than 7 indicates acidity – sulphuric acid has a pH of between 2 and 3 – while base solutions have a pH of more than 7. The easiest way to measure the pH of hold bilge water is to use pH paper (also called litmus paper), supplied in bundles of 50s and 100s. Acids will turn blue litmus paper red, while bases will turn red litmus blue[81].
- Since methane is lighter than normal air, it may leak into adjacent places and adjoining tanks. Therefore, check the gas levels before entering into adjacent spaces around the cargo holds;
- Some types of coal are shipped in wet condition (coal slurry), will turn out about 3% less than in weight. Therefore, records of bilge pumping should be kept, and B/L's should be claused adequately protect against claims for short delivery;
- Ensure no smoking in unauthorized areas; and
- Trim the cargo.

c) Carriage of CONCENTRATES

Concentrates are usually in small granular or powder form. Generally, concentrates are very dense and may be liable to act as a liquid but remember that different types of concentrates may behave differently. There are different types of concentrates such as iron ore concentrates, copper concentrates, zinc concentrates etc.

- Usually powdery in form and liable to have a high moisture content;
- Under certain conditions, have a tendency to behave almost like a liquid;
- Sometimes appear to be in a relatively dry condition when loading, but at the same time, contain sufficient moisture to act as a fluid due to the movement and vibration of the vessel;
- If the moisture content is above the TML cargo may shift as a result of liquefaction. Cargo may flow to one side of the hold with one roll but not flow fully back with the next roll, thus increasing a list and this may lead to capsizing of the vessel;
- As this is a powdery material, it may affect the people engage on deck work and also the deck machinery;
- Ensure to cover all the deck machinery, provide face masks to the deck watch keepers. Most probably the ship's AC has to be put on recirculation mode; and
- If the concentrate is a high-density cargo:

[81] https://rightship.com/resources/insights/a-guide-to-dry-bulk-operations-monitoring-loaded-voyage-cargo (Last visited 21/08/2026)

- ✓ consider about alternate loading system, to avoid higher GMs. Make sure to follow the instructions given in the loading manuals if doing so;
- ✓ trim level to avoid structural damages and cargo shifts during passage; and
- ✓ start at a slow loading rate and avoid higher free fall to avoid localized impacts.

d) Carriage of cargoes that may LIQUEFY OR DYNAMICALLY SEPARATED

- Do not ship any cargoes with moisture contents above TML;
- No cargo containing liquids to be stowed in the same space, except canned foods;
- Avoid ingress of fresh water;
- Do not use water to cool the cargo but if unavoidable use a spray;
- All cargoes liable to liquefy should be trimmed level on completion of loading;
- The cargo should be properly sampled, and a copy of the results should be kept on board;
- Refer the IMSBC code for details of sampling procedures;
- If the master doubts about the condition of the cargo for safe carriage, refer the IMSBC Code for details of approximate tests which can be carried out on board the vessel; and
- May have to use shifting boards.

e) Carriage of SULPHUR cargoes

There are two types of sulphur having completely different characteristics. The first type (Group C, as categorised in IMSBC) is not considered as hazardous, no corrosion effects and not dangerous for human tissue or vessel. But the other type (Group B, as categorised in IMSBC) is flammable; and liable for dust explosions during loading/discharging and hold cleaning. This Group B sulphur is toxic, very irritating and emit suffocating gas when involved in a fire. They (Group B sulphur) shall not be transported in bulk when in fine grain form. Refer the IMSBC Code for further details. In general, following precautions shall be taken:

- Emits small volumes of hydrogen sulphide, therefore, need to follow entry in to enclose space procedures;
- May emit SO_2 if exposed to heat;
- Dry sulphur is not corrosive. But the wet sulphur is corrosive;
- Fire might occur due to static electricity generated on loading pipes. These fires can be extinguished by using sulphur itself and or freshwater spray;

- Since some countries consider the sulphur dust as an air pollutant, they use water spray over bulk sulphur while handling, to avoid releasing of sulphur dust into the atmosphere;
- Ensure the holds are thoroughly cleaned to maintain the purity of the cargo. Usually, need 'grain clean' standards. Washing with fresh water is required to achieve grain clean standards and also to remove salt, as the corrosive effect is higher with the presence of salt;
- Ensure the paint condition is sufficient to avoid corrosion;
- Lime wash if required;
- Cover the bilges with burlap to avoid bilges being choked;
- Check the bilges daily after loading and pump out if required. Maintain the records of the same;
- Clean and wash down the decks after the completion of cargo operations; and
- After discharging the cargo, clean the holds thoroughly and ensure no cargo residues in the holds.

f) Carriage of DIRECT REDUCED IRON (DRI, also known as sponge iron)

Direct reduction of iron is the removal of oxygen from iron ore, without melting in a furnace. In simple terms, DRI means concentrates of iron ore. DRI is a raw material used in the production of steel in electric arc furnaces, which form the majority of the steel production facilities. At present the industry has identified four types of DRI cargoes:

- DRI (A);
- DRI (B);
- DRI (C); and
- DRI (D)

The hazards and safety precautions vary with the type of the DRI to be loaded. The following provides safety precautions to be observed when carrying DRI in general. Refer the IMSBC code for further details.

- Dangers include:
  - ✓ Some types produce heat while oxidizing. This process will be faster when in wet condition, especially with sea water; and
  - ✓ Emits hydrogen when considerably heated.

- Prior to loading, the shipper shall provide the Master with a certificate issued by a competent person recognized by the national administration of the port of loading stating the cargo is suitable for shipment and that it conforms with the requirements of the IMSBC Code in terms of particle size, moisture content and temperature;

- The shipper shall provide comprehensive information on the cargo and safety procedures to be followed in the event of an emergency;
- Cargo shall not be accepted when it's temperature is in excess of 65°C, or its moisture content exceeds the permitted value, or if the quantity of fines exceeds the permitted value, where appropriate;
- Cargo holds to be well cleaned and dry, without salt and previous cargo residues;
- Combustible material to be removed from holds;
- No loading during precipitation;
- Cargo temperatures shall be monitored during loading and recorded;
- Cargo to be trimmed;
- Adjacent tanks other than double bottom tanks shall be kept empty (to avoid accidental water ingress);
- Safety precautions to be observed against dust;
- "NO SMOKING" signs shall be posted and no naked lights or other ignition sources permitted;
- Enclosed space entry procedures to be followed when entering into cargo spaces;
- Cargo temperatures and hydrogen concentrations in hold atmospheres shall be measured at regular intervals during the voyage;
- If the hydrogen concentration exceeds 1% or the cargo temperature exceeds 65°C, appropriate safety precautions shall be taken. If in doubt, expert advice shall be sought;
- Bilges to be checked and pumped out if found water;
- All records of temperature, hydrogen and oxygen measurements, where appropriate, are to be retained on board for 2 years; and
- The hydrogen concentration shall be measured in the holds prior to opening the hatch covers at the port of discharge.

g) Carriage of HIGH-DENSITY cargoes

In accordance with the IMSBC Code, a solid bulk cargo with a stowage factor of 0.56 m^3 t^{-1} or less is defined as a high-density solid bulk cargo, while chapter XII of SOLAS puts it more explicitly as solid bulk cargoes having a density of 1780 kg m^{-3} and above[82]. The general precautions that need to be taken while loading heavy density cargoes include:

[82] https://gard.no/en/insights/bulk-carrier-safety-be-aware-of-vessel-structural-limitations/ (Last visited 04/07/2026)

- Avoid high free falls;
- Terminal representatives shall be notified to inform the master when the individual grab loads are large, since there may be high, localised impact loads on the ship's structure until the tank top is completely covered by cargo, especially when high free-fall drops are permitted and special care is taken at the start of the loading operation in each cargo hold[83];
- Loading rates to be considered as it may damage the fittings in the cargo holds;
- Even though the angle of repose is higher than 35^0, trim the cargo to avoid concentrated weights in the holds;
- Distribute the cargo in the vessel properly (longitudinally and transversely) to avoid over stressing of the hull;
- Ensure the load densities are not exceeded;
- Do not make the vessel stiff (high GM). Refer to the loading manual and if it allows different cargo distributions such as alternate hold loading or block loading or any other options consider one of them which suits best to the vessel to maintain a safe GM; and
- Masters should be aware that tween decks can collapse even when overloading is marginal. There are no safety margins, and all cargo must be carefully trimmed. Where ships are fitted with twin hatchways (port and starboard), the cargo should be loaded in equal quantities on each side, unless there are specific instructions in shipyard plans that dictate otherwise[84].

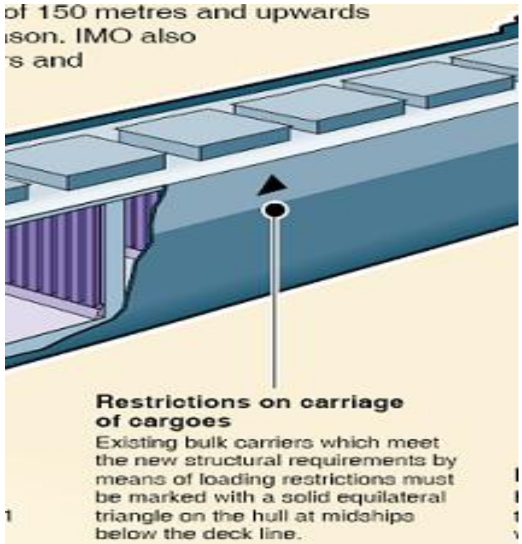
Loading restrictions when carrying high density cargoes

SOLAS regulation XII/8.3 requires a triangle to be marked on the side shell of the ship when compliance with regulation XII/6.2 involves imposition of loading/operating restrictions as described in regulation XII/6.3. Such operating restrictions only need to be imposed for solid bulk cargoes having a density of 1,780 kg/m^3 and above, and apply at all times when solid bulk cargoes having a density of 1,780 kg/m^3 and above are carried[85]. **This should be mark at midship on both sides 300 mm below the deck line**. Refer the figure below:

[83] MCA, Safe loading and unloading of bulk carriers 2003, https://assets.publishing.service.gov.uk/media/5ed0e02ed3bf7f4601e576a2/Safe_loading_and_unloading_of_bulk_carriers_-_Tagged.pdf (Last visited - 18/04/2026)

[84] UK P & I, Chapter 51 – Preparing cargo plans – Structural limitations, https://www.ukpandi.com/fileadmin/uploads/ukpandi/Documents/uk-p-i-club/carefully-to-carry/2023/UKPI_Carefully_to_Carry_2023_51.pdf (Last visited - 18/04/2026)

[85] Refer Resolution MSC.89(71) of IMO or the latest for further details



Restrictions on carriage of bulk cargoes[86]

Such a triangle shall be marked[87]:

- when a ship's deadweight is restricted, but the load line assignment permits deeper draughts, and operating restrictions in the form of draught or deadweight limits are imposed on the ship to obtain compliance with the requirements, the loading booklet is to clearly specify the operating restrictions and a triangle is to be permanently marked on the ship's sides.
- where restrictions, other than a general restriction to homogeneous loading, are imposed on the distribution of cargo in the two foremost cargo holds as a condition of compliance, then the loading booklet is to clearly specify the applicable operating restrictions and a triangle is to be permanently marked on the ship's sides.
- where a homogeneous distribution of cargo in the two foremost cargo holds is required as a condition of compliance, then the loading booklet is to clearly specify the applicable operating restrictions and a triangle is to be permanently marked on the ship's sides.

Such a triangle is not required to be marked[88]:

- when a ship's loading booklet restricts the ship to carry solid bulk cargoes having a density of **less** than 1,780 kg/m^3. **The loading booklet is to clearly specify that the**

[86] https://bulkcarrierguide.com/survival-and-safety.html (Last visited 01/08/2026)
[87] Ibid
[88] Refer Resolution MSC.89(71) of IMO or the latest for further details

ship is prohibited from carrying solid bulk cargoes having a density of 1,780 kg/m^3 and above.

- where restrictions are imposed on the maximum mass of packaged cargoes to be carried in the foremost cargo hold as a condition of compliance with the Standards for the evaluation of allowable hold loading of the foremost cargo hold, as contained in annex 2 to 1997 SOLAS Conference resolution 4, the loading booklet is to clearly state these limits, but the triangle marks are not required.

10) Carriage of TIMBER on deck

Carriage of timber cargoes under deck is not regulated by the Timber Deck Cargo Code. Therefore, when carrying timber underdeck, preparation of the holds, loading, lashing, carriage and discharging of cargoes shall be carried out in accordance with the requirements of the lashing manual, stability book, shipper's requirements and good seamanship.

Carriage of timber cargoes on deck is discussed below. Remember, the reduced stability criteria as stated in the Timber Deck Cargo Code can be applied when;

- the vessel is timber classed;
- carrying timber on deck;
- loaded in accordance with the Timber Code; and
- lashed in accordance with the Timber Code.

a) Information required

- Amount of deck cargo to be loaded;
- Type of timber cargo (such as swan wood or round wood or cant etc.);
- Dimensions of the cargo;
- Number of bundles (if in bundles);
- Stowage factor of the cargo;
- Density of timber;
- Friction factor (dry, wet and winter condition);
- Whether the timber is covered by plastic covers or not. If the timber is not covered with plastic, need to consider about the water absorption by the timber deck cargoes. If the timber deck cargoes are covered by plastic covers, no need to consider about the water absorption by the timber deck cargoes);
- If covered with plastic, type of cover of packages and whether non-slip type and the friction factor of the covers; and
- Racking stress (in case of carrying timber in packages).

b) Documents required

- Timber Deck Cargo Code;
- Documents related to above information from the shipper;
- Certificates for all lashing materials to be used;
- Cargo securing manual; and
- Timber load line requirements.

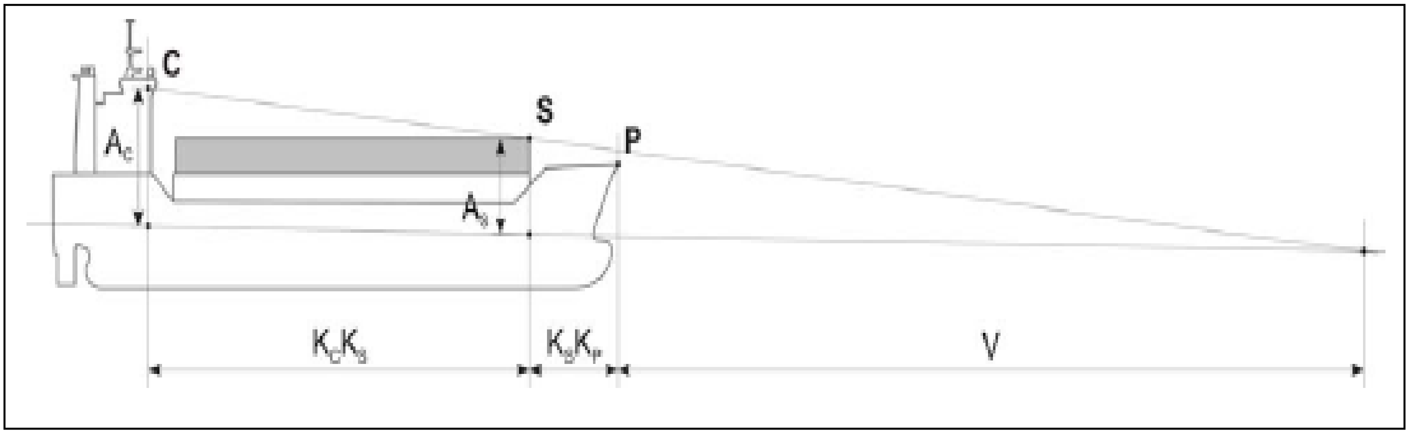
c) Safety precautions to be observed before, during & after cargo handling

Loading

- Refer the Timber Deck Cargo Code and the ship's cargo securing manual for technical instructions to be followed while loading, stowing and lashing the deck cargo;
- When calculating the stability, consider about the following:
  - ✓ Amount of water absorption by the deck cargoes;
  - ✓ Possibility of ice accretion;
  - ✓ Consumables during the voyage; and
  - ✓ The FSE at the time of loading and during the passage.

- Before the commencement of deck cargo loading, ensure to secure holds properly;
- Remove all objects on deck which are left in the areas where the cargo to be loaded. The loading area on deck should be firmed;
- Ensure to keep safe accesses for all ventilators, sounding pipes, safety equipment etc. and keep all emergency escapes free for immediate use;
- Minimize FSE;
- If any obstructions by lashing or securing points (not by the timber itself) to any escape routes, access to safety equipment or sounding pipes are unavoidable, they shall be clearly marked;
- Dunnage (if used) should be rough lumber, shall lay them in such a way to spread the load and not to accumulate water;
- The maximum height shall not affect the visibility requirements provided in SOLAS Chapter V, which states that the view of the sea surface from the conning position should not be obscured by more than two ship lengths, or 500 m, whichever is the less, forward of the bow to 10° on either side under all conditions of draught, trim and

deck cargo. Following formula can be used to calculate the visibility range from bridge[89];



$$V = \frac{K_C K_S \cdot A_S}{A_C - A_S} - K_S K_P$$

Where:

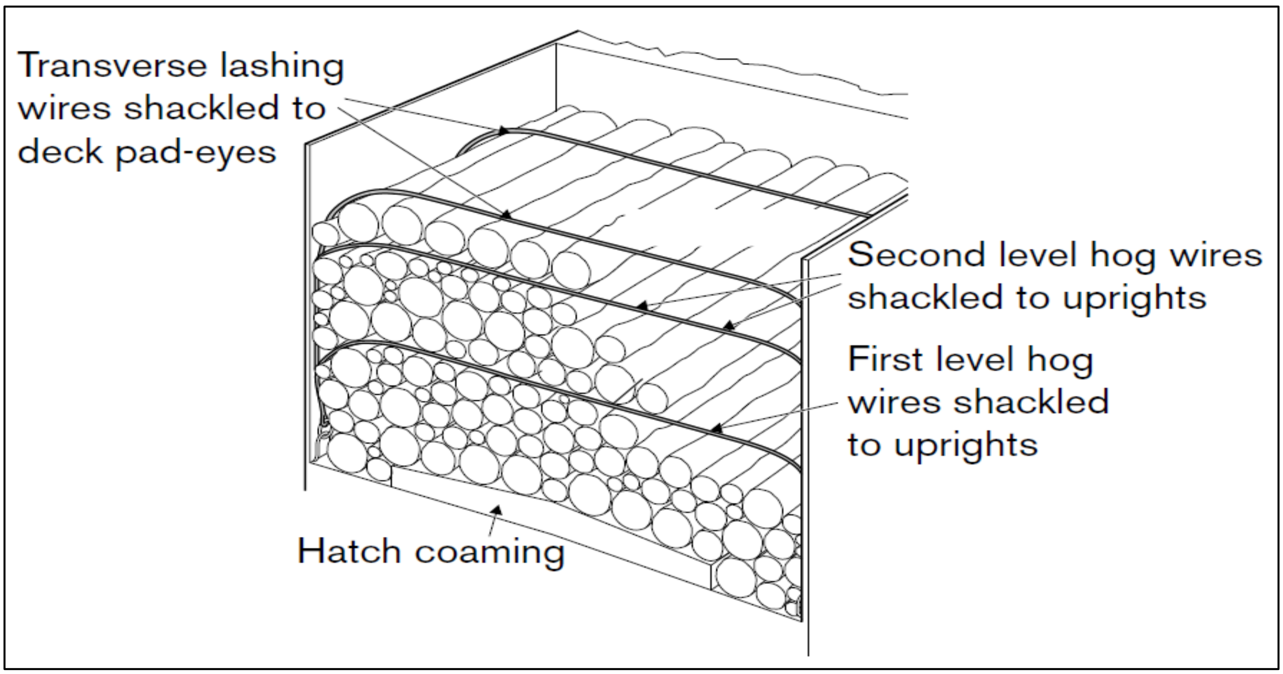
K_CK_S	*Horizontal distance from conning position to position 'S'*
K_SK_P	*Horizontal distance from position 'S' to position 'P'*
A_C	*Airdraft of conning position*
A_S	*Airdraft of position 'S'*

- If any list is encountered during loading operations, due to any unexplainable reasons, stop loading until the stability condition of the vessel is assessed;
- If there are reasonable grounds to believe that the weight provided by the shipper is incorrect, samples of the timber cargo should be weighed;
- Cargo shall be stowed compactly in such a way not to slacken the lashing;
- Damaged timber packages shall be rejected in case of loading packaged timber;
- In winter conditions, loading on layers of ice shall be avoided as the friction will be reduced;
- People working on cargoes stowed at heights of 2 m and above, within 1 m of an unguarded edge, if required shall wear safety harness with fall resistant device;
- Ensure safe access is available to the top of, and across, the cargo stow;
- Cargo shall not be loaded over hanging on the ship sides; and
- Preferably, the GM should not exceed 3% of the breadth of the vessel.

[89] Code of safe practice for ships carrying timber deck cargoes, 2011

Lashing

- Refer the Timber Deck Cargo Code and the ship's cargo securing manual for technical instructions to be followed while securing the deck cargo;
- All lashings and components used for securing shall comply with the criteria given in the Timber Deck Cargo Code;
- All lashing tightening devices shall comply with the criteria given in the Timber Deck Cargo Code;
- All lashing equipment should be visually checked in accordance with the cargo securing manual before use;
- Lashing gang should be informed about the lashing requirements;
- The specifications of uprights that are going to be used must comply with the ship's cargo securing manual;
- Use of uprights when carrying logs on deck is necessary and it is most important always to rig and attach hog wires between such uprights. The uprights' strength relies upon the weight of logs above the hog wires. This rule applies whenever hog wires are rigged, even with packaged timber. Never use uprights without rigging hog wires[90]. (refer to the diagram below);



Always rig hog wires when using the deck side uprights for logs, packages and loose timber[91]

[90] UK P & I, Carefully to carry, 2023, Chapter 14, Timber deck cargoes, https://maritimecyprus.com/wp-content/uploads/2025/01/UKPI_Carefully_to_Carry_2023_14_c.pdf (Last visited 20/06/2026)
[91] Ibid

- If any extra lashing points are to be used, they should be approved by the Administration; and
- Turnbuckles should have sufficient threads remaining to permit lashings to be tightened during the voyage as needed.

During the voyage

Apart from the normal activities such as sounding the tanks, checking lashing etc. following shall be checked:

- The rolling period of the ship should be regularly checked in order to establish that the metacentric height is still within the acceptable range;
- Since vibrations and working of the ship will cause the cargo to settle and compact, lashing should be retightened to produce the necessary pre-tension, as needed;
- Uprights should be checked for any damage or deformation;
- Supports for upright should be undamaged; and
- Corner protectors (this is used to prevent lashings from cutting into the cargo and to protect lashings from sharp corners) should still be in place.

DRY DOCKING AND IN WATER SURVEY

1) Docking interval

A vessel's outside of the bottom and the associated equipment are required to be inspected at least twice every 5 years during the validity period of the safety construction certificate. This means outside the bottom to be inspected every 30 months (2.5 years). But, in all cases the interval between any two such inspections not to exceed 36 months. An extension of inspection of the ship's bottom of 3 months beyond the due date can be granted in exceptional circumstances such as:

- unavailability of dry-docking facilities;
- unavailability of repair facilities;
- unavailability of essential materials, equipment or spare parts; and
- delays incurred by action taken to avoid severe weather conditions

The interval between examinations of the outside of the ship's bottom and related items for ships operating in fresh water and for certain harbour or non-self-propelled craft may be increased beyond the periods stated above with flag state approval.

2) In water survey (IWS)

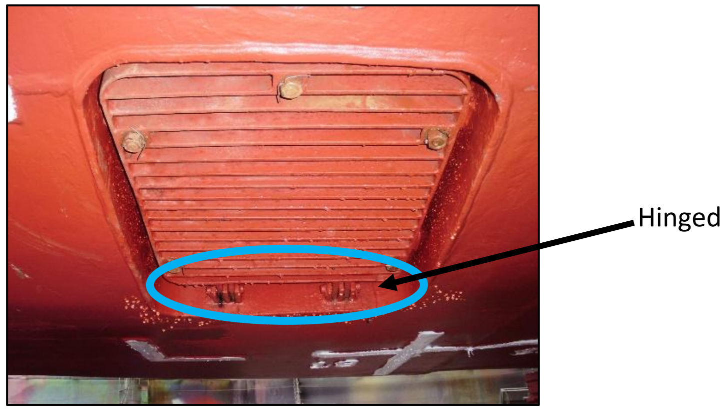
Under normal conditions the outside bottom of a cargo vessel is to be inspected twice every five years, at intervals of not exceeding 36 months. One of these inspections may be replaced by an IWS. But, if the IWS is not carried out for the satisfaction of the attending surveyor, the outside bottom must be inspected in a dry dock.

Ships of less than 15 years of age are allowed for IWS. Ships above 15 years of age may be allowed provided, agreed by the Flag and the ship's classification after special considerations. IWS is not allowed for tankers and bulk carriers of more than 15 years of age undergoing the Enhanced Survey Programme.

If a ship owner is expecting to comply with the IWS programme, he must take necessary steps to prepare his vessel for IWS, from her last dry dock itself. There are lot of areas to be considered in the dry dock, but only few are listed below to give you an idea:

- The cathodic protection system must be sufficient;
- Hull is properly de-rusted and good quality paint is applied;
- The colour of the underwater paint matters as well since a successful underwater inspection may not be possible with some colours;

- The hull should be permanently marked externally to indicate the positions of transverse primary members, transverse and longitudinal bulkheads or frame numbers;
- Special consideration is required for areas where the divers do not have accesses;
- Need to have arrangements to:
  - ✓ inspect sea chests (require having hinged gratings). Refer the figure below:



Sea chest

  - ✓ access to rudder bearings and determine the condition and clearance of the rudder bearings; and
  - ✓ access the seal assembly of the stern bearings of oil lubricated bearings to make sure they are intact and determine the clearance of wear down.

After the dry dock, following records are required to be maintained onboard if expecting for an IWS next time:

- A record of all suspected or actual hull damage and all contacts occurred between the last dry dock and the IWS;
- Oil usage for propeller shaft seals and thrusters to indicate the condition of the seals; and
- Records of regular oil analysis and temperature of bearings.

Before the IWS:

- The ship owner is required to make an application to the classification society of the vessel indicating the date and place of the expected IWS. This application must include the following as well:
  - ✓ Master's declaration of all suspected or actual hull damage and all contacts occurred between the last dry dock and the IWS;
  - ✓ Records of oil usage for propeller shaft seals and thrusters; and

- ✓ Records of regular oil analysis and temperature of bearings.

- If required, the hull should be cleaned before the IWS so that the actual condition of the hull can be inspected.

At the time of the IWS, the vessel shall be;
- at a suitable draught and trim;
- in ballast condition specially, for large vessels; and
- the rudder, propeller, and fittings may be above the water in ballast condition on large vessels and the trim of the ship should be arranged to give the best results for the survey.

Procedure of IWS
- A meeting to be arranged between all the parties to make a plan for the IWS;
- All safety precautions to be observed, such as locking of propellers, rudders & thrusters, stopping of all pumps etc.;
- Appropriate signals are displayed (flag – A);
- Ensure proper communications are established;
- A permit to work system is to be used for the safety of the diver(s); and
- Following areas will be inspected:
  - ✓ The above water part of the hull;
  - ✓ The actual and suspected contacted areas (as per the master's records) will be inspected from outside as well as from inside if it is accessible;
  - ✓ Propeller (cracks, pitting etc.) and "propeller stern shaft clearance" or "propeller wear down" or "stern bush clearance" to be Measured by using a poker gauge;
  - ✓ Under water shell coating;
  - ✓ Rudder, rudder "pintle clearance", rudder bearings and bearing clearances (jumping clearance); and
  - ✓ Sea chests and their arrangements.

3) Extended dry docking (EDD)

The above-mentioned dry-docking intervals may be extended till 7.5 years if a vessel is qualified for the EED. That means, when a vessel is delivered, the first two bottom inspections (at 2.5-year intervals) have to be carried out in the form of an In-water survey. The first dry docking will be when the age of the vessel is 7.5 years. Again, next two bottom inspections have to be carried out by means of In-water surveys at 10 years and 12.5 years. The second dry docking will be at the age of 15 years. The EDD is not applicable after the age of 15 years. Even the existing vessels can join EDD till the age of 10 years, but it will be terminated when she reaches 15 years of age.

Vessels which are expecting to enter EDD are subjected to classification society requirements and flag state regulations. Among other things, following shall be considered for new buildings, to be eligible for EDD:

- A Planned Maintenance Scheme for Hull and Machinery shall be implemented;
- Dry film thickness of primer coating shall be sufficient for 7.5 years;
- Anodes (alu/zinc) shall be sufficient for 7.5 years or impressed current system is to be installed and maintained;
- Ballast water tanks shall have a corrosion prevention system with "Good" coating condition; and
- The vessel's Flag State authority has to approve the EDD programme.

Certain types of vessels such as passenger ships, ships subjected to enhanced survey program (ESP) etc. are not qualified to follow the EDD programme.

EDD programme will be terminated when:

- A vessel reaches 15 years of age or
- Ship's owner or the management is changed or
- Administration is changed or
- If the class or the flag decides that the conditions for maintaining the EDD scheme are not complied with.

4) Documents required for dry docking

- Docking plan;
- Plug plan (may be combined with the docking plan);
- Shell expansion plan;
- Midship section plan;
- General arrangement plan;
- Tank arrangement plan;
- Gas free certificate (for tankers only);
- Cargo plan (if docking with cargo);
- Repair list;
- Rigging plan; and
- Capacity plan.

5) Duties of a chief officer when dry docking

Well before entering:

- Arrange meetings with the heads of the departments and prepare the repair list. Make sure no repairs are overlapped with engine department;
- Send the required documents to the dock/superintendent (as per SOLAS, copies of certain above plans to be kept at the shore office as well, therefore those plans may not be required to send);
- Prepare watch schedules for ship's watchkeepers; and
- Have a briefing with the officers and the crew. Following should be addressed during the briefing:
  - ✓ Adhere to safety regulations issued by the dock authorities and ship's SMS;
  - ✓ They should be told about the watch schedules, emergency contact numbers, regulations which are specific to the dock;
  - ✓ They must have a good idea about the repair items;
  - ✓ Appropriate PPE to be worn;
  - ✓ Strict and frequent fire rounds must be carried out (be very cautious during tea times, lunch times and when the work is ceased at the end of the day);
  - ✓ Proper illumination must be available at repair stations;
  - ✓ They must have a thorough knowledge about daily work while the vessel is in the dock;
  - ✓ The commencement and the end of each repair item must be informed to chief officer;
  - ✓ They also must be given a summary of a repair list. So that, it can be tick-off at the end of each work;
  - ✓ All the important times must be noted down (commencement and completion of each work, work ceasing times, raining time periods-specially, in case of hull painting etc.);
  - ✓ Always the hull painting must be carried out during appropriate weather conditions. Must ensure that the previous paint coating is properly dry before applying the new coat;
  - ✓ If any ship's equipment is given to dock workers, make sure to take them back;
  - ✓ Strict, enclosed space entry regulations must be carried out;
  - ✓ Adhere to the ISPS requirements; and
  - ✓ If in any doubt the chief officer or the master must be informed.

Just before entering:

- All hatches, beams, derricks, cranes, cargoes (if docking with cargo onboard) to be well secured;
- Vessel to be upright;
- Free surface in tanks to be reduced;
- Stability should be adequate, so that the virtual loss of GM does not affect the vessel. Ensure the GM is positive at the time of critical instant:
  - ✓ Virtual loss of GM at the critical instant = **P x KM / W** or **P x KG / (W – P)**;
    Where,
    P = upward reactionary force exerted by the dry dock blocks on the ship's keel
    KM = Vessel's KM at the critical instant
    W= displacement
    KG = Vessel's KG at the time of entering the dock

  - ✓ P = MCTC x trim / L
    Where,
    t = trim in centimetres on entering the dock
    L= distance between COF and the P force in metres.

- The virtual loss of GM can be reduced by reducing the trim when entering the dock, if required;
- Draft & trim should be as per the requirements of the dock;
- Sound all tanks;
- Lock toilets (this is not required in some docks);
- Ensure fenders are available if required;
- Ensure to take whatever the equipment in which are protruding outward from the hull, such as speed logs, stabilizer fins etc.;
- When entering a dock, a stern trim is more preferable because;
  - ✓ Easy to handle a ship with a stern trim;
  - ✓ Level of the dock bottom (the declivity) is compatible with a stern trim; and
  - ✓ The stern area is strengthened with a "sole piece", so that it is better to touch the sole plate first.

- Note down the following times:
  - ✓ Bow passing dock gate;
  - ✓ Vessel entered the dock;
  - ✓ Dock gate closed;
  - ✓ Dock pumping out commenced;
  - ✓ Time of stern touching the keel blocks;

- ✓ End of critical period; and
- ✓ Dock empty.

When inside the dock:

- If used, ensure shores are rigged at correct positions (at the intersections of frames & stringers). This is not a common practice with large ships;
- Before the power is switched to shore power, switch off all navigational equipment (note down the gyro heading before switching off);
- When the vessel is sitting on the keel blocks, sound all the tanks again;
- Obtain telephone, electricity, garbage bins, portable heaters for cabins (in case of cold climates) and connect the ship's fire line to shoreline and ensure the fire line is pressurized;
- Obtain emergency contact numbers as well as the dock regulations which are specific to the dock (if available) and display them in prominent places onboard;
- If possible, arrange two gangways;
- Ensure the ISPS requirements are complied with;
- Keep the life buoys which are on deck at a safe place;
- When bottom plugs are removed, name them and keep in a safe place;
- Ensure that grease is applied on transducers and port holes which are closer to painting areas;
- Ensure to isolate the fixed CO_2 system to avoid dangers in case of accidental release;
- Ensure the repairs are done as per the repair list; and
- Ensure fire watches are being carried out, and appropriate fire extinguishers are available at places where welding works are being carried out. These fire extinguishers will be brought by the dock people.

6) Inspections to be carried out in a dock

- Shell plating and openings on the shell;
- Plate thickness measurements;
- Inspection of critical areas on the hull;
- Under water coating and hull marking;
- Sea chests & gratings;
- Anchor cables;
- Chain lockers;
- Testing of watertightness on hatch covers;

- Hull corrosion preventive system;
- Rudder bearing and bush clearances;
- Propellers;
- Stern bush clearance; and
- Oil gland.

7) The contents of a repair list

Standard items:

- Hull cleaning, surface preparation, painting;
- Inspection of anchors and cables, including ranging and marking;
- Inspection, cleaning and painting of cable lockers;
- All sea valves and sea chests to be inspected;
- All anodes to be inspected (the location and weight or size to be ascertained);
- Survey of ship's bottom;
- Inspection & maintenance of rudder;
- Stern frame inspections; and
- Inspections and maintenance of propeller.

Repair items may include (this depends upon the type of the vessel, age of the vessel, damages experienced during service period etc):

- Renewal of piping;
- Maintenance & repairs of cargo-handling equipment;
- Maintenance & repairs to hatch-closing arrangements;
- Bulkhead, deck and hull plates changes;
- Maintenance of fire detection and fixed firefighting systems;
- Replacement of parts of longitudinal and transverse frames;
- Repairs for damages caused due to heavy weather and contacts with jetties etc.; and
- Replacement of stringer plates in the fore peak tank.

Modification items (this also depend upon the age of the vessel and the new amendments entered into force):

- Modifications required due to changes in regulations which are required to be complied with at the time of next dry dock;
- Conversions or restructuring of the vessel; and

- Modifications to improve the efficiency or carrying capacity of a vessel.

8) Inspections to be made in forepeak and after peak tanks

- Ensure the ladders are in position and no damages;
- Check the stringer plates, shell plating, girders and beams for cracks, bends and corrosion;
- As many as welds as possible should be checked;
- Check the sacrificial anodes;
- Check the condition of the paint;
- Check the fore peak isolation valve;
- Check the sounding pipes and striker plates;
- The middle portions (vertically) of the tanks are more prone for wear and tear than the top and the bottom areas of the tanks. Therefore, pay more attention to the middle areas of the tanks;
- Check the longitudinal stiffeners and brackets at the collision bulkhead to shell junction;
- Check the condition of the collision bulkhead, the area where the fore peak ballasting line is coming through; and
- In the after-peak tanks, check the longitudinal shell stiffeners, particularly in areas adjacent to bulkheads and web frames.

9) Inspections to be made in double bottom tanks

- The paint conditions;
- Sacrificial anodes;
- Ensure the lightening holes are not blocked;
- Check the sounding pipes and the striker plates;
- Check the longitudinals. Wastages are usually more severe close to the tank top. This may result in the fillet welds, attaching longitudinal to the deck, being wasted thus leading to detachment of the longitudinal and consequent buckling of tank top plates; and
- The plate thicknesses must be checked.

10) Ranging a cable

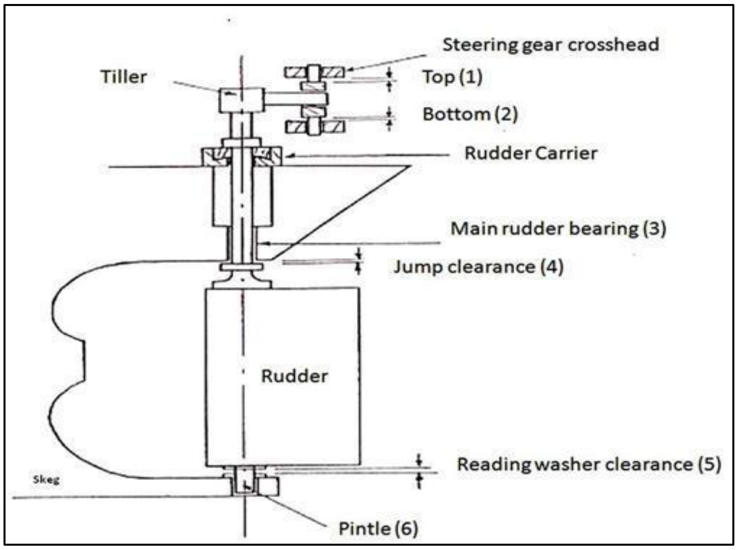
The laying of the cable on the dock bottom is done with the help of a shore crane. Cable must be lowered under power throughout the operation. In certain docks the total operation is done by the dock yard crew. If it is the case, your staff should observe the operation. In certain docks, this is done with the assistance of the ship staff.

Cable ranged on the dock bottom

11) Inspections of the rudder

Rudder to be inspected for:

- Cracks;
- Deformations;
- Loose nuts;
- Rudder pintle clearance (by inserting a filler gauge);
- Jumping bar clearance (by inserting a filler gauge);



Jump clearance[92]

- Leaks (if there are any leaks when the drain plug is opened water should come out); and
- Sacrificial anodes and draught marks must be in good condition. Refer the picture below:

After fitting anodes and after painting

12) Checks to be made on a propeller

- Check oil leakage from stern tube;

[92] https://marinesurveypractice.blogspot.com/2013/01/rudder-rudder-stock-and-pintle-survey.html (Last visited 24/07/2026)

- The clearance in the stern bush and the efficiency of the oil gland should be ascertained;
- Inspect blade surfaces for erosion, pitting damage, corrosion and bending;
- Check stern tube for leakages;
- Inspect propeller for cavitation damages; and
- In the case of a CPP (Controllable Pitch Propeller):
  - ✓ check for blade movements and zero pitch settings with respect to wheelhouse;
  - ✓ check hydraulic oil leakages; and
  - ✓ check securing arrangements for blades and carrier.

13) Maintenance works done on anchor cables

- Check the diameter of the shackles (usually, 11% of wear down in bar diameter is allowed before replacement);
- Transpose two or three shackles to the inner end of the cable;
- Hammer test or ultrasound test to be done on the cable to identify cracks. Penetrating oil also can be used to detect cracks; and
- Joining shackles to be painted.

14) Thickness measurements on the hull plates and the allowance given prior changing of such plates

Plate thicknesses are checked by using an Ultrasonic Thickness Gauge (UTG). The UTG consists of a probe connected to a digital indicator and the probe consists of an ultrasonic sound transmitter and a receiver. Once the probe is kept on a steel plate, the ultrasonic sound will penetrate through the plate which needs to be measured, and the ultrasonic sound will turn back at the other end of the plate. The digital indicator monitors the time taken by the ultrasonic sound to leave the probe and return back to the probe (uses the same principle used in an echo sounder). Finally, the thickness can be measured as the speed of the ultrasonic sound is known.

Before using a UTG apply lubrication (greasy lubrication) on the probe and calibrate it by measuring the thickness of a steel plate which the thickness is known (such a plate comes along with UTG). If the measurement is correct, it can be used to check the thickness and each time, the probe to be lubricated.

The allowable thickness depends upon the classification society requirements, the place of the plates, size of the ship etc. classification societies use a “**minimum thickness table**” in deciding whether to change the plates or not.

15) Hull painting in dry dock

Hull painting shall be carried out in a proper manner to ensure that it lasts long till the next dry dock. Make sure no precipitation and the steel surface is properly prepared for painting purposes.

Before the commencement of hull painting, need to ensure the surface of the hull is prepared for painting. This is done by means of water blasting or grit blasting. Ensure the hull is washed after the completion of grit blasting and completely dry. Double check the areas where grease was applied to ensure still the grease remains before start painting.

To calculate the amount of paint required, need to calculate the surface area of the hull. This can be taken from the ship's hydrostatic tables since the wet surface area is given against the draught. Is also can be calculated by the following formula as well[93]:

$$S = 2.58\sqrt{\Delta L}$$

Where:

S = surface area (m^2)
Δ = displacement (t)
L = length of the ship (m)

Then divide the area by the coverage area of the paint selected (this of course depends upon the type of the paint and the brand of the paint) and determine how many litres per coat is required. Multiply the litres per coat by the number of coats to calculate the total volume of the paint required. Need to order some extra amount of paint to compensate for lost factor which is unavoidable during painting. This information can be obtained from the paint manufacturer.

Required paint thicknesses and drying periods

The required paint thickness depends upon the brand of the paint and as well as the expected date of the next dry docking, since the paint is required to last long till that date. The paint manufacturer should give this information in the paint manual (sometimes called as Onboard Maintenance Manual) and the thicknesses could be given as follows;

- In wet condition: 160 – 320 microns
- In dry condition: 75 – 150 microns

[93] IMO, Model course 7.01, Master and Chief Mate (2014 edition)

The time period required to dry the applied paint depends upon the surrounding temperature and also the brand of the paint. This information is also given in the paint manual as follows;

- at 5º of temperature: 24 hrs
- at 30º of temperature: 10 hrs

Now computer software's are available where you can get the volume of paints required by inserting the relevant information such as area to be applied (m^2), dry film thickness, volume of solids etc. The dry film thickness and the volume of solids can be obtained from the information given regarding the individual paints that need to be applied in various places of the vessel.

16) Checks to be carried out before flooding a dock

- Ensure the hull painting is completed and dried;
- Ensure the Zinc anodes are fitted as planned;
- Ensure the transducers are not painted and grease removed;
- Ensure bottom plugs are in position;
- Check with the chief engineer & dock master, whether the propeller, thrusters, stabilizer fins and rudder are fixed properly and sea chests, sea valves are fixed in position;
- Check the tanks for any rubbish left by dock workers;
- Ballast the tanks as the same condition as arrived;
- Secure all cargo gears, hatches, beams etc.;
- Ensure all required surveys and repairs are completed;
- Check whether there is sufficient crew onboard;
- Ensure the mooring lines are passed & secured;
- Ensure that all garbage and refusals are taken away by the dock;
- Ensure that all the equipment provided (heaters, fire extinguishers etc.) by the dock are taken away;
- Inform the master and with his permission, sign the "authority to flood certificate" with date & time;
- Ensure all LSA and FFA equipment are in proper order and in their original locations;
- Write down all the timings;
- When the vessel is re-floated, start generators, disconnect shore power supply & fire lines;
- Check with chief engineer, whether all in order in the engine room;
- Re-start bridge equipment & check whether the gyro is indicating the same heading as she came in, once it is settled; and

- It is advisable to keep a check list for “completion of work in dock”.

17) Precautions to be taken when docking with cargo on board

- Ensure no perishable or dangerous cargoes on board. If available on board, they must be discharged before docking;
- Proper fire watches to be maintained in the cargo holds by taking fire rounds and by the detectors;
- Ensure cargo is properly lashed and the vessel is upright;
- Ensure the cargoes are evenly distributed and cargo plan should be given to the dockyard;
- Reduce free surface effect;
- If possible, advisable to press up double bottom tanks;
- Ensure the vessel has sufficient GM throughout the critical period;
- Discuss the docking requirements, such as trim and draught with the dock master;
- Have a briefing with officers, engineers and crew; and
- If possible, try for water borne docking (without emptying the dock completely).

ANCHOR, ANCHOR CABLE AND ANCHORING

1) General information

a) Contents of an anchor certificate

- Certificate serial number;
- Name of the certifying authority;
- Name of the testing establishment;
- Weight of the anchor;
- Type of anchor;
- Length of the shank in millimetres;
- Length of arms in millimetres;
- Diameter of trend in millimetres; and
- Proof load applied in tonnes.

b) Contents of an anchor cable certificate

- Type of cable;
- Diameter in mm;
- Total length in metres;
- Total weight in Kg;
- Length & breadth of a link in mm;
- Tensile breaking load applied in tonnes; and
- Tensile proof load applied in tonnes.

c) Markings on anchor and cable

Markings on an anchor:

- Certificate number;
- Letters representing the certifying authority; and
- Weight.

Markings on an anchor cable:

- Certificate number; and
- Letters representing the certifying authority.

d) The maximum weight that can be heaved up by a windless

No international regulations specify about a maximum weight that can be heaved up by a windless. Generally, the windless power is sufficient to heave up the weight of the anchor plus weight of 4 shackles. Therefore, lowering more than 4 shackles without touching the bottom shall be avoided. This may not be applicable if the vessel is allowed or has a class notation for deep water anchoring.

e) Deep and shallow water anchoring

Anchoring in depths of less than 35 m may be considered as shallow water anchoring and anchoring in depths of more than 35 m may be considered as deep water or deep-sea anchoring. Refer your company SMS for the exact definitions of shallow water anchoring and deep-water anchoring that is defined by the company.

Anchor to be walked-backed throughout the operation in case of deep-water anchoring irrespective of the size of the vessel. At the same time, anchor to be walked-backed on large ships whether it is shallow or deep-water anchoring.

f) Scope of the cable

The 'scope' of the cable is the ratio of the length of the cable paid out to the depth of water.

Usually it is 5 (minimum) to 10 (maximum), but this depends upon number of factors such as the length of the stay, possibility of bad weather, rate of current/wind, distances to navigational dangers and traffic density. Following formulas may be useful when deciding the length of the cable to be paid out:

- Number of shackles of cable = 1.5 x $\sqrt{D}$
- Length of cables in 'm' = 6 to 10 x D
- For special steel cable:
  Length of cable used in 'm' = 39 x $\sqrt{D}$
  (D=Depth in 'm')

At the same time, Liu[94] says that the cable length of should be 3 times of the water depth plus 90 m in normal condition. It should be 6 shackles under normal circumstances for a

[94] Liu, J. H., https://www.skuld.com/topics/ship/safety/good-anchoring-practice/ (Last visited 29/06/2026)

depth of 25 m. In rough weather condition, the cable length should be 4 times the water depth plus 150 m. congested anchorage is one of the exceptions. For example, in Singapore Roads, there should be 3 shackles in the water for handy size vessel, and only 4 shackles in the water are acceptable for "Panamax".

Refer the ship's SMS for company specific and ship specific requirements.

2) Selecting a good anchoring ground

Need to consider the following in selecting a good anchoring ground:

- Should not be an anchoring prohibited area;
- Clear of underwater cables, obstructions, shallows etc.;
- Even seabed (a flat seabed);
- Good holding ground (Mud or Clay);
- Availability of landmarks during day & night (if possible) to monitor the ship's position;
- Away from traffic;
- It should be a sheltered area;
- Less current & tidal effects;
- Avoid if there is a possibility of bad weather;
- Distances to navigational hazards; and
- Availability of swinging room (this will depend upon the number of shackles that will be paid out, the length of the own ship and the distances to other ships & navigational hazards).

3) Anchoring procedure

- Prepare the anchoring plan;
- Carryout a risk assessment;
- Ensure the anchor is cock-o-bill, on the breaks and ready for letting go, in the case of shallow water anchoring and on medium to smaller ships;
- Approach the anchoring position with a head wind or current. If both are present, head to the strongest. This can be identified by referring to the headings of the other vessels at anchor in the area;
- Once the vessel is at the anchoring position, stop her in relation to the ground;
- Put the engines astern;

- Stop engines and let go the cable or start walking back when she gathers stern way, i.e. when the;
  - ✓ propeller wash comes to about half-way up the vessel's length or
  - ✓ when the propeller wash passes the accommodation on smaller and aft accommodation ships.

- Note down the anchor dropping position;
- While laying the cable, ensure not to pile up the cable at the same place, use the brakes to lay the cable along the seabed;
- Once the planned number of shackles are out, apply the brakes and wait until the v/l is brought up;
- Once the vessel is brought up;
  - ✓ put the anchor signals/lights;
  - ✓ put the gelatine on and tight the brakes. Because gelatine is the one designed to take the weight of the cable, not the brakes; and
  - ✓ note down the position again and make the swinging circle of the vessel.

4) How to identify when a vessel is brough up

Just after the breaks are applied the cable will become tight due to the stern momentum of the vessel. Once this stern movement of the vessel is stopped, she will move towards the cable again due to the weight of the cable. Then the cable will become slack. Due to wind or tide (since the vessel is heading into it), she will start moving stern again making the cable a little tight again. This fwd and aft movement of the vessel may happen few times and it will stop. It is known as the vessel is brought up. If the cable continuously becoming tight and slack, that means she is not brought up but dragging the anchor.

5) The precautions to be taken while heaving up a cable and how to identify when the anchor is aweigh while heaving up a cable

- Need to have a good communication with the bridge;
- Open the anchor wash;
- If the cable is very tight and not coming up, do not use the windless continuously as it may stop the windless due to overheating. Inform the bridge, because need to use engines to ease down the weight on the cable;
- If there is a strong current or wind, may have to use engines throughout the operation;

- If the cable is crossing the bow, advisable not to heave up the cable as it will damage the paint on the bow. May have to use engine with the rudder or the bow thrusters to turn the vessel;
- Keep reporting the number of shackles on deck, weight on the cable and the direction of the cable when each shackle is on deck;
- Inform the bridge as soon as the anchor is aweigh (When the anchor is aweigh, suddenly the cable will become up and down with a little pendulum movement); and
- Inform the bridge again when the anchor is sighted.

6) Open moor

Open moor is used to increase the holding power of the cable and to stop dragging. Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

7) Running moor

This is good when anchoring in restricted areas (especially, restricted by land) and when excessive yaw is expected, to reduce the swinging circle. Students must understand that this moor will not increase the holding power as she will be riding to one cable always. Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

8) Standing moor

The advantages and disadvantages are the same as running moor but theoretically required less engine movements during this manoeuvre. Practically, engines may be required depending upon the circumstances. Same as the running moor this will not increase the holding power as she will be riding only to one cable. Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

9) Baltic moor

Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

10) Mediterranean moor

Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

11) Clearing foul hawse

Foul hawse means the port and starboard cables are crossed when both cables are used. Refer "Seaman Ship Techniques" by D.J. House for the procedure of the operation.

12) Foul anchor, clearing a foul anchor and slipping the cable on deck

Foul anchor means the anchor is entangled with an underwater obstruction. In some cases, the anchor may not be able to heave up at all and sometimes it may be possible to heave up the cable with the fouled object. If the anchor cannot be heaved up at all, and if the berth is available for the vessel, you may:

- Inform the port authority, agents, owners, class and P & I;
- Connect the anchor buoy to the cable with a rope having a length little more than the depth of water;
- Slip the cable on deck; and
- Log down the position and time.

A vessel may be allowed to sail with one anchor provided that the situation is informed to the vessel's classification society, flag and need to comply with the conditions issued by the class (example – Keeping the engines ready when at anchor). Usually, they will allocate a time period to fix the anchor again. The Cargo Ship Safety Construction Certificate will not be suspended if the anchor is fitted within this period.

Cargo Ship Safety Construction Certificate will be suspended if both the anchors are lost and the vessel will not be allowed to sail until rectified.

An anchor cable may be slipped either from the bitter end or by detaching from a joining shackle. Detaching the cable through a joining shackle is known as slipping on deck. In case of slipping the cable on deck, follow the procedure bellow:

- Make the cable up and down to ease down the weight on the cable;
- Heave or lower the cable until the next joining shackle is on deck (if heaved up, ensure the cable is not tight);

- Pass a wire rope [with a sufficient SWL and with a length of about three times the depth] through the shackle fwd of the joining shackle. The SWL of the wire rope may be calculated as below:

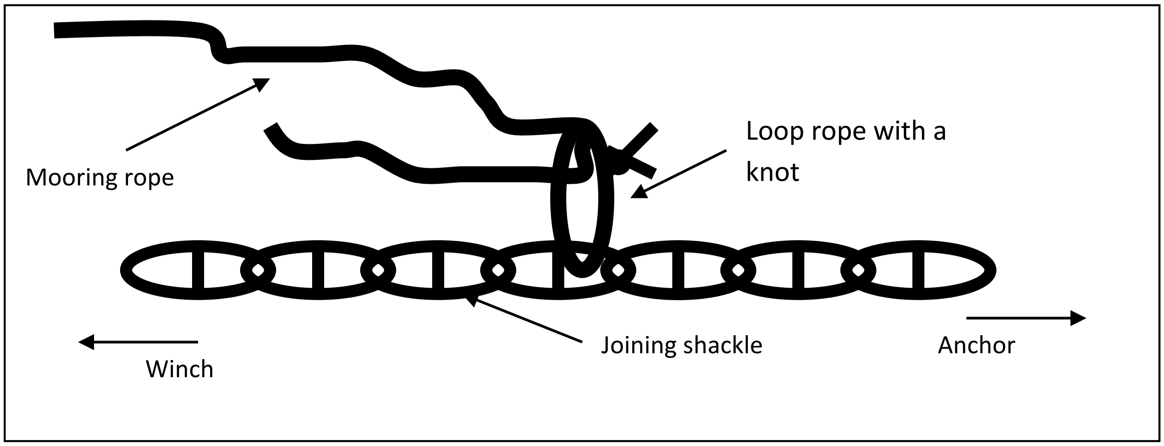
  Depth of the water = L metres
  Weight of a shackle = W tonnes
  Diameter of the rope = D millimetres
  Minimum SWL of the rope = (L x 1.5 x W)/27.5 tonnes

  For a 6x12 wire rope,
  Breaking stress = $(15\ D^2)/500$
  SWL = (Breaking stress)/5
  Therefore SWL = $(15\ D^2) / (500 \times 5)$

  Therefore,
  $(15\ D^2) / (500 \times 5) = (L \times 1.5 \times W)/27$
  $D^2 = (L \times W \times 1.5 \times 500 \times 5) / (27.5 \times 15)$ (mm^2)

  Generally, on medium sized ships 20 to 24 mm diameter rope is sufficient.

- Make fast one end of the wire rope on to a bollard;
- Put the other end of the wire over a warping drum;
- Lower the anchor cable until the weight is taken by the wire;
- Connect the anchor buoy to the cable forward of the joining shackle with a rope having a length little more than the depth of water;
- Disconnect the joining shackle;
- Slack the wire until it loses its weight;
- Once the wire is fully slack, remove the end which is on the bollard and start heaving up; and
- If you don't have a wire rope, use a good mooring rope. Since the mooring rope cannot pass through a shackle, use a loop wire to attach the mooring rope to the shackle (see the figure below).



13) Actions to be taken when dragging an anchor

- Get the engines ready;
- Call the master & anchor party;
- If there are any barges or boats made fast to the ship, inform them and let go the barges and the boats. Never ever heave up an anchor with the barges and boats made fast;
- Inform other ships around (security message);
- Hoist the “Y” flag and remove the anchor ball. If it is night, switch off anchor lights and switch on the navigational lights;
- Inform port authority if required;
- Use engines to stop dragging, if available;
- Try to stop the dragging by dropping the second anchor under-foot; and
- If the vessel is dragging towards another vessel without engines, prepare fenders, inform the other ship and use the rudder to cant the ship away from the other vessel.

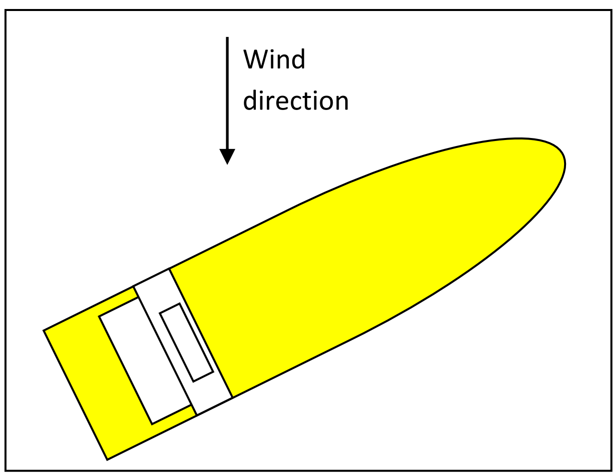
SHIP HANDLING AND MANOEUVRING

Keep the following important points in your mind as they may help in ship handling and manoeuvring:

- In a channel when there is a current, the maximum rate of the current occurs at the centre of the channel and very close to the banks of the channel, the rate of current is almost zero. This can be used to the advantage of ship handling.

- A good idea about the current may be obtained by means of a Doppler log, GPS (when there is a difference between course over ground & course steered) and also the fixed objects such as buoys (by referring to the water turbulence at the buoy).

- When a vessel is exposed to wind, the area which is having the largest windage area will be pushed away from the wind. In the case of aft accommodation ships, aft windage area is larger than the forward windage area. Therefore, an aft accommodation vessel drifting at sea will face the wind diagonally. Refer the diagram below:



Behaviour of a vessel when experiencing wind

- A good idea about the wind can be obtained by anemometer (relative direction), funnel smoke (relative direction), sea clutters on the radar (true direction), by referring to the sea waves (this may not be very accurate if the vessel is in waters covered by land).

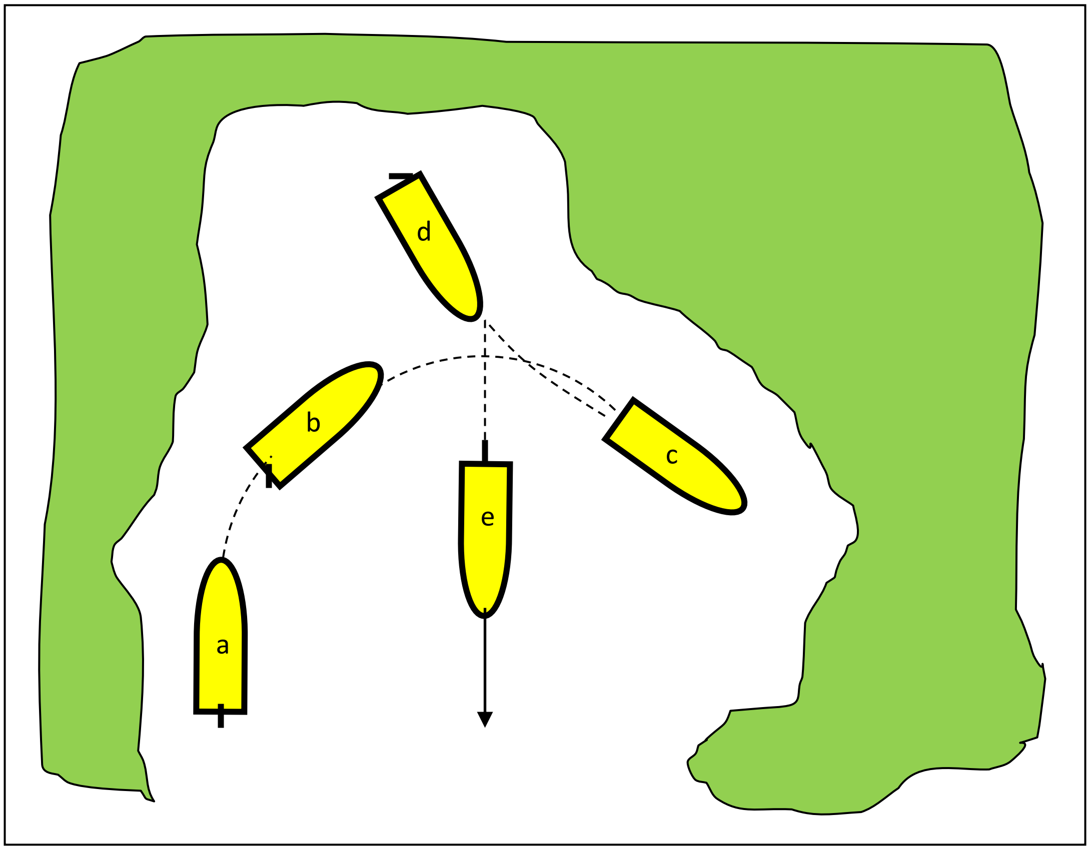
- You need to know whether the propeller of your vessel is right-handed or left-handed.

- When a half ahead or a fuller ahead kick (depending upon the loaded condition of the vessel) is given with the rudder hard over, vessel will start turning rather than start going ahead.

1) Turning short round

Turning short round means, turning a vessel within her own length. But practically, she may go beyond her own length due to the manoeuvring characteristics of the vessel, wind, current and the experience of the handler.

Turing short round with a right-handed crew propeller



With a right-handed propeller; the turn should be made to starboard side as shown in the above diagram so that the effect of transverse thrust, when the engines are going astern is of assistance. Approach the turning point, keeping to the port side of the channel with engines slow ahead and make sure to leave enough room at the port side for the stern to swing. The below points refer to the letters in the above diagram:

a) Start the manoeuvre from the port side of the channel to provide the maximum distance for the head reach of the vessel.
b) Put the rudder hard a-starboard and give a full ahead kick. Stop engines. Do not allow the vessel to gather headway.
c) Rudder amidships, engines full astern.

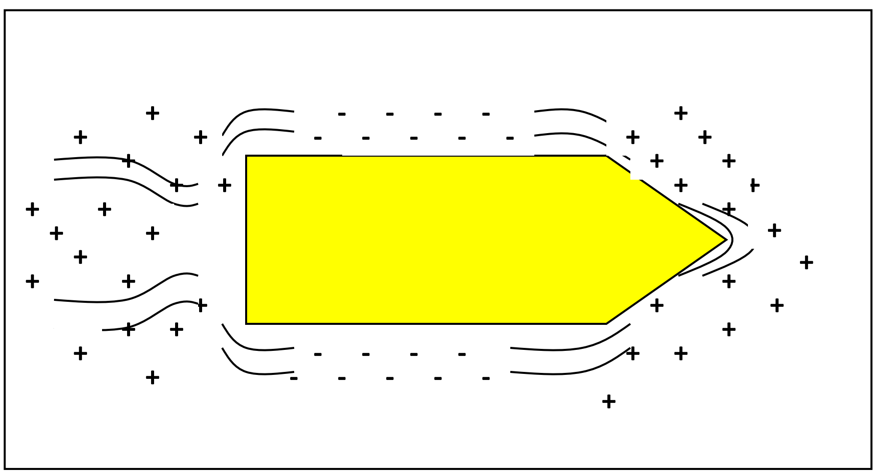
d) As sternway is gathered, the bow of the vessel will cant to starboard side owing to the effects of the transverse thrust. Stop engines. Rudder to starboard, engines ahead.
e) Steady the vessel and steer on the reciprocal course.

Think of turning the vessel around an anchor, if the turning short round is impossible due to weather effects, manoeuvring characteristics of the vessel and also due to available sea room.

2) Interaction between ships

Hydrodynamic interaction may occur between ship - sea bottom, between ship - ship and ship - bank. The effect caused by the ship & bottom interaction is called as **smelling the ground**. The effect caused between the ship & riverbank is called as **bank cushioning effect**. The effect caused by ship-to-ship interaction is known as interaction or **interaction between ships**.

When a ship moves forward, there is a region of high pressure at the bow and the stern. **The stern high-pressure region is of lower magnitude due to frictional loses**. The water displaced by the ship at the bow flows around and under the hull towards the stern and creates negative pressure in the mid-ship region.

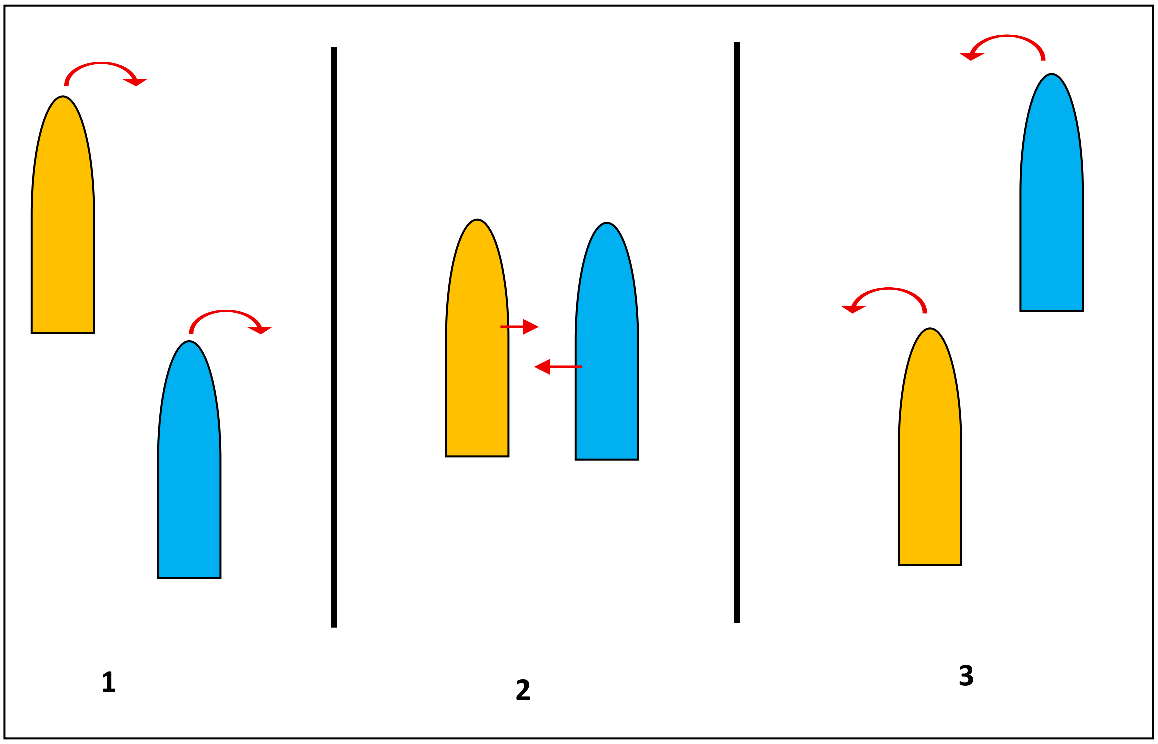


Change of pressure around a vessel when moving forward

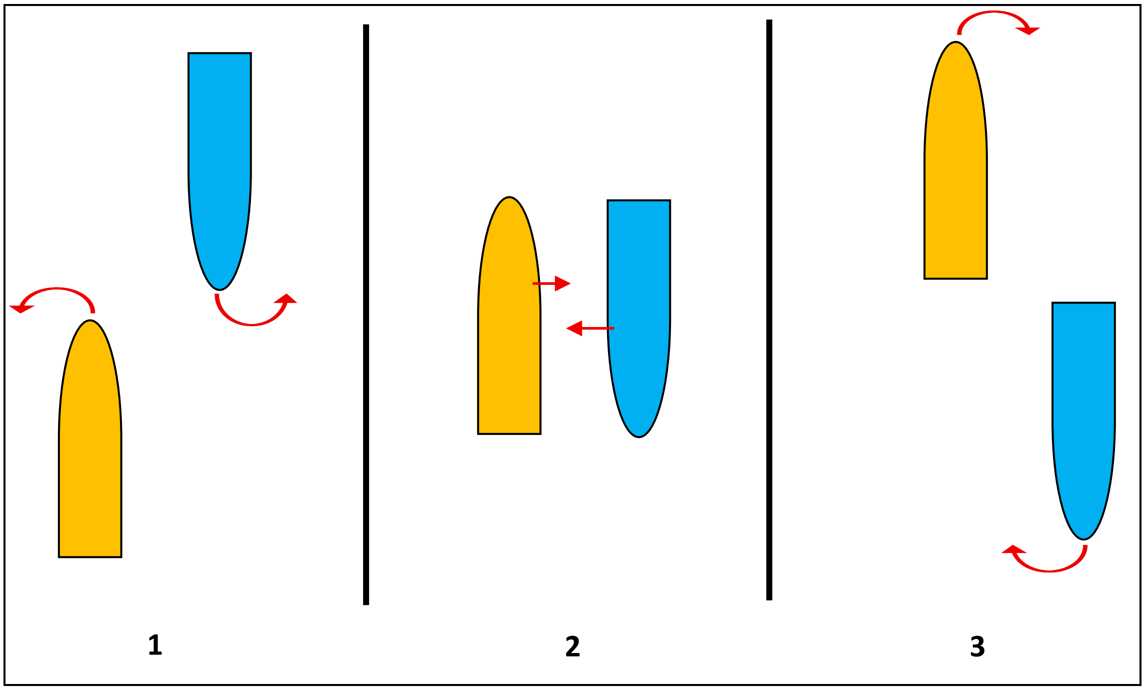
Hydrodynamic interaction between ships occurs at any depth but it is amplified in shallow water, and it is proportional to the ships passing speeds. i.e. if the speed is more, interaction between ships is more and vice versa. When different sizes of ships pass close to each other, effects of interaction are more on the smaller vessel. When a large vessel and a small vessel passing closely, there is a possibility of capsizing of the smaller vessel due to interaction effects.

- **Interaction between ships when over taking**

  You must understand that these effects depend upon the sizes of the ship, their speeds, distances between them and other effects from surrounding areas, such as the bank cushioning effects, weather condition etc. The most important thing is to understand is the pressure distribution system around a vessel. Once it is understood, all these can be predicted up to a certain accuracy.



- **Interaction between ships when passing close by in reciprocal courses**

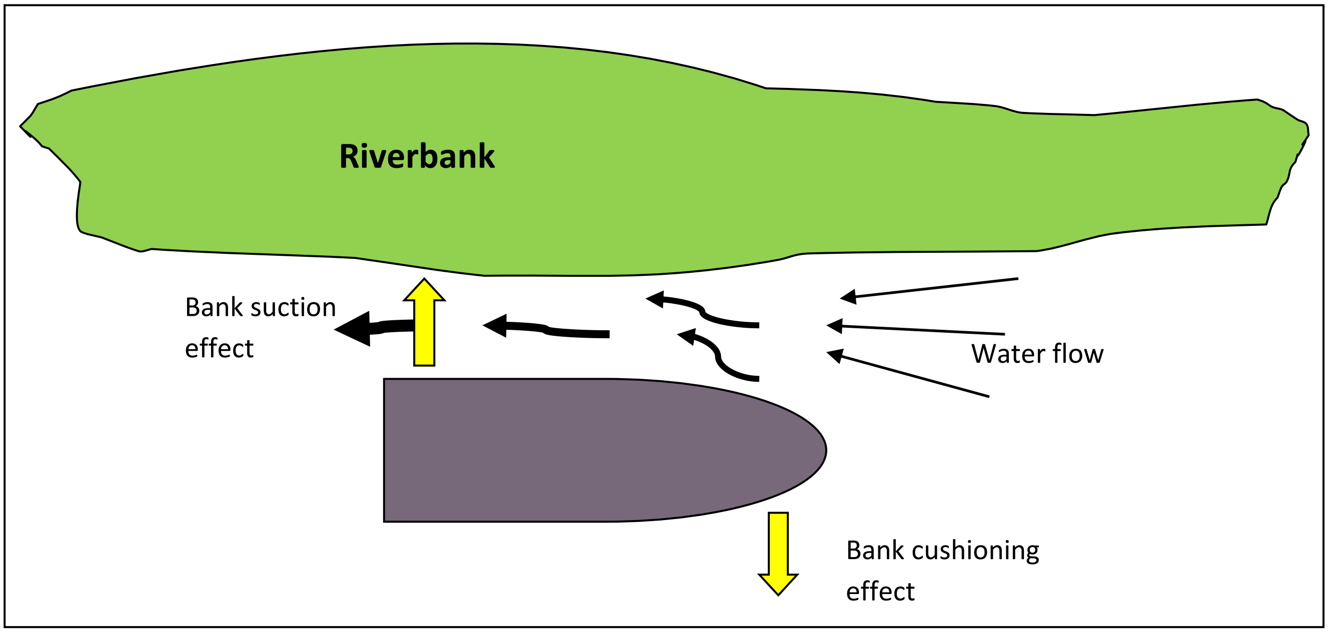


3) Smelling the ground

This occurs when a vessel is coming close to shallow water areas. A vessel coming closer to such a shallow water area will experience a sudden sheer towards the shallow area and then violently away from it. That is why it is known as smelling the ground.

4) Bank cushioning and bank suction effects

When a vessel is moving close to a bank, high pressure develops between the bank and the bow of the ship making the bow to push away from the bank. This is known as bank cushioning effect or the bow cushioning effect. The **width** of the black colour arrows indicates the **speed** of the 'water flow' in the diagram below.



Due to the loss of pressure and the increased speed of the water along the hull of the ship, her stern will be sucked towards the bank, and this effect is known as bank suction effect.

5) Squat effect

This occurs due to Bernoulli's principle. It says that as the speed of a moving fluid (liquid or gas) increases, the internal pressure within that fluid simultaneously decreases[95]. That means a reduction of pressure below the keel will take place when a vessel is moving at a higher speed in shallow waters. This is known as squat effect, and it increases the ship's draught virtually.

Therefore, the squat is the result of hydrodynamic interaction between ship and sea bed. It is not an increase in draft. Therefore, the mean draught remains the same. Water flow around box-shaped ships is more restricted and it is expected that these vessels squat will be more pronounced. If the vessel is even keel, squat will cause a trim by the bow for box-shaped vessels. Squat will cause a trim by stern for fined hull vessels. In case the vessel is already trimmed, squat will make her further trimmed in the same direction. When a vessel encounters squat;

- steering will be sluggish;
- she may encounter higher vibration;
- there will be RPM fluctuations;
- discolouration of water at the stern may take place; and

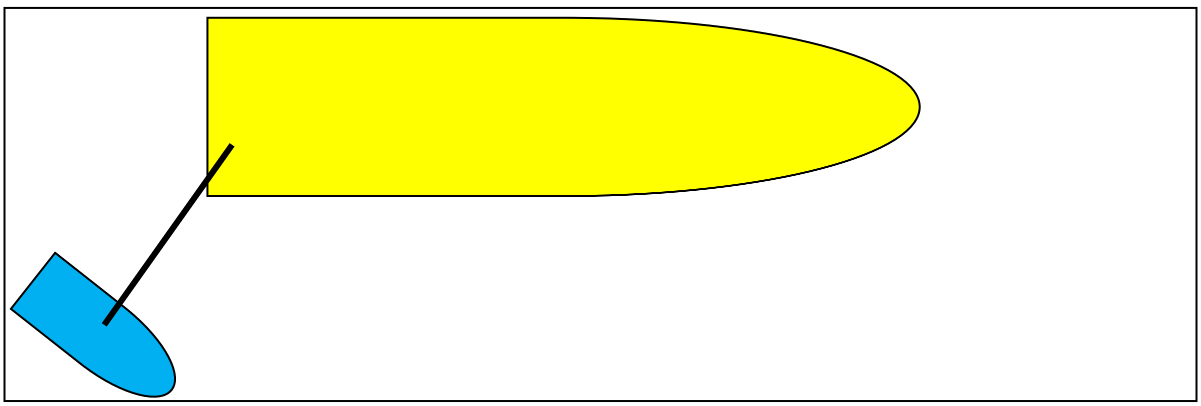
[95] https://www.nasa.gov/wp-content/uploads/2023/06/bernoullis-principle-k-4-02-09-17-508.pdf (Last visited 29/06/2026)

- change of trim will occur.

Squat is more prominent when the depth is less than 1.5 times the draught of a vessel. The only available method to reduce the squat effect is to reduce the ship's speed.

6) Girting

Girting occurs on tugs when the tow line is secured on the midship area of the tug and when the tow line is perpendicular (or nearly perpendicular) to the fore and aft direction of the tug.



When the force on the tow is higher than the righting moment of the tug, she will continue to heel without coming back to the upright position. This is known as girting, girthing, tripping or girding. A tug may capsize due to girting.

7) Towing and being towed

Ships are required to have an emergency towing booklet which contains at least:

- Ship's name, call sign, IMO number;
- Details of anchor and anchor cable;
- Diagrams showing the arrangements of mooring facilities with their SWL. This includes fwd & aft mooring arrangements as well as the bollards, winches, fairleads etc. around the deck;
- Various towing patterns;
- List of duties and responsibilities of the staff onboard in case of a towing operation; and
- Methods/procedure of connecting towing line to the own vessel.

Copies of the emergency towing booklet shall be available at least:

- with the ship owner/operator;
- on the bridge;
- in the forecastle space; and
- in the ship's office or cargo control room.

Apart from the emergency towing booklet, a plan for communications shall be available onboard for contacting a tug or salvor. Usually, this plan is included in the ship's emergency towing booklet. This plan shall contain at least the following:

- Condition of damage and the seaworthiness of the vessel;
- Status of ship's steering;
- Status of ship's propulsion;
- Availability of power on deck;
- Towing equipment onboard;
- Availability of quick release system of the tow rope;
- Towing locations in fwd and aft;
- SWLs and capacities of points and equipment used for towing operations; and
- Ship particulars.

The rigging procedure of a tow line and the towing procedure will be ship specific and need to refer the emergency towing booklet for the procedure of the rigging and the safety precautions to be followed. Common safety precautions to be adhered are listed below:

- Carryout the reporting as required;
- Select a towing pattern (refer your towing booklet) in consultation with the ship's master and the tug. The emergency towing booklet contains various towing patterns. One of the most suitable towing patterns can be selected depending upon the damaged positions on board the ship;
- Carryout a risk assessment;
- Crew to be briefed about the operation;
- Proper communication to be established during the rigging operation between the fwd / bridge and bridge / tug;
- Wear appropriate personal protective equipment;
- Use proper equipment as listed in the emergency towing booklet otherwise, failures may occur due to exceeding the SWLs;
- Try to avoid large turns with the towing lines;
- Ensure no chaffing of the towing line;
- Ensure the towing line is rigged in accordance with the towing pattern selected from the emergency towing booklet;
- Monitor the rigged equipment for some time period once the towing operation is started to ensure all are functioning correctly. Keep away from the snap back zones;

- Wearing-out conditions in Panama chock should be constantly checked;
- Rudder should be operated to improve the ship's movement in accordance with the tug's requirements, if necessary;
- It should be confirmed with the engine room if there is a problem of free propeller rotation;
- It is necessary to determine in advance how to lock the propeller shaft; and
- Consider of having additional tugs when entering narrow areas.

Bollard pull (BP) of the tug[96]

When a tug is hired the chartering party requires knowledge of the BP of the tug i.e. the pulling capability of the tug. The specification given to the charterer will usually be as per the BP certificate. The tug will have on board documentation, including a certificate issued by a competent authority proving the BP. It is not unexpected that as the tug gets older, the efficiency of the main engines and equipment will decrease the BP. It is generally accepted that if the BP certificate is less than 10 years old the BP rating is as stated on the certificate.

> If the BP certificate is older than 10 years, the accepted BP rating should be reduced by 1% per year higher than 10 years i.e. a tug with a 20 year old BP certificate of 50 tonnes will effectively have a BP rating of 50 tonnes less 10 x 1% = 45 tonnes.

For tugs less than 10 years old with no valid BP certificate, the BP can be estimated by the following formula:

Rough BP = (1 tonne /100) x Brake Horse Power (BHP) of the main engines

For tugs over 10 years old without a valid BP certificate, the BP value can be estimated by the following formula:
Rough BP = 1 tonne/100 x BHP reduced by 1% per year of age greater than 10 years.

If the own vessel's SWL of the bollards are required, it can be taken from the own vessel's towing booklet.

[96] Tugs and Tows – A Practical Safety and Operational Guide – ship owners club, https://shp-13383-s3.s3.eu-west-2.amazonaws.com/media/5216/8779/4999/PUBS-Loss-Prevention-Tug-and-Tow-Safety-and-Operational-Guide_A5_onscreen.pdf (Last visited 29/06/2026)

SEVERE WEATHER CONDITIONS

1) Heavy weather

a) Preparing a vessel for heavy weather

- Make sure to follow and complete the heavy weather check list;
- Avoid slack tanks and eliminate free surfaces of tanks if possible. If required (in consultation with the master), consider about changing the trim to reduce shipping seas over the fwd deck;
- Rig lifelines from Fwd to Aft if required;
- Warn all departments of the expected heavy weather;
- Ensure all the hatches, ventilations and manholes, forecastle stores etc. are closed watertight;
- Ensure the cargo lashings are properly in place;
- Check securing of lifeboats, & life rafts;
- Make sure the water-tight doors are closed;
- Ensure the cargo gears are well secured;
- Secure all side scuttles and dead lights if available;
- Secure all the loose gear on the deck;
- Put additional lashings on anchors (if required), close Spurling pipe weathertight (with cement), secure mooring ropes;
- Drain swimming pool if available;
- Establish heavy weather work routine;
- Check securing on accommodation ladder;
- Secure bridge against heavy rolling/pitching;
- Ensure the LSA equipment which are in open areas are in appropriate positions (may have to stow/secure them with the master's permission);
- Enter a statement on the deck logbook for the compliance of the heavy weather checklist; and
- Following to be considered by the master:
  - ✓ Refer updated weather reports, plot storm movement and assess the risks;
  - ✓ Verify vessels position and consider of re-routeing;
  - ✓ Reduce speed in ample time to avoid pounding;
  - ✓ If the actual weather is different from the forecasted weather by the weather routeing services, inform them about the actual weather conditions;
  - ✓ Consider of steering weather courses to avoid severe pitching and/or rolling;
  - ✓ Consider of heave-to. This means having a speed just enough to climb up the waves. Past tense is "hove-to". When heave-to the vessel will be stopped in

relation to ground. This will reduce pitching and pounding. But you will not be able to move away from the TRS when heave-to.;

- ✓ Change the settings on the autopilot accordingly or engage manual steering as appropriate;
- ✓ During heavy weather try to avoid beam swell/wave (may cause rolling synchronization), head swell/wave (may cause heavy pitching, panting and pounding) and stern swell/wave (may cause pooping); and
- ✓ Revise ETA if appropriate.

b) Approaching signs of a TRS

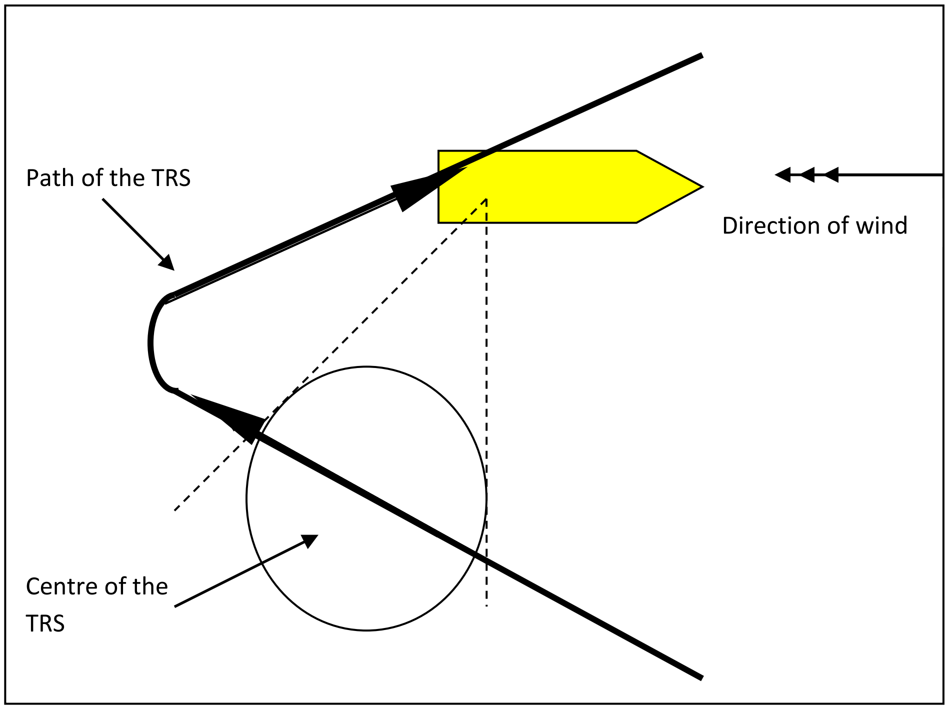
First and the foremost the vessel has to be in an area where TRS occur and the signs of an approaching TRS include:

- If the barometric pressure drops more than 5 mb (after correction for index error, height above sea level and semi diurnal variation);
- Increase of wind force when the pressure drops;
- Bands of Cirrus clouds directed towards the centre of the TRS;
- Threatening appearance of heavy clouds on the horizon;
- Sometimes frequent lightening may occur; and
- Succession of squalls with or without rain.

c) Avoiding actions of a TRS

- The most important thing is to ascertain the ships position against the position of the TRS;
- This can be identified by the Buys Ballet law or by observing the change of the direction of the wind:
  - ✓ As per the Buys Ballet law, in the northern hemisphere, the low pressure is on 8 to 12 points on the right-hand side when you face the wind. In the southern hemisphere, the low pressure is on 8 to 12 points on the left-hand side when you face the wind.
  - ✓ In the northern hemisphere, if the wind is veering you are on the dangerous semi-circle and if the wind is backing you are on the navigable semi-circle.
  - ✓ In the southern hemisphere, if the wind is veering, you are on the navigable semi-circle and if the wind is backing, you are on the dangerous semi-circle.
  - ✓ If the wind direction is steady, you are on the path of the TRS on both the hemispheres.

- In theory, to observe the change of the wind direction, the vessel may be stopped, and it will take some time. This may not be possible due to the prevailing weather conditions.



Application of the Buys Ballet law in the Northern hemisphere

- In the northern hemisphere, if you are on the dangerous semi-circle, keep the wind on 1 to 4 points on the starboard (if the vessel's speed is less than 12 knots keep the wind closer to one point and if the speed is more than 12 knots keep the wind closer to four points) on the bow. Alter the course as the wind veers (in the southern hemisphere keep the wind on the port bow).
- In the northern hemisphere, if you are on the path or on the navigable semi-circle, keep the wind on 1 to 4 points on the starboard quarter and alter the course as the wind backs (in the southern hemisphere keep the wind on the port quarter).
- Use the maximum possible speed in doing so. Sometimes you may have to "heave-to" to avoid heavy pitching & pounding.

2) Ice navigation

When polar classed vessels are navigating in polar regions, need to comply with the Polar Water Operations Manual (PWOM), which is a ship specific document. General precautions to be taken while navigating in ice areas are described below.

- Ensure that the sufficient number of winter clothing available onboard;
- Assess the ship's stability with ice accretion on deck;
- To avoid risk of damage to ballast & freshwater tanks due to freezing, the usual practise is to keep the tanks not more than 90% full to allow for expansion. Usually when the temperature of a liquid is increased, the volume will be increased to a certain extent. But the water acts differently when the temperature is increased. If the temperature of a sample of water (which is at 0º C) is increased, the volume will be reduced from 0º C to 4º C. There after the volume will be increased like other liquids. Due to this reason, if the temperature of water which is at 30º C is reduced, from 30º C to 4º C the volume will be decreased and from 4º C to 0º C, the volume will increase. If the tanks are kept full, this increase of volume may create structural damages;
- Fresh water tanks in the lifeboats should be kept no more than 75% full. Keep additional fresh water ready inside the accommodation and assigned crew to carry them into the lifeboats in an emergency;
- The master needs to consider of taking additional fuel, stores and fresh water that may require due to delays;
- Ensure the search lights are working in order;
- Ensure the crew are supplied with warm clothing;
- Add anti-freeze to lifeboat engine cooling systems;
- Ensure a sufficient trim is available, but excessive trim by the stern is not recommended, as it cuts down manoeuvrability and increases the possibility of ice damage to the more vulnerable lower area of the exposed bow;
- Make sure the hot water system for the bridge windscreen is working in order or keep ready de-icing liquids or spray cans;
- Additional shovels, scrappers and crow bars may be required to remove accumulated ice on deck;
- Keep the fire lines running or drain it completely;
- Do not keep the cargo lashings and wires of cargo gears too tight as they may break due to contraction;
- Ensure the heaters inside the accommodation are working in order;
- May require keep running the hydraulically operated equipment such as mooring equipment to avoid freezing;
- Add anti-freeze for PV valves on tankers;
- Make sure to keep the water seals of the scrubber and deck water seal warm on tankers;
- If the anchor is housed, it may not be able to let go the anchor due to ice accretion on the anchor handling equipment and in the hawse pipe. Therefore, it is a good practice to leave anchors slightly lowered in the hawse pipe in order to free them from ice accretion (to be done when started to encounter ice); and

- If ice accretion on deck occurs, check the rolling period frequently and calculate the GM. This is important to ensure that she is not coming to a negative stability condition.

Preparations with regards to safety of navigation

Master is the person in charge of the navigation of a vessel. Therefore, following to be considered by the master.

- Watch keeping personnel should be aware of the dangers, problems that may encounter and safety precautions to be observed during ice navigation;
- After encountering ice, speed should be reduced to minimum but not too slow & not too fast;
- Keep engines ready for manoeuvring all the time (if at a berth);
- Keep additional personnel to keep visual lookouts and may need to engage hand steering at short notice;
- Keep ready the search lights;
- Try to collect more information with regards to ice;
- Give a wide berth to ice bergs;
- Enter ice at right angles; and
- If possible, move with the movement of ice, without moving against it.

Reports to be made on encountering ice

On encountering air temperatures below freezing point, that are associated with gale force winds and causing severe ice accumulation on ships, the master is obliged under SOLAS to send a report to the ships in the vicinity and to the nearest coast station covering;

- Air and sea temperatures;
- Force and direction of wind;
- Position of the ship; and
- UTC time and date of observation.

The masters of every ship which meets with dangerous ice, are required to report the following information,

- The kind of ice;
- Position of ice; and
- The time and date in UTC of the last observation.

Pre-warnings of the presence of ice

- Sea and swell lower than expected for the existing wind speed may indicate the presence of significant ice to windward.
- Animals and or birds far from land may indicate the presence of large ice sheets.
- When steaming up wind, small pieces of ice may forewarn of larger formations to windward.
- When steaming down the wind large ice formations may be approached directly without forewarning.

The navigational errors that you may encounter

- GPS is reliable, provided the correct datum is applied. But may encounter errors due to tropospheric delays and ionospheric refraction in the auroral zone.
- Radar should be used with caution as ice may significantly change the effectiveness of the coastline.
- Radar scanner may become frozen.
- Ice particles on the radar scanner will reduce the transmitting & receiving pulse energy.
- Visual fixes with identified objects are the best.
- Light colours of navigational aids may be affected by ice.
- Light sectors & ranges may be affected by ice. Sometimes it may be totally obscured.
- Gyro compass errors may occur due to large course & speed alterations.
- Ice on the compass will make taking bearings difficult.
- After 70º latitude, gyro is not reliable and after 85º latitude it is totally useless.
- Above 70° latitude, the magnetic compass will not settle unless the ship remains on the same heading for a prolonged period.
- Echo sounder may not give correct reading due to false echoes.
- Radio communications may be difficult due to ice formation on the aerials.
- Buoys may be moved or removed in the ice seasons.
- Stars of below 10º of altitude are the best for celestial navigation.

Anchoring in ice areas

It is not advisable to anchor in ice areas except in emergencies. If, anchoring is extremely necessary, use minimum amount of cable and ensure the windless power is available, to heave up the cable. Keep the engines running slowly to avoid freezing.

3) Rolling synchronization

Rolling synchronization occurs when the vessel's natural rolling period equal to the wave encounter period. This happens when a vessel is experiencing beam seas and when the rolling synchronization occurs; vessel's rolling angle will be increased with each wave. She will experience vigorous rolling movements and there is a high possibility of capsizing the vessel. Rolling synchronization can be avoided by altering the course. Change of ship's speed is not effective in reducing the rolling synchronization at all.

4) Pitching synchronization

Same as rolling synchronization, pitching synchronization occurs when a vessel's natural pitching period equal to the wave encounter period. This happens when a vessel is experiencing head seas and when the pitching synchronization occurs; vessel's pitching will be increased with each wave. When a vessel is experiencing pitching synchronization, she will experience violent pitching movements and bow will start digging more and more into head seas.

Reduction of ship's speed is the most suitable action to reduce this effect. The second option available is to alter the course. Speed shall not be increased to avoid this, as it may start pounding the vessel. The slamming effect of the forward section against the sea is known as pounding. This is also dangerous as she may encounter structural damage.

5) Parametric rolling

Parametric rolling means sudden, unstable, unsymmetrical (unsymmetrical means stbd rolling angle does not equal to port side rolling angle) and large rolling motions of a vessel while encountering head or stern seas. This is a dangerous phenomenon and could occur with rough weather as well as moderate weather conditions. A vessel may experience parametric rolling even though she is complying with the required stability criteria.

Parametric rolling was further defined as a threshold phenomenon, meaning that it occurs when certain environmental, operational, and design parameters exist[97]. Which means, a vessel may encounter parametric rolling with any stability conditions provided the environmental and design parameters are tallying with the present stability condition of the vessel.

[97] https://www.tsb.gc.ca/eng/rapports-reports/marine/2021/m21p0297/m21p0297.html (Last visited 25/08/2026)

Parametric rolling motion occurs when the vessel is sailing in head or stern seas or with a small heading angle relative to the wave direction, and where the length of waves is about the length of the vessel and the encounter period of the wave is equal or close to half the ship's natural roll period[98].

The other factors which increase the risk of parametric rolling includes;

- the way the vessel is loaded[99];
- the vessel's speed[100];
- wave height is large[101]; and
- the ship's roll damping characteristic is low[102].

Parametric rolling is very common with container ships as they have parallel hull around the mid length of the vessel and large flares at the fwd and aft ends.

Hull form of a container ship[103]

Parametric rolling may be experienced by certain generations of Pure Car & Truck Carriers (PCTC) as well as they are also having similar hull forms[104].

With regards to transverse stability;
KM = KB + BM

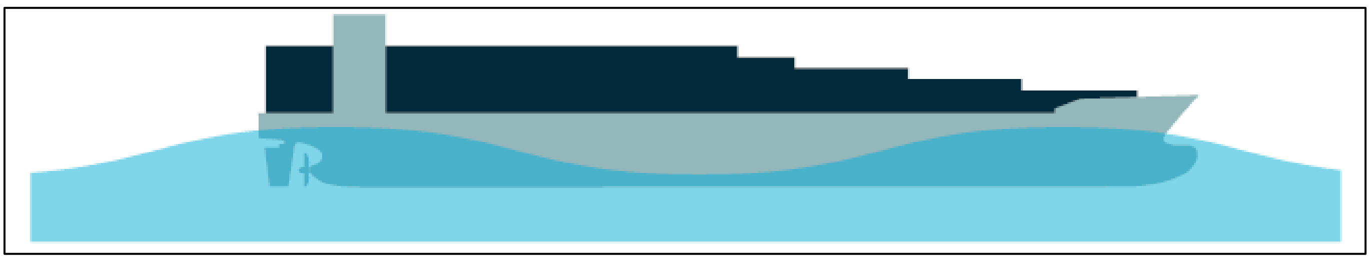
When a ships draught is less, KB will be less. When the water plane area is less BM will be less and finally, KM will be less. By keeping this in mind refer the diagram below;

[98] https://safety4sea.com/parametric-rolling-movement-what-to-know/ (Last visited 25/08/2026)
[99] https://www.tsb.gc.ca/eng/medias-media/fiches-facts/m21p0297/m21p0297-20240731.html (Last visited 25/08/2026)
[100] Ibid
[101] Jeroen de Haas, Gard guidance on freight containers, Gard
[102] Ibid
[103] https://edgedsign.com/downloads/container-ship-3d-model/ (Last visited 24/07/2026)
[104] Anders Sjule, Evaluation of vulnerability to parametric rolling, , http://www.diva-portal.org/smash/get/diva2:1057139/FULLTEXT01.pdf (Last visited 24/07/2026)

Wave crest is amidships[105]

In the above situation, KM is reduced as water plane area is reduced. But KG does not change. Therefore, when the midship section of a vessel is on a crest of a wave, GM will be virtually reduced, because;
GM = KM – KG

When the opposite happens with a container vessel;

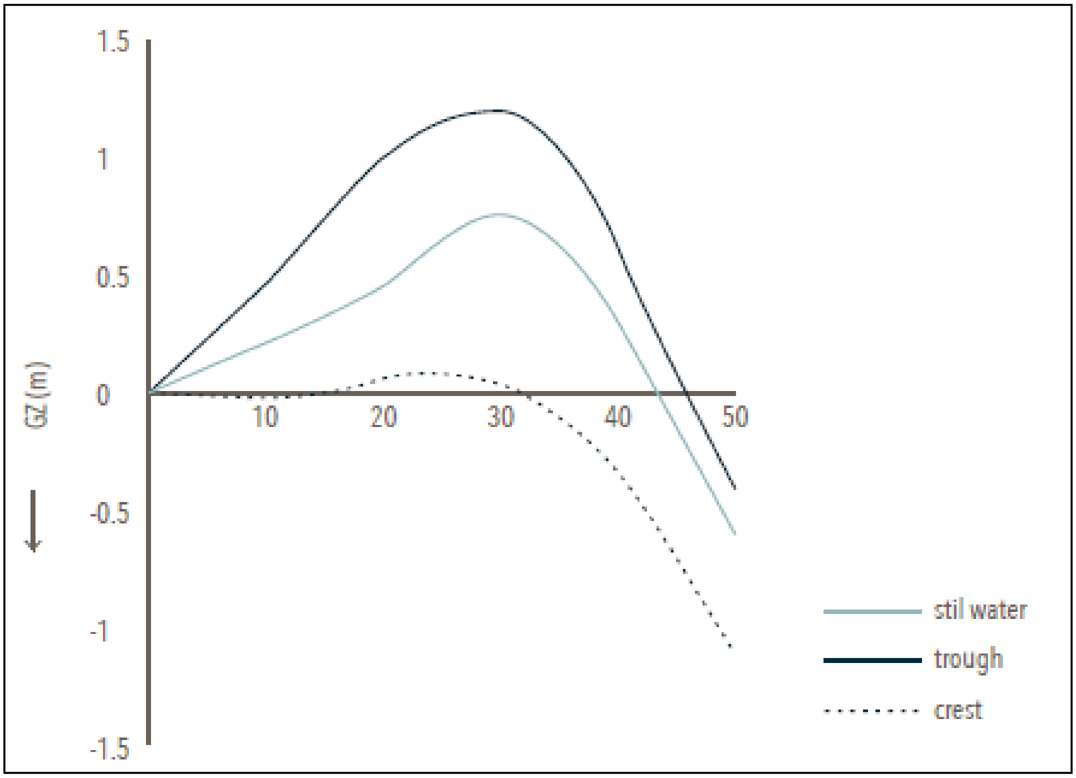


Wave trough is amidship[106]

Since the container vessel are having large flares fwd and aft, the water plan area will be increased. This will increase the KM virtually and that will cause the GM to increase virtually.

Refer the GZ curve below for both the above situations above:

[105] Jeroen de Haas, Gard guidance on freight containers, Gard
[106] Ibid



GZ curve when a vessel is on trough and crest[107]

Therefore, when a vessel is experiencing parametric rolling, the stability of the vessel will be improved when the wave trough is amidships, and the stability will be worsening when the wave crest is amidships. At the same time, higher the wave height, higher the virtual loss of GM and if the vessel is not having a sufficient GM for that threshold phenomenon, she may encounter a negative GM as well.

Actions to be taken to avoid parametric rolling and damages

- Master is required to select the course and the speed in such a way to avoid the encounter ratios of 1:1 and 1: 0.5 as mentioned above[108]. To avoid this, need to know the rolling period before hand.
- Have a higher GM but without making her stiff, so that the GM will not become negative while experiencing parametric rolling.
- Ensure the GM is similar to the GM used in the cargo securing manual (CSM) in arranging the lashings. Parametric rolling cannot be avoided by this, but damages due to rolling can be avoided. The stresses acting on lashing material will be increased during rolling and pitching. If the vessel's GM is not similar to the GM used in CSM, the

[107] Jeroen de Haas, Gard guidance on freight containers, Gard
[108] Refer Resolution MSC.1/Circ.1228, IMO or the latest for further details

stresses on the lashing material will be further increased causing damages to lashing materials and then the cargoes.

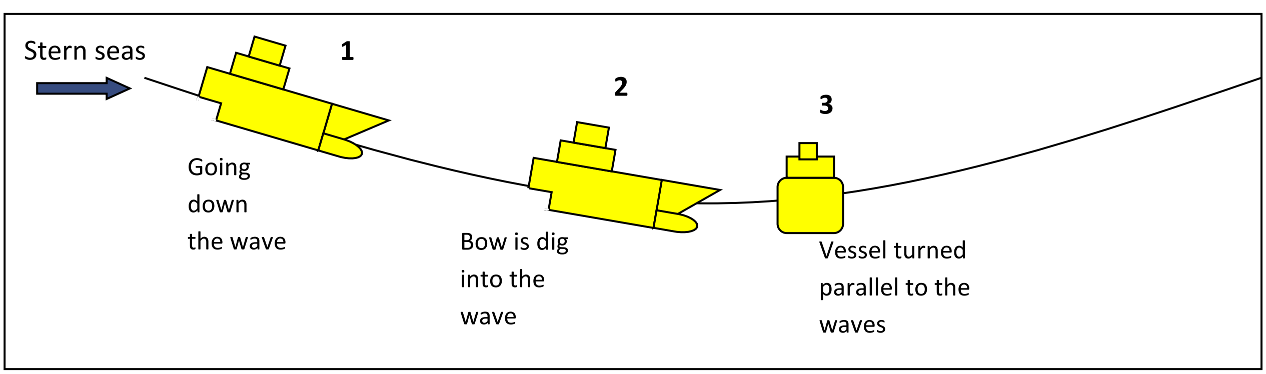
- Master to make proper route planning by referring to the forecasted weather.
- Reduce the FSE as this will increase the loss of GM virtually during parametric rolling.
- Follow the instructions provided in the stability book and ship's SMS in avoiding parametric rolling.

6) Pooping

Pooping means shipping spray and seas over the poop deck. Pooping occurs when a vessel is experiencing following or quartering seas and when the speed of the swell/wave is higher than the speed of the ship. While the wave/swell is trying to overtake the vessel, shipping seas may take place from the poop deck. This is a dangerous phenomenon with smaller ships than with large ships. Pooping is dangerous mainly due to two reasons. First one is that as there are more openings around the poop deck than in the forecastle, therefore possibility of flooding is higher and the second reason is that no much control over the manoeuvring of a vessel when pooping occurs. The best option available to avoid pooping is to alter the course.

7) Broaching

Same as pooping this also occurs with the stern seas. A vessel riding down a wave is known as surfing or surf riding. This will accelerate the speed of the vessel considerably causing the bow to dig into the wave ahead and finally, the forces acting behind the vessel may swing the stern violently either to port or stbd side creating a severe list. This phenomenon is known as broaching. A vessel may capsize due to severe broaching. This is a dangerous phenomenon on smaller ships rather than on larger ships. This could be avoided by altering the vessel's course.



Broaching a vessel

8) Altering course in heavy weather

If a vessel is turned into the seas or away from the seas in heavy weather, carelessly, she may encounter excessive rolling and pitching and there is a possibility of capsizing as well. Therefore, a careful observation must be done about the sea condition, which needs experience and good seamanship. Always try to turn her in a relatively calm area. When turning, the speed must be minimized to maintain steerage and large helm will be required. To initiate the turn full helms and the short but full engine movements may be required. Always try to avoid pooping and broaching effects and rolling synchronization.

When turning away from the seas or when turning into the seas an experienced mariner would initiate it in a trough of a wave than on a crest of a wave. When turning away from the seas the latter half of the turn should be completed faster to avoid broaching and rolling synchronization. When turning into the seas, again the letter half of the turn should be completed as soon as possible to avoid heavy rolling and swaying.

DECK AND ACCOMMODATION MAINTENANCES

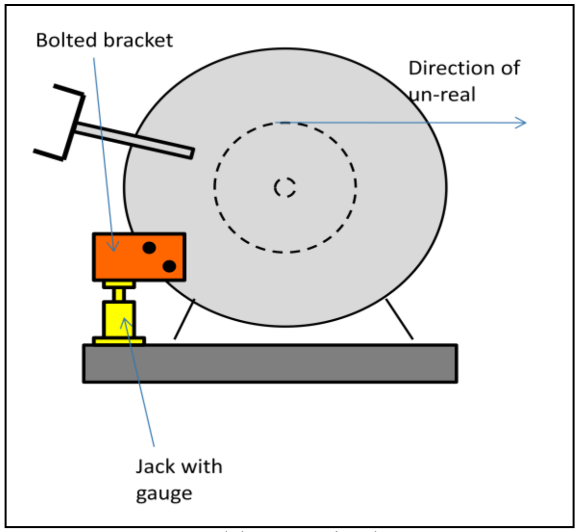
1) Maintenance of mooring winches, windless and anchor

The maintenances to be carried out on mooring winches and windlasses depend upon the type (hydraulic or electric or steam powered) of the mooring winch/windless and the manufacturer's instructions. Therefore, a chief officer must refer the PMS and also the manufacturer's instructions for ship specific maintenance procedures. A general list of items to check and general maintenance works to be carried out on a mooring winch and windless are listed below:

- Check the oil level in the oil tank (preferably before starting each time);
- Check the viscosity of the hydraulic oil and change oil if required;
- Carryout greasing of all the grease nipples and the hinged joints;
- Ensure the drain cap of the dip tray is in place;
- Check the base (for deformations, cracks, welding intact etc.) of the mooring winches and windlasses to ensure it is in good order;
- Check the brake liners;
- Ensure the safety pins of engaging/disengaging levers are usable and connected to levers;
- Ensure that the paint condition is acceptable and the markings on the winches and the windlass are legible. Markings should include:
  - ✓ winch ID number;
  - ✓ SWL;
  - ✓ Maximum break force;
  - ✓ directions of slacking and tightening;
  - ✓ maximum break tightening limits; and
  - ✓ date of last break test done.

- Ensure the snap back zones are properly and clearly marked and are legible;
- Check the insulation of the motor. Due to the sea water and spray the insulation may get damage which will cause the motor to overheat. This should be checked with a mega-meter;
- Carryout brake rendering test annually. Mooring lines will be parted if the load on the mooring ropes exceeds MBS (Maximum Breaking Stress) endangering those who are working around when a vessel is moored at a berth. To ensure the MBS is not exceeded, the brake is set to slip when the load on a mooring rope equals to a certain percentage of the MBS. Usually, brakes are set to slip when the load exceed 60% of the MBS of the ropes. Brake rendering test is carried out to ensure that the brake slip when the load on the rope equals to the set load. The procedure of carrying out the brake rendering test is given below. A test kit (which contains bracket to attach to the collar of the winch, bolts to attach the bracket to the collar and a jack) is available on board the ship. Refer the

below simple explanation on the rendering test. Different ships may have different testing methods:



Jacking a winch

- ✓ Disengage the winch;
- ✓ Fix the bracket to the collar of the winch;
- ✓ Turn the winch by hand until the bracket touches the jack (refer the diagram above);
- ✓ Tight the brake up to the marked position;
- ✓ Keep pumping the jack until the brake slips;
- ✓ Measure the gauge at that moment; and
- ✓ It should be equal to the set values (usually, 60% of the MBS of the rope).

2) Anchor and the cable

- Ensure that the anchor shackle and the shackle pin is in place;
- Shackles on the cable to be marked and/or painted if required;
- Ensure that the bitter end of the cable is free to let go in an emergency;
- Ensure that the bow stopper and the other securing devices of the anchor cable are in good condition;
- Transpose shackles backwards when the vessel is in a dry dock;
- Check the diameter of the shackles (11% of wear down in bar diameter is allowed before replacement) when dry docked; and
- Hammer test or ultrasound test to be done on the cable when dry docked.

3) Maintenance of mooring ropes

Care should be taken to maintain the mooring ropes to ensure the long-term use and also to avoid accidental parting during operations. These include:

- Inspect the mooring ropes for any visible damages routinely, before and after each use;
- Ensure the ropes are properly wound on the drums after each use;
- Keep the mooring ropes covered which are on drums during long sea passages;
- Avoid and oil and chemical contaminations with mooring lines;
- During the use:
  - ✓ Try to avoid large angles, if not avoidable, use roller leads;
  - ✓ If possible, use mats to avoid friction damage when the ropes are not going through rollers;
  - ✓ In case of a split drum mooring winch **(**A winch with a drum divided by a notched flange into a tension section and a line storage section[109]) only one layer of rope should be kept on the tensioning section when the ropes are under tension. Refer to the picture below:

Split drum mooring winch[110]

- Junior officers and the others involved in mooring operations shall be instructed to report when any kind of damage including chafing damage is noticed;
- Spare mooring ropes shall be stored away from sunlight, chemical & oil contaminations, and in dry spaces; and
- Comply with rope manufacturer's instructions.

[109] https://www.wartsila.com/encyclopedia/term/mooring-winches (Last visited 03/05/2026)
[110] Ibid

Apart from the above standard procedure, MSC.1/Circ.1620 issued by IMO describes detailed requirements regarding inspection and maintenance of mooring equipment including mooring ropes. Following are few important areas addressed by the above circular.

Definitions[111]

In order to understand the rest of the circular, need to know the meaning of the following definitions:

Bend radius (D/d ratio) means the diameter, D, of a mooring fitting divided by the diameter, d, of a mooring line that is led around or through the fitting. The D/d ratio is used by mooring line manufacturers to specify the minimum radius of a fitting around or through which a mooring line of diameter "d" should be led, in order to reduce or mitigate bend loss of strength of the mooring line.

Line Design Break Force (LDBF) means the minimum force that a new, dry, spliced, mooring line will break at. This is for all synthetic cordage materials.

Ship Design Minimum Breaking Load (MBLSD) means the minimum breaking load of new, dry, mooring lines for which shipboard fittings and supporting hull structures are designed in order to meet mooring restraint requirements.

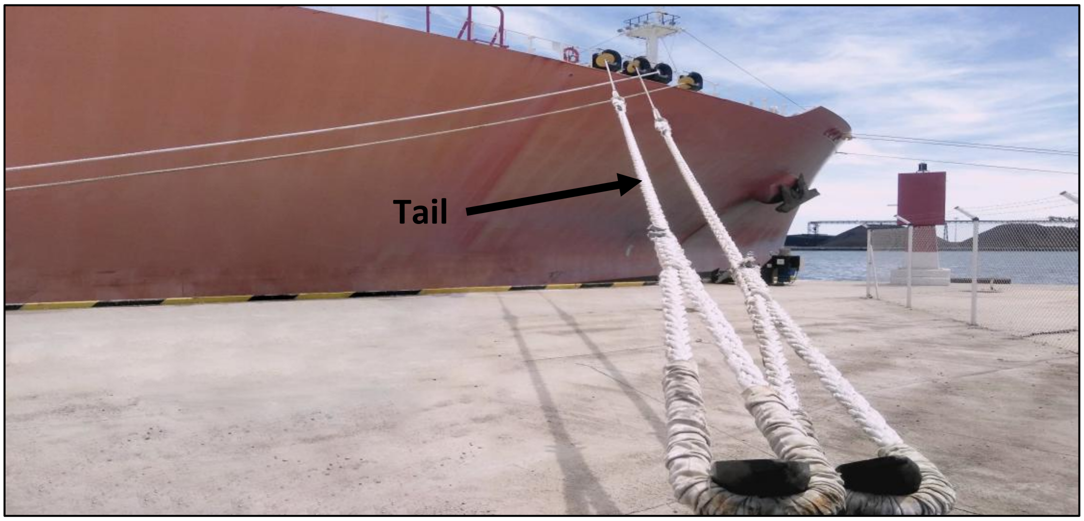
Ships are required to have mooring rope arrangement plans and procedures. This should include[112]:

- Procedures allowing identification and control of mooring lines, tails*, and associated attachments;
- On board maintenance plan or equivalent maintenance management system which includes the periodic inspection of mooring lines, mooring line tails and associated attachments;
- Manufacturer's criteria for replacement of mooring lines;
- Records of original design concept, equipment, arrangements, and specifications**;
- Manufacturer's test certificates for mooring lines, joining shackles and synthetic tails which should be properly linked back to the equipment; and
- Records of inspection and maintenance of mooring equipment. Such records of inspections and replacement of mooring lines should be retained on board. Such records

[111] Refer IMO, MSC.1/Circ.1620 or the latest for further details
[112] Ibid

should be kept for a period determined by the Company, but in any event the records should be kept until completion of the next annual survey.

* Tail means ends connected to steel wire ropes and certain types of synthetic ropes. Synthetic tails provide the necessary elasticity and safety in the mooring system and therefore lower the peak loads on the main mooring line[113].



Tails connected to wire ropes[114]

** For ships constructed before the 1 January 2007 and without the appropriate records mentioned above:

- If the SWL (safe working load) of the mooring equipment(s) is provided on board, Owner may establish MBLSD (Ship Design Minimum Breaking Load) for mooring based on the SWL. The value of MBLSD is to be evidenced on board[115].

Selection of replacement mooring lines[116]

When replacing mooring lines, compatibility with the mooring equipment and fittings on board, as specified in the mooring arrangement plan, should be taken into account. This should be achieved by selecting a replacement mooring line which meets the designed

[113] Katradis group of companies, User's Manual – Synthetic Mooring Tails, https://www.katradis.com/wp-content/uploads/2024/11/Users-Manual-Synthetic-Mooring-Tails.pdf (Last visited 03/05/2026)
[114] Katradis group of companies, User's Manual – Synthetic Mooring Tails, https://www.katradis.com/wp-content/uploads/2024/11/Users-Manual-Synthetic-Mooring-Tails.pdf (Last visited 03/05/2026)
[115] https://marine-offshore.bureauveritas.com/newsroom/safe-mooring-entry-force-1-january-2024-amended-solas-regulation-ii-13-8 (Last visited 03/05/2026)
[116] Refer IMO, MSC.1/Circ.1620 or the latest for further details

specifications. In cases where this is not possible, the following properties should be taken into consideration and the towing and mooring arrangement plan updated accordingly:

- breaking strength;
- environmental conditions to be used (e.g. temperature);
- linear density (Compiler's note – This is the mass per metre length of a mooring rope. It can be obtained from the rope manufacturer's certificate, if a certificate is not available, weigh a sample length of the existing rope and divide the mass by length);
- tenacity; [Line Tenacity (LT) represents material stress at the LDBF. For a given line size and material type, a line of lower LT offers increased resistance to the majority of fatigue and wear modes. LT of lines of different materials should not be compared[117].]
- D/d ratios;
- compression fatigue; and
- stiffness.

In addition to above, LDBF should fall within the range of 100-105% of MBLSD, or 105% of SWL if higher, when selecting mooring lines[118].

4) Maintenance and operation of Cargo lifting appliances

a) Use of cargo gears to embark or disembark people

This depends upon the flag state regulations. The MGN 332 issued by the MCA, UK states that no person should be lifted by a cargo gear except where;

- the equipment is designed or
- specially adapted and equipped for the purpose or
- for rescue or
- in emergencies

There are no regulations from the flag state relevant to this does not mean that cargo gears can be used for lifting persons. Chief Officers and deck officers should take due care not to use cargo gears for lifting people during normal operations.

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[117] https://www.ocimf.org/publications/tools/263-meg4-mooring-line-base-design-certificate/file (Last visited 03/05/2026)

[118] https://www.dnv.com/news/2023/towing-and-mooring-equipment-update-january-2024-preparation-for-solas-regulation-ii-1-3-8-248367/#:~:text=Technical%20specification%20documents%20of%20the,by%20the%20mooring%20line%20bending. (Last visited 03/05/2026)

b) Documents with reference to maintenance of cargo lifting appliances[119]

Ships are required to maintain a "Register of lifting appliances and items of loose gear"[120] which is also referred as "Register of Ship's Lifting Appliances and Cargo Handling Gear"[121].

Loose gear means items that are not attached to the lifting appliances permanently, but, items that used to attach the load to the lifting appliances. Loose gear also known as lifting accessories and may include wire ropes, hooks, blocks, chains, shackles, swivels, rings, links, slings, grabs, spreaders, lifting beams and lifting frames etc. Practically, it is not that difficult to identify whether any item is a loose gear or not as all the loose gears are listed under the loose gear section of the register.

Register of lifting appliances and cargo handling gear should be maintained in an approved form. This has two parts;

- Part I – this contains thorough examinations of lifting appliances; and
- Part II – this contains the regular inspection of loose gear.

All the loose gears shall have certificates issued by the manufacturer and these certificates to be attached to the Register of lifting appliances and loose gear (Part – II). These certificates shall contain at least:

- the distinguishing number or mark applied on the loose gear;
- description of particular loose gear;
- date of test;
- proof load applied; and
- safe working load.

c) Thorough examination of cargo lifting appliances[122]

Cargo lifting appliances including the loose gears are required to be thoroughly examined by a competent person every 12 months. This requirement may be changed by the ship's flag administration, therefore, need to refer flag state regulations and / or ILO Convention 152 (this will be applicable, if the flag state has ratified this Convention only).

[119] https://www.ilo.org/media/304621/download (Last visited 01/05/2026)

[120] Refer Article 25(2) of the ILO Convention concerning Occupational Safety and Health in Dock Work (No. 152), 1979

[121] Refer IMO, MSC.1/Circ.1663 or the latest for further details

[122] Survey and Examination of Ship's Lifting Appliances by Lloyd's Register / UK P&I Club, 2011

Above ILO Convention provides only a general definition of the “competent person”, therefore, some flag states leave it to the vessels technical managers to identify the competent person. Because of this, some companies has appointed the chief engineer or the chief officer as the competent person, but, when you go through the below mentioned procedure which gives a general idea of a thorough examination, you will realize that it cannot be carried out by any of the onboard personnel as they are not correctly trained for it. The most suitable person would be a class surveyor.

The competent person may require the following documents during a thorough examination:

- Existing certificates of lifting appliances, loose gear and ropes;
- Survey history;
- Outstanding problems from the last thorough examination;
- Serviced and maintenance history; and
- General arrangement plan.

Following items of the cranes and derricks may be checked by the competent person:

Cranes	**Derricks**
Loose gear	Loose gear
Ropes	Ropes
Protection and limitation devices	Protection and limitation devices
Winches, brakes and drums	Winches, brakes and drums
Built-in sheave units	Deck fittings
Hydraulic cylinders and pins (ram luffed cranes)	Derrick booms
Jibs	Mast fittings
Jib heel pins (the pin which attaches the jib to the crane. The jib is lowered or heaved vertically around this pin)	Masts, derricks posts and guy posts
Slewing columns (the cabin and the structure that rotates when the jib is swung horizontally) and machinery deck	
Slew bearings (bearings at the base that rotates horizontally) and bolts	
Pedestal and foundation	

The wear and tear of slew bearings can be monitored by (following two tests are explained in detail below):

- Rocking test (this measures the play or the relative movement between the inner and outer bearing race, to get an indication of the wear taking place). This can be done onboard and the procedure will be given by the manufacturer of the appliance; or
- Grease sampling data (wear and tear of a component can be identified by the metal content in the grease used to lubricate the component). Grease samples to be tested in a laboratory but not onboard. This is an alternative to the rocking test.

The inspection of the loose gears may be carried out by:

- Hammer tests – to identify the extent of corrosion.
- Non-destructive examination (by using electronic devices such as ultrasonic sound measurements) – to identify the cracks.
- Dismantling of moving parts – to identify the wear and tear.
- Visual inspection of wire ropes – to identify damages, corrosion, chaffed areas etc.

As the meaning of the word a thorough examination means it is a thorough examination. Therefore, the surveyor will inspect even the hard-to-reach places of the cargo lifting appliances. Therefore, make sure to arrange suitable means of access to all the areas including the hard reach areas of the cargo gears.

The limits of allowed wear down and corrosion depend upon the class requirements or the flag state requirements. These wear down and corrosion allowances are not important for a chief officer to remember, but the wear down and corrosion allowances required by the Lloyd's Register are provided below to gain additional information:

Item	Limit
Structural members of the lifting appliances	Reduction of 10% maximum at any point, based on the material thickness
Loose gear	Reduction of 5% on any diameter Reduction of 2% on any diameter of a pin in a hole
Wire ropes	5% of broken, worn or corroded wires in any length of 10 rope diameter[123]

After a successful thorough examination of lifting appliances and loose gears, a certificate or report shall be issued on the appropriate form by the competent person.

[123] This is the requirement of Lloyd's Register. The customary practice was, a rope to be discarded if more than **10%** of strands are broken in a length of **eight times the diameter** in any place of the rope

These certificates shall be kept on board for at least 2 years from the date of receipt of the next certificate.
During a thorough examination, if the competent person finds any defects, he may:

- Instruct to take out of service or
- Impose conditions of class or recommended withdrawal of class (if it is a classed item) or
- Restrict the use of the appliances, depending upon the type of the deficiency

d) Proof load testing

In accordance with the flag state requirements a proof load testing of all cargo lifting appliances shall be carried out:

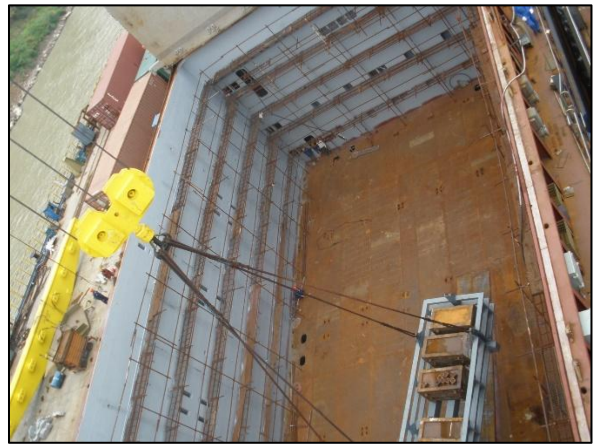
- After manufacturing or installation; or
- After any repair or modification which is likely to alter the SWL or affect it's strength; or
- At 5 yearly intervals.

Following proof loads shall be used while testing cargo gears:

- SWL up to 20t : 25% in excess of the SWL
- SWL 20t – 50t : add 5t to SWL
- SWL greater than 50t : 10% to SWL
- Hand operated pulley blocks to be proof load tested with a test weigh of 1.5 x SWL
- Various other proof loads will be used in testing loose gear depending upon the type of the loose gear.

Usually, cement blocks (with known weights) having sufficient weights are used for proof load testing, but, also water bags having the required weights can be used as an alternative to cement blocks.


Load testing for twin crane operation


Load testing for single crane operation

e) General maintenances of cargo gears to be carried out

- Refer the PMS and the manufacturer's instructions for ship specific maintenance requirements and procedures.
- Ensure the deck areas, crane/derrick machinery rooms, operating cabin and access areas are free of oil and grease.
- Machinery rooms and the controlling cabins shall be free of accumulation of water.
- Cable sealing arrangements of junction boxes, switches and terminals shall be checked frequently for water ingress.
- Make sure the SWL and the other important makings on the jibs or booms are clearly visible.
- Frequent visual inspections to be carried out to identify possible defects.
- All greasing points shall be greased with the correct type of grease periodically.
- Wires to be lubricated periodically with the correct wire rope lubricants.
- Wire ropes shall be replaced if:
  - ✓ Excessive corrosion is found or
  - ✓ Crushed badly or
  - ✓ Chaffed badly or
  - ✓ More than 10% of strands are broken in a length of eight times the diameter in any place of the rope.

- Limit switches and other safety devices which have sensors may damage very easily, therefore, need to check them frequently.
- Oil level and filters of the hydraulic cranes to be checked regularly.
- Ensure the cooling units of the hydraulically operated cranes are clean.

- Check the magnet in the oil reservoir, if a magnet is fitted, check the build-up of ferrous debris in it. Oil needs to be renewed if lot of ferrous debris is found on the magnet.
- Ensure the general condition of masts, posts, booms, jibs including attachments such as eye plates, goosenecks are in good order.
- The loose gears shall be periodically checked for:

✓ Condition
✓ Corrosion
✓ Damages
✓ Excessive wear and tear
✓ Legibility of distinguishing numbers stamped on them

- Refer to the table below for a sample maintenance requirement for a deck crane

Interval	Crane part or test	Maintenance
Daily or before taking crane into operation	Slewing gearbox	Oil level check
Every 200 operating hours or every two months	Slewing ring bearing screws	A visual inspection of the slewing ring bearing screws from the deck and inside pedestal. If any screws show the tendency to slacken, these should be tightened with a torque wrench or hydraulic tensioner as per manual.
After 200 operating hours	Slewing gearbox	First oil change
Every 500 operating hours or every 6 months	Crane house, foundation and jib welding joints	Inspection for any signs of cracks
	Parking support and jib structure resting parking support	Inspection for wear or any signs of cracks
	Hydraulic System	Check and adjust pressure as necessary for: • Feed pressure inlet • Control pressure • Pressure cut-off (overload) valve/valves
	Slewing gear and pinion	Backlash*and seals check
Every 200	Slewing gear set	Check for any leaks

operating hours or every two years		
Every 1000 operating hours or at least every year	Slewing gearbox	Oil change
3 months	Lubrication points	Greasing
6 months	Rocking test**	Testing
12 months	Crane annual thorough examination	Examination
48 months	Slewing ring bearing***studs/ screws	• All studs or screws should be tightened with a hydraulic screw tensioner or a torque wrench • If any studs or screws need replacement, MacGregor Cranes should be consulted
60 months	Hydraulic hoses inside crane house	Check for any damages
60 months	Crane five yearly thorough examination	Examination
60 months	Crane five yearly load test	Test
Every 10 years	Hydraulic hoses	Renew all hoses

* Backlash is also known as the 'play'.

** Rocking test can be done by ship's officers. This is done to ensure that slewing ring bearings are not worn. The rocking test comprises the measurement of the deflection between the crane pedestal and the rotating crane housing in the way of the slewing ring using a dial test indicator to determine the bearing clearances.

Measurements are taken at two locations on the slewing ring susceptible to the most significant bearing wear, under the jib's centre and diametrically opposite. A set of eight readings are taken with the crane pointing dead ahead, dead astern, to port and then to starboard, initially with the jib luffed to its minimum radius with no weight on the hook and then with the jib luffed to its maximum radius, the difference between the two readings giving the bearing clearance.

The readings are compared against the manufacturer's maximum permissible clearances, which will depend on the type and size of the slewing ring and bearing size[124].

[124] WEST P & I Club, Loss prevention bulletin, Crane slewing gear maintenance and rocking tests, https://www.westpandi.com/getattachment/9121a166-3d88-4ea1-841f-7839294b9e68/crane-slewing-gear-maintenance-and-rocking-tests.pdf (Last visited 19/04/2026)

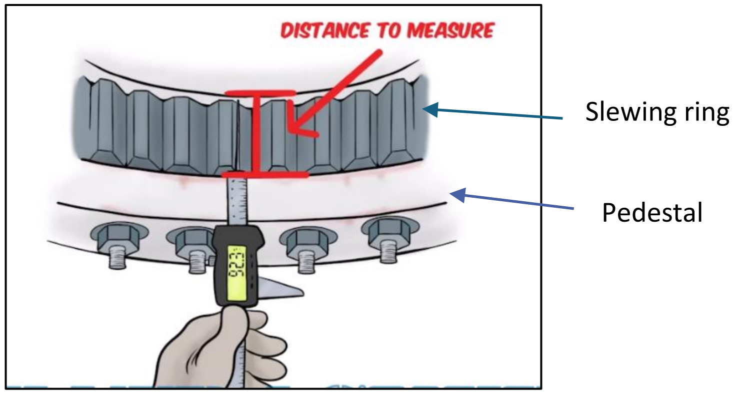


Illustration of what to measure[125]

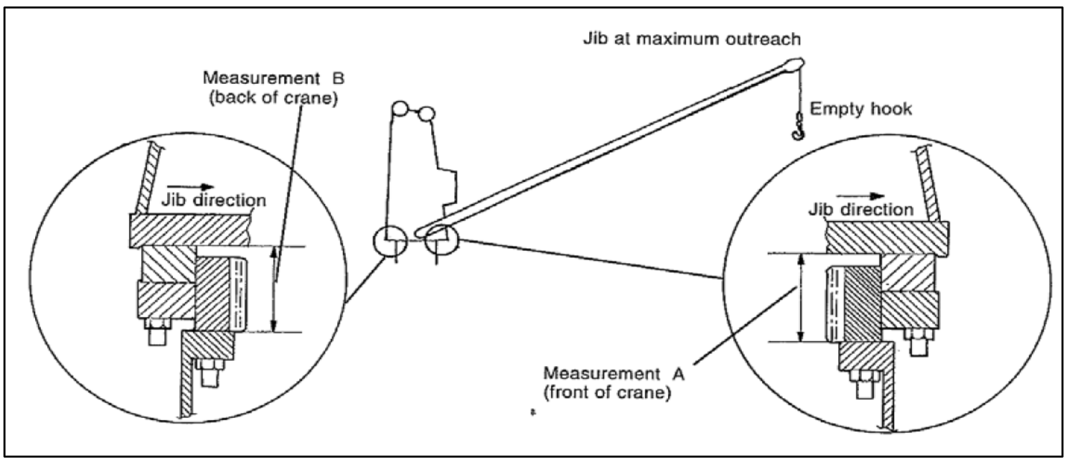


Illustration of jib positioning & measuring[126]

*** Some manufacturers recommend analysing grease samples to evaluate a slewing ring bearing condition. The general procedure is as follows:

- If grease sampling points are available, use the sampling points as per the manufacturer's instructions.
- If sample points are not available, clean the **inner or outer seal** and the surrounding areas from the sample to be taken. Generally, need to take samples from four equidistance points.
- Apply new grease into grease nipples without rotation and collect the first used grease, which will come out from the seal.

[125] Marine Tracker, https://seatracker.ru/viewtopic.php?t=58537 (Last visited 19/04/2026)
[126] Rocking test of deck crane, https://dieselship.com/deck-machinery/rocking-test-of-deck-crane?srsltid=AfmBOoqL9EVD7fqUgJsvTobpoMM2lndBn0RZV9sJxiZAlnapwPWmvtgG (Last visited 19/04/2026)

Once the sample is collected, the analysis can be done onboard or in a laboratory to get detailed and accurate results.

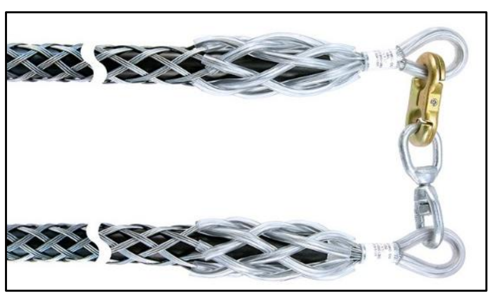
To do the analysis onboard, spread a very thin layer of sample grease on a white paper and check for steel particles under good artificial lighting conditions. Compare it with a sample of fresh grease. Send for further laboratory test if considerable amount of steel particles is present.

The maximum part per million (PPM) of Iron, Sodium, particle quantifier, Silicone etc. shall not exceed the maximum PPM allowed by the manufacturer. This can be done only through a laboratory test.

f) Procedure of changing a runner wire of a cargo crane

When changing wires, you will have to bypass limit switches and also to mark certain positions of the wire drum as reference points to make sure the new wire is fixed properly. Your ship's crane manual will provide the exact ship specific procedure of changing the wires. Below points are for your guidance only:

- Place the new wire coil on a turn table;
- Select a suitable size rope with a length equal to about four times the upper most position of the crane. This is required to detach the old thimble and to fix the new thimble;
- A nut or a ring with a diameter equal to the diameter of the wire rope (to weld the new rope to the old rope) or a wire rope pulling snake grip with a suitable size and SWL (to connect the two ropes);



Wire rope pulling snake grip[127]

- Place the jib in the rest position;
- Slack the runner wire until the cargo hook is on the deck;

[127] https://lewismfg.com/product/lsg-snake-grips/ (Last visited 02/08/2026)

- Secure the cargo hook to avoid accidental shifting;
- Take the above-mentioned rope over a suitable position of the top of the crane and tie it to the thimble end of the runner wire and take the weight;
- Detach the thimble from the crane top;
- With the aid of the rope connected, lower the thimble safely on to the deck;
- While keeping the old runner through the cargo block, cut the thimble off the old runner wire. Seizing the end is important before cutting it to avoid strands coming out;
- Weld the nut or the ring to the old runner wire;
- Weld the free end (the end without the thimble) of the new runner wire to the nut or the ring. This is done to avoid the accidental detaching of the new runner wire from the old one when heaving up. Or use the wire rope pulling snake grip to connect the two wire ropes;
- Slack the old runner wire further until about 3 to 4 turns are on the drum of the runner wire;
- Fix at least two stoppers on the runner above the drum inside the crane house;
- Remove the securing nuts of the old rope from the drum;
- Remove the stoppers and start heaving up on the runner. New wire rope will start coming though the cargo hook and through other sheeves. While doing so, the wire will move to the other end of the drum. The free end of the old runner must be coiled on the deck.;
- Grease the new wire while it is being heaved up;
- When the wire comes to the other end of the drum fix the stopper again, slack the wire and shift the turns to the initial end. This should be repeated few times;
- Continue above until the welded joint of the new & old wires go through the drum and comes out on deck;
- Then cut the new wire after seizing;
- Slack the wire again until the free end of the new wire come back to the securing position of the drum;
- Secure the new wire to the drum with the nuts;
- Secure the thimble of the new runner to the rope that was used to lower the old thimble and raise the new thimble to it's securing point;
- Take the weight of the cargo hook; and
- Try out the crane including the limit switches. Sometimes the limits may need adjusting.

g) **Procedure of changing a luffing wire of a cargo crane**

A similar procedure as mentioned above should be followed. Refer to your ship's crane manuals before the commencement of the operation.

5) **Maintenances and inspections to be carried out in cargo holds, ballast water tanks, freshwater tanks, cargo tanks and hatch covers**

Inspection intervals of ballast water tanks, freshwater tanks, cargo holds and cargo tanks may be provided by the flag administration or class. The PMS is developed taking into consideration of the requirements provided by the flag administration, class and the company. Therefore, chief officers shall adhere to the instructions provided in the PMS. The following table provides commonly practiced time intervals for ballast water tanks, freshwater tanks, cargo holds and cargo tanks inspections:

Type of ship	Areas to be inspected	Frequency
Oil & chemical tankers	Cargo tanks	Not exceeding 2.5 years
	Ballast tanks	Annually
Gas tankers	Ballast tanks, void spaces, cofferdams and cargo tanks	Annually
Bulk carriers	Cargo holds	Before loading and after unloading
	Ballast tanks	Depending upon the PMS
Container ships	Cargo holds	Depending upon the PMS
	Ballast tanks	Depending upon the PMS

a) **Inspections to be carried out in cargo tanks**

Following shall be checked when carrying out an inspection of ship's cargo tanks by the ship's crew:

- The condition of the access arrangements;
- The condition of cargo handling and monitoring equipment inside the tanks;
- The extent of sedimentation;
- Structural deformations (dents, cracks);
- The condition of the pipelines running through the tanks;
- The condition of the paint; and
- Extent of corrosion, pitting and wastage.

b) **Inspections and maintenances to be carried out on hatch covers**

Hatch covers shall be inspected and maintained as per the requirements of the PMS. This is also surveyed during annual survey as required by the International Convention on Load Lines.

Routines shall be established to perform checks during the voyage and inspections when the hatch covers are opened. Voyage checks shall consist of an external examination of the closed hatch covers and securing arrangements in anticipation of, and after, heavy weather but in any event at least once a week, weather permitting. Particular attention shall be paid to the condition of hatch covers in the forward 25% of the ship's length, where sea loads are normally greatest[128].

The following items, where provided, shall be inspected for each hatch cover set when the hatch covers are opened or are otherwise accessible on each voyage cycle, but need not be inspected more frequently than once per month[129]:

- hatch cover panels, including side plates, and stiffener attachments of opened covers for visible corrosion, cracks or deformation;
- sealing arrangements of perimeter and cross joints (gaskets, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non-return valves) for condition and permanent deformation;
- clamping devices, retaining bars and cleating for wastage, adjustment, and condition of rubber components;
- closed cover locating devices for distortion and attachment;
- chain or wire rope pulleys;
- guides;
- guide rails and track wheels;
- stoppers;
- wire, chains, tensioners and gypsies;
- hydraulic system, electrical safety devices and interlocks; and
- end and inter-panel hinges, pins and stools where fitted.

Apart from above if the hatch covers are fitted with cargo hold ventilators, make sure they can be closed weather tight, no corrosion or any damages and the wire meshes are in good condition.

[128] Refer Resolution MSC.169(79) or the latest by IMO for further details
[129] Ibid

c) Maintenances and inspections of cargo holds

- Ensure the access arrangements are in good working order along with proper safety fencing;
- Access openings shall be able to close weather (rubber beadings must be in good order. Cleats and hinges must be greased and good working condition);
- Check for the condition of corrosion and the amount of rust scale;
- Check for welding cracks, cracks on steel plates and dents;
- Check for damages made by bulldozers/grabs (on bulk carriers, general cargo ships and multipurpose ships);
- Ensure the stress monitoring sensors and water ingress detectors are in working order, if available;
- Ensure no damages to electrical cabling passing through the holds;
- Ensure no damages to fire detection and fixed firefighting systems, if available. Ensure the lines are not clogged;
- Make sure the markings and safety signs are legible;
- Check for the proper functioning of lighting system;
- Check for any dents and deformations on cell guides (on container ships);
- Ensure the cargo securing points are in good order (on container ships, general cargo ships, multipurpose ships and car carriers);
- Ensure the watertight and gas tight doors are in good working order (on car carriers);
- Ensure the internal and the external ramps are lubricated and maintained in accordance with the PMS (on car carriers);
- Make sure to lubricate the wires used for opening and closing of ramps (on car carriers);
- If the holds to be painted, depending upon the type of the vessel and the type of the cargo to be carried, you may need to take permission from charters;
  Example – On car carriers, even a paint mark is present on a tier on a brand-new car, it is considered as damage. Therefore, charterers require painting to be completed in car decks some specified days before the commencement of loading.
- Ensure the scuppers in the tween decks are not blocked;
- Ensure the holds are cleaned according to the type of the ship (Examples - Holds shall be cleaned up to grain standards when expecting to load grain cargoes on bulk carriers. When carrying cargoes such as iron ore and coal on bulk carriers, sweeping or shovelling alone may be sufficient); and
- Clean the bilges, check the strum boxes, ensure the suction is available and make sure the bilge cover is in good condition to avoid accidental falling of people into the bilge well.

d) **Potable water reception, disinfection, production and maintenances of potable water storage facilities**[130]

Portable water means fresh water that is intended for human consumption, such as drinking, washing, teeth brushing, bathing or showering; for use in freshwater recreational water environments; for use in the ship's hospital; for handling, preparing or cooking food; and for cleaning food storage and preparation areas, utensils and equipment etc[131].

The most effective means of ensuring the safety of the fresh water supply is through the use of a risk assessment and management approach that covers the whole process from loading to delivery at the tap and includes a planned maintenance system. All of the information gathered should be used to develop a Fresh Water Safety Plan (FWSP), particularly for ships with a complex system, which could be incorporated into the ship's planned maintenance system. A FWSP should be based on the following format:

- System assessment and hazard analysis (including an assessment of source water loaded on to the ship);
- Management plan and control measures (the selection and operation of appropriate treatment processes);
- Monitoring and corrective action system in accordance with the FWSP (the prevention of contamination/re-contamination during storage and distribution).

Control measures (treatments) will be influenced by the quality of the source water. In the event of potable water becoming unfit for human consumption then the tank(s) and distribution system should be drained, super-chlorinated and flushed as described under the heading of 'Maintenance of water systems' below.

Fresh Water Loading and Supply Arrangements

Fresh water obtained from shore mains supply or water barge should be transferred by a designated freshwater hose. Hoses should be durable, with a smooth, impervious lining, and equipped with fittings, including adapters, to permit connection to the shore potable water hydrants and filling connections to prevent their use for loading other liquids. Hoses designated to load fresh water should be:

- Clearly marked (generally coloured blue);
- Stowed in a locker clear of the deck;

[130] Refer MSN 1845, Amendment 2, MCA, UK or the latest for further details

[131] For further details refer the Guide to Ship Sanitation, 2011, 3rd edition or the latest by WHO

- Drained and capped at both ends after use; and
- Flushed through and discharged to waste before loading.

Often ships use quayside hoses, in which case a designated crew member should ensure that such hoses are in good condition and that they are routinely disinfected, safely stowed and capped in a clean environment.

Every potable water tank should have a filling line to which a hose can be attached. This line should not be cross contaminated by connection to any line of a non-potable water system. Each line should be clearly identified as such and painted blue with a screw cap or plug fastened by a short chain so that the cap does not touch the deck when hanging free.

Disinfection

There should be no facility for by-passing primary automatic disinfection systems. Automatic disinfection systems should have a fail-safe control arrangement with an audible/visual automatic alarm to prevent the passage of water in the event of any malfunction. The power supply required to operate the alarm should be independent of the disinfection unit power supply. Disinfection methods may include:

- Chlorination;

    The UK generally accepts chlorine as a disinfectant which requires around 20 minutes contact time to react. It can be the case that shore mains water only contains low concentrations of free chlorine which may be further decreased within the ship environment. Although there is no requirement to do so, and control measures will be influenced by the quality of the source water, it is considered good practice to add chlorine as a routine when loading fresh water to a level that produces 0.2mg/L (ppm) residual free chlorine or 1.0mg/L (ppm) chloramine when chloraminated water is supplied. Chlorine should preferably be applied as a hypochlorite solution, using a commercial hypochlorinator designed for the purpose or by using an automatic chlorination unit in the ship's deck filling line. The concentration may also be achieved by the manual method using the formula contained in the WHO's "Guide to Ship Sanitation". A commercial test kit should be used to check the free chlorine or chloramine levels.

Other than chlorination, which is explained above, disinfection methods may include the following as well. Refer the manufacturer's guidance or the ship's PMS for further details.

- Silver Stabilised Hydrogen Peroxide
- Silver-coated Filter Candles
- Electro-silver Ionisation
- Ultra-violet Sterilisation
- Therman Disinfection (Calefaction)

Fresh Water from Water Making Plant

Sea water that is to be treated on ships should be taken from areas relatively free from pollution, including air pollution. Twenty miles from land is generally considered to be a safe distance but it may be in excess of the twenty miles in some cases. Judgement should be used based on a risk assessment which should include consideration of the possible effect that ship operations might have on the quality of the water intake.

The seawater inlets (sea chests) should be located forward and if possible, on the opposite side of the ship from the overboard wastewater and ballast tanks discharge outlets. Sea water should pass through suitable filters before entering the water making equipment.

The manufacturers' operating instructions should be clearly posted in the plant room and strictly followed.

By-passes should not be installed around treatment units except where necessary as part of the treatment process. There should be an adequate store of spare replacement parts particularly for any vital or fragile parts. Distillation units should indicate low range salinity levels, operational temperature levels and have an automatic discharge to waste. They should also have an alarm with trip setting or equivalent.

Any chemicals used in an injection system to a sea suction intended to prevent the growth of organisms in the ship's piping system serving water making plant should be suitable for that purpose.

High pressure distillation and reverse osmosis plants are highly effective in removing micro-organisms and chemical constituents. They can therefore be employed as a single treatment so long as they remain effective. There is therefore a need for highly reliable on-line monitoring linked to rapid management intervention. They can however be combined with the application of a low level of residual chlorine or other equivalent disinfectant. Because low pressure evaporators operate at lower temperatures, this type of plant should be fitted with an automatic disinfecting unit, generally chlorine is used, before it is pumped to the storage tanks.

Desalinated water effectively demineralises the seawater which makes it corrosive with the potential damage to lines, tanks etc. Also, the taste of desalinated water is bland and may be considered unpalatable. Appropriate stabilising and mineralising chemical treatments should therefore be applied before the water is passed into the storage tank.

Filtration

Filters should be used only where necessary as part of a purification system that includes disinfection. Terminal or tap filters often collect bacteria and accelerate its growth and for this reason their use should be discouraged unless they can be disinfected or replacement cartridges are used. Filters should be maintained or replaced according to manufacturers' instructions.

Potable Water Storage Tanks

Storage tanks should normally be sited above the inner bottom and independent of the hull and not adjacent to tanks containing oil. They should be sited and be of such dimensions that they are readable accessible to facilitate inspection, cleaning and coating.

Tanks should be clearly marked "Potable Water". They should be used in regular rotation to avoid stagnation.

Storage should normally never be less than a two-day supply. Consideration should be given to the size of the ship's complement of officers and crew, the maximum number of passengers, the time and distance between ports of call and the availability of water suitable for treatment with facilities aboard. Storage may be decreased if the water supply can be supplemented by water produced by water making plants, but only to the amount that can be reliably supplied by the water making plant.

Coating systems other than cement should be specially developed for use in potable water tanks. Manufacturer's recommendations for application and drying or curing of the coating must be followed. All items that penetrate the tank, for example bolts, pipe flanges etc. should be coated with the same product.

Distribution Systems

The fresh water distribution pumps should not be capable of being connected to any other service. The suction lines of the pumps should not be cross-connected with the piping or storage tank of any non-potable water system. Lines should not be submerged in bilge water or pass through tanks storing non-potable liquids. Overflows, vents and drains from tanks, and drains from the distribution system (including any treatment plant) should not be connected directly to sewage drains.

Potable water piping should be painted or hatched blue. If the direction of the flow is important this should be shown by means of an arrow pointing in the respective direction. Potable water outlets should be labelled **POTABLE WATER**. All non-potable outlets should be labelled **UNFIT FOR DRINKING**. If hot water piping and cold water piping run adjacent to one another, appropriate thermal insulation should be carried out.

Calorifiers and pressure tanks should be fitted with efficient circulation, avoiding dead legs and optimum conditions for bacterial growth (15°C-50°C). The risk increases where sections of the system are not kept in continuous use. To minimise the risk, a ring main system with circulation pumps in hot and cold water lines should be considered for large scale demand such as passenger ships for example.

Corrosion and scale inhibitors, if used, should be suitable for use in fresh water systems.

Maintenance of Water Systems

All elements of the fresh water production, treatment and delivery system including filters, pumps, calorifiers, pressure tanks etc. should be inspected, cleaned, flushed out or items replaced where appropriate, according to the manufacturer's instructions and the planned maintenance system. The following maintenance is recommended.

- **Fresh Water Storage Tanks**

  Persons inspecting or working in fresh water tanks should wear clean protective clothing and footwear which has not been used for any other work area and they should not be suffering from any skin infections or communicable disease.

Actions	Intervals
To be thoroughly pumped out and where necessary hosed prior to refilling.	6 monthly
To be opened up, emptied, ventilated and inspected, thoroughly cleaned, recoated as necessary, aired and refilled with clean fresh water chlorinated to a concentration of 0.2ppm free chlorine. The cleaning process should include disinfection with a solution of 50ppm chlorine.	12 monthly
The system (from machinery space to furthest outlets) should be charged with super-chlorinated fresh water at a concentration of 50ppm for 12 hours and then completely flushed out and refilled at 0.2ppm residual free chlorine.	Re-fit or dry dock
Pressure tests on all fresh water tanks. After the pressure test, the system to be thoroughly flushed with potable water.	Not exceeding five yearly.

- **Distribution Systems Maintenance**

Parts	Actions	Intervals
Filters	Clean or change	Monthly or according to manufacturer's instructions
UV exposure area	Clean	According to manufacturer's instructions
Calorifiers	To be opened up, inspected, scaled and cleaned. Before draining temperatures should be raised to 70°C for at least an hour to ensure destruction of bacteria which may have colonised the lower and cooler zone of the unit.	Periodically (general recommendation - annual inspection)
Shower heads	Particularly in accommodation that has been out of use for an extended period. Clean in a 50ppm chlorine solution.	3 monthly
FW Hoses	Flush and fill with 50ppm chlorine solution and allow to stand for at least an hour before emptying and stowage.	6 monthly or more frequent if required.

e) Testing of drinking water

There are few requirements adopted by WHO (World Health Organization) and ILO (International Labour Organization) with regards to drinking water, storage of drinking water and testing of drinking water. Refer the below requirements and Conventions and the brief description of requirements concerning fresh water as provided under each Convention and regulation.

- **International Health Regulations (IHR) 2005 by WHO**

  In accordance with the IHR 2005, The drinking water may be tested before issuing Ship Sanitation Control Exception Certificate or Ship Sanitation Control Certificate. Also, it says that under the supervision of a competent authority vessels are permitted to take water onboard.

- **MLC 2006**

  MLC 2006 states that the competent authority shall require that frequent documented inspections be carried out onboard ship, by or under the authority of the master with respect to drinking water.

- **Guide to Ship Sanitation, 3rd Edition, 2011 by WHO**

  In a nutshell, this says that;

  ✓ the ship's operator must seek assurance as to the quality and nature of the source water before taking onboard.
  ✓ the ship's master or officer responsible for taking water onboard must be responsible for ascertaining whether or not the source of the water is potable.
  ✓ ships using ports where water treatment is unreliable must carry calibrated equipment for basic testing (turbidity, pH and disinfectant residual) and ensure capacity to those disinfectant or filter to appropriate levels to provide a minimum level of safety.
  ✓ regular verification and operational monitoring of pH and chlorination can be performed by appropriately trained and competent ship staff, sampling for complex chemical and/or microbiological analysis should always be performed by well-trained professional persons who are authorized by a certified laboratory

- ✓ documentation of monitoring should be kept for assurance and analysis in the event of an incident. Documentation should be showed to the competent authority under the IHR 2005 whenever requested.

- **Guidelines for Drinking Water Quality 2008 by WHO**

  In brief, it says that;

  - ✓ the frequency of monitoring should reflect the probable rate of change in water quality. For example, monitoring of drinking-water on ships may be more frequent when the ship is new or recently commissioned, with frequencies decreasing in the light of review of results. Similarly, if the ship's water system has been out of control, monitoring following restoration of the system would be more frequent until it is verified that the system is clearly under control.
  - ✓ the port authority has responsibility for providing safe potable water for loading onto vessels. If water is suspected to have come from an unsafe source, the ship's master may have to decide if any additional treatment (e.g. hyperchlorination or filtration) is necessary.
  - ✓ independent surveillance is a desirable element in ensuring drinking-water safety on ships which may include periodic audit and direct assessment

  None of the above requirements states any time frames to test drinking water or the methods of testing. But all the regulations are very concern on providing proper quality drinking water to seafarers. Therefore, need to refer the SMS and the flag state regulations about testing methods, frequencies etc. of drinking water.

f) Inspection of ballast tanks

Following shall be checked when carrying out inspections of ship's ballast water tanks by the ship's crew:

- Existing coating condition;
- Condition of anodes (if applicable);
- Extent of corrosion, pitting and wastage;
- Condition of access arrangements;
- Condition of sounding pipes and striker plates;
- Condition of the vent pipes;
- Condition of ballasting / deballasting pipes;
- Welding cracks;
- Cracks & dents on plates;

- Ensure the lightning holes are not blocked; and
- The condition of the suction end.

6) **Maintenances and inspections of the accommodation spaces**

- Refer the PMS for ship specific maintenance procedures.
- If necessary, clean the decks after each departure from a port.
- Need to wash down the external surfaces of the accommodation if salt particles are accumulated around or if found dirty or soot dust or cargo dust is found.
- Ensure all fire doors are in proper order.
- Routinely grease all doors which are exposed to weather, ventilation flaps and ensure they are in working condition.
- Accommodation inspections to be carried out to ensure all the cabins, galley, food storage areas, common areas, toilets and alleyways are in good order and condition.
- Ensure the deck scuppers are not blocked.
- Ensure the condition of the paint outside the accommodation is in good order.
- Ensure all the weather doors are in good working order.
- Periodically check the ship's hospital to ensure it is being maintained well. Ensure the ventilation, emergency call button and the access to the hospital from outside the accommodation is in good order.
- Routinely flush the toilets which are in spare cabins and other toilets which are not used frequently. Try out the hot and cold-water systems, showers and ventilation systems frequently in these toilets as well.
- Ensure the floor tiles are in good condition without damages.
- Ensure the firefighting appliances, first aid boxes, emergency escape devices and the other similar equipment available to use in emergencies, are available and clear of obstructions.
- Ensure all notices and placards are posted in appropriate places in accordance with the company SMS and they are legible.
- Ensure the cabin muster cards (if available), muster lists and training manuals are available in appropriate places.
- Ensure all the safety, security and pollution prevention signs are in good order and legible.
- Make sure the emergency escapes are properly marked and clear of obstructions.
- Alleyways and staircases shall be clear of obstructions providing clear passages.
- **Inspection of food and catering facilities**[132]

[132] Refer MSN 1845, Amendment 2, MCA, UK or the latest for further details

The master of a ship must ensure that, not less than once a week –

- ✓ the supplies of food and drinking water on board are inspected and
- ✓ the catering department and its equipment are inspected

Above inspection may be carried out by

- ✓ the master, or
- ✓ a person authorised by the master, together with a member of the catering staff.

The master must ensure that the results of any such inspections are recorded in the official logbook of the ship.

- ✓ **Galley and pantry inspections**[133]:
  - wash basins shall be cleaned;
  - water drainage system should be in good order;
  - the range hoods, ventilation openings with wire mesh to be clean of oil;
  - ensure the garbage bins contain foot-operable lids, daily emptied to storage facilities outside the galley, and clean and disinfected;
  - Ensure the firefighting appliances, first aid boxes, fire blankets and the other equipment available to use in emergencies are available and clear of obstructions;
  - Ensure hot & cold-water systems are working in order;
  - Ensure that only portable water is supplied to the galley;
  - Cutting boards must be free of open seams or cracks and finished smoothly on all sides;
  - Raw food, especially meat, needs to be effectively separated, either physically or by time, from ready-to-eat foods;
  - If sliding doors are available, ensure the lower and upper tracks are clean; and
  - The general appearance of the galley must be in good and free of bad odours.

- ✓ **Inspections of dry provision rooms:**
  - Should be dry and cool with plus 10^0 C, preferably[134];
  - Ensure the ventilation and exhaust fans are working in order;
  - Ensure the provisions are arranged on shelves, keeping the access areas clear;
  - Randomly check whether expired food is available and whether the food is stored in such a way that it can be consumed in accordance with the expiry date;
  - Make sure the provisions are not stored against the exposed steel bulk heads or ship's side to avoid heat damage;
  - The locking devices of the provision room must be in good condition;
  - Lighting system should be in good condition; and

[133] For further details refer the Guide to Ship Sanitation, 2011, 3rd edition or the latest by WHO

[134] Ibid

- Storeroom should be clean and without any bad odours.

✓ **Inspections of cold rooms**

- Safe temperatures for cold stores are generally considered to be[135];
    - plus 5˚C or colder for chill compartments and
    - minus 18˚C or colder for freezer compartments
- ensure the temperature log is maintained by the catering staff;
- Lighting should be working in order;
- Check the condition of the door seals;
- Ensure that the food is stored in such a way to allow air circulation;
- Trapped alarm must be working in order, and the watertight integrity of the activating button must be checked;
- The door opening devices from inside the cold room must be in good condition; and
- Storeroom should be clean and without any bad odours.

- Routinely inspect the condition of the illumination in and around the accommodation.
- Routinely clean the bulk heads.
- Routinely clean the deck heads, especially in the common areas (such as ship's office, mess rooms etc.) as the cigarette smoke dust deposits on the deck head making it discolour.
- Ensure the mess rooms are daily cleaned; garbage bins and ash trays are daily emptied.
- Ensure the blind folders of port holes in common areas are in good condition.
- Ensure the objects and equipment which are not commonly used are kept secured/lashed against accidental shift during bad weather conditions.

7) Guidelines for periodic servicing and maintenance of lifeboats, launching appliances and on-load release gear

Authorized persons to conduct '*Annual thorough examinations and operational tests*' AND '*Five yearly thorough examination, overhaul and overload operational tests*'[136]

Above two shall be conducted by **certified personnel** of either by the manufacturer or by an authorized service provider.

[135] Ibid

[136] Refer Resolution MSC.402(96) of IMO or the latest for further details

Weekly and monthly inspections, and routine maintenance which are required by the equipment manufacturer, should be conducted under the **direct supervision of a senior ship's officer**.

Maintenance and service

Maintenance manuals issued by equipment manufacturer shall be available onboard and all the services and maintenance carried out shall be in accordance with such maintenance manuals only[137].

Annual thorough examinations and operational tests[138]

a) Lifeboat, freefall lifeboat, rescue boats, fast rescue boats:

i. All items undergo weekly/monthly inspections form the first part of the annual inspection;
ii. Reviewing of maintenance records made by the ship staff;
iii. Visual inspection of the lifeboat structure, fender/skates and loose equipment;
iv. Engine & propulsion system;
v. Sprinkler and air supply system (if fitted);
vi. Manoeuvring system;
vii. Power supply systems;
viii. Bailing system;
ix. Fender/skate arrangements;
x. Rescue boat righting system, where fitted; and
xi. Release gear.

b) Operational test of on-load release function (for davit-launched lifeboats and rescue boats):

i. Position the lifeboat for on-load release. The boat should be just touching the water with the weight on the falls. Never drop the boat from above the water surface;
ii. Operate the on-load release gear;
iii. Reset the on-load release gear; and

[137] Refer Resolution MSC.402(96) of IMO or the latest for further details
[138] Ibid

iv. Examine the release gear and hook fastening to ensure that the hook is completely reset, and no damage has occurred.

c) Operational test of off-load release function (for davit-launched lifeboats and rescue boats):

i. Position the lifeboat for off-load release (waterborne);
ii. Operate off-load release gear;
iii. Reset the on-load release gear; and
iv. Recover the lifeboat to the stowed position and verified ready for launching in an emergency

d) Operational test of free-fall lifeboat release function:

i. Engage the simulated launching arrangements as specified in the manufacturer's operating instructions;
ii. If required to be onboard the lifeboat, the operator should be properly seated and secured in the seat;
iii. Operate the release mechanism to release the lifeboat;
iv. Reset the lifeboat in the stowed configuration;
v. Repeat procedures (ii) to (iv) above, using the back-up release mechanism, when applicable;
vi. After ensuring that the boat is safely re-stowed remove the simulated launching arrangements; and
vii. Verify that the lifeboat is in the ready to launch stowed configuration.

e) Davit-launched life raft automatic release function:

i. Manually release the hook with a load of 150 kg on the hook;
ii. Automatically release the hook with a dummy weight of 200 kg on the hook when it is lowered to the ground and
iii. Examine the release hook and hook fastening to ensure that the hook is completely reset and no damage has occurred.

f) Launching appliances of lifeboats, freefall lifeboats, rescue boats, fast rescue boats & life rafts:

Following will be checked for satisfactory condition & operation;

i. Corrosion, misalignments, deformations and excessive free play of launching devices;
ii. Wires and sheaves, possible damage such as kinks and corrosion;
iii. Lubrication of the wires, sheaves and moving parts; and
iv. If applicable:
    - Functioning of limit switches;
    - Stored power systems;
    - Hydraulic systems; and

v. For winches:
    - Inspect the braking system in accordance with the winch manual;
    - Replace brake pads, if necessary;
    - Winch foundation; and
    - If applicable;
        - ✓ Remote control system; and
        - ✓ Power supply system

g) Winches of launching appliances (Dynamic winch break test):

For winches of the launching appliances for lifeboats, freefall lifeboats, rescue boats, fast rescue boats & life rafts annual operational testing shall be done **by lowering the empty boat or equivalent weight**. When the boat has reached its maximum lowering speed and before the boat enters the water, the brake should be abruptly applied.

For release gear of lifeboats (including free-fall lifeboats), rescue boats, fast rescue boats and life rafts, the following shall be thoroughly examined for satisfactory condition and operation after the annual operational test of the winch brake with the empty boat or equivalent load[139]:

- operation of devices for activation of release gear;
- excessive free play (tolerances);
- hydrostatic interlock system, where fitted;
- cables for control and release; and
- hook fastening.

[139] Refer MGN 560 (M), Amendment 2 of MCA, UK or the latest for further details

Five yearly thorough examination, overhaul and overload operational tests[140]

A) **Operational tests and overhaul at five-year intervals of release gear for lifeboats, freefall lifeboats, rescue boats, fast rescue boats and life rafts** shall include:
   - Dismantling of hook release units;
   - Examinations with regards to tolerances and design requirements;
   - Adjustment of release gear system after assembly;
   - Operational tests as stated in (b), (c), (d) and (e) above, as applicable, but with a load equal to 1.1 times the weight of the survival craft or rescue boat and it's full complement of persons and equipment; and
   - Examinations of vital parts with regard to defects and cracks.

B) **Winches of launching appliances (Dynamic winch break test)**

   At least once every five years rescue boats and lifeboats shall be lowered when loaded with weights to simulate 1.1 times weight of the survival craft or rescue boat and its full complement of persons and equipment or with an equivalent load.

It is worth to note the following which are mentioned in MGN 560 (M), Amendment 2 issued by MCA, UK with regards to 5-year load tests:

- The test is to be carried out by the authorised service provider with a ship's officer in charge (OIC) and witnessed by an MCA surveyor or other person appointed by the MCA.
- The OIC is in charge of the test at all times and should brief those carrying out the test on what is required.
- The surveyor or other person appointed by the MCA should take no part in the test and should not be the OIC.
- All such tests are to be planned in advance. All routine maintenance and records are to be updated before the test.
- Lifeboats must be weighed before testing to confirm that the weight remains as previously recorded and that it is no more than the certificated production test weight.
- Load test can be done by means of two methods as explained below:

[140] Refer Resolution MSC.402(96) of IMO or the latest for further details

First method – testing the boat and the davit together

Boats should be loaded with weights amount to a load of 1.1 times the weight of the survival craft or rescue boat and its full complement of persons and equipment or with an equivalent load. The weights shall be distributed around the boat equally. This is to be done at the embarkation position of the boat. Usually, lifeboat will be filled with water bags to achieve the above weight.

Using water bags during load test[141]

If the embarkation position is not the stowed position, bring the boat alongside using bowsing tackle (this should be done from the ship, not from the boat as usually done), remove tricing pendants and do the loading as above.

The method of loading weights must be such that no-one enters the boat once the 70% load is reached.

If this cannot be achieved, then the weight of the boat must not be taken by the falls during loading but by a crane (of capacity at least 2.2 times the loaded weight of the boat) and a spreader bar. Once loaded, the OIC should agree the test procedure with the attending authorised person, and this subsequently explained to the accredited service personnel prior to the test. The attending surveyor should take no further part in the proceedings until the test is complete.

Once ready, the boat is to be lowered lifting the brake fully to enable the boat to reach maximum speed on the centrifugal brake. The mechanical brake is then applied suddenly and the test paused to ensure that the position of the boat is held at least 1 m above the water. If space permits, then it is repeated before the boat reaches the water. The boat is then lowered until the keel of the boat is just touching the water.

[141] https://doowin.cc/load-testing-services/lifeboat-davit-testing/ (Last visited 10/07/2026)

On no account should the boat be dropped from above the water surface and it is preferred by the MCA for alternative methods of testing the on-load release function using mechanical or hydraulic load simulation approved by the Original Equipment Manufacturer (OEM).

Personnel can then enter the boat from another tender and override the release mechanism to release the boat to test that both hooks release simultaneously under load. Only the minimum operating crew should enter the boat to operate the release mechanism.

Once released, the weights may be removed from the boat. **Under no circumstances should the ship's davits be used to lift the loaded boat.**

If the unloaded boat is to be raised on the falls, the hooks should be reset and the falls attached. The boat should be raised just clear of the water and the hook and interlock mechanism double checked and the secure location of the falls confirmed prior to full recovery. No persons should be in the boat while it is being hoisted on the falls until the hook mechanisms have been thoroughly examined by a competent person.

Once the boat is stowed and secured on the vessel, the boat and davit should be inspected by the authorised person for any signs of test damage or straining (Non-destructive examination is strongly recommended at this point). The results of the test should be recorded on a test certificate produced by the competent persons and signed by the witnessing authorised person.

Second method – testing boat and davit separately

Separate tests are made of the davit and winch using weights, and a spreader-bar suspended from the falls. A load equivalent to 110 % of the weight of the boat when fully loaded with persons, equipment and stores should be applied before the dynamic test is applied to the davits, wire and winch as in combined test mentioned above.

The purpose of the test is to provide assurance that if the boat is required in an emergency, it can be used in its fully loaded condition without risk to those on board.

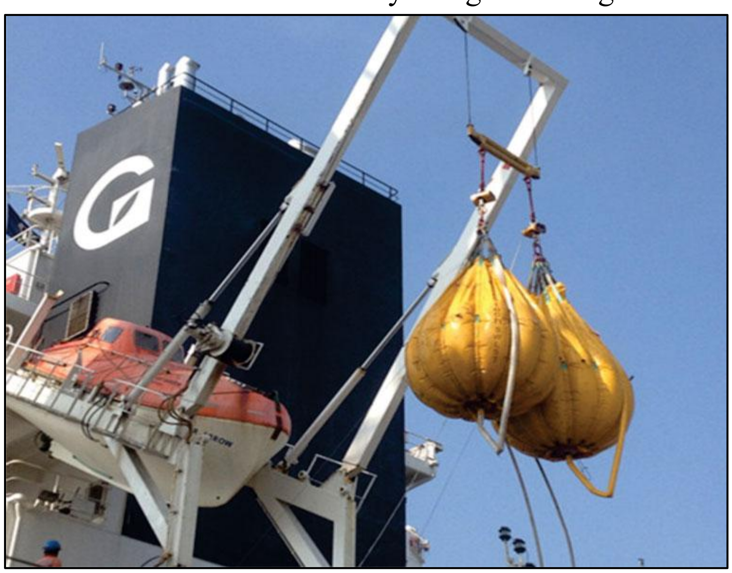
This also can be done by using water bags as shown below:

Testing of lifeboat falls with water bags[142]

With this method the boat is tested by suspending it from a spreader-bar and it is loaded to a weight equivalent to the peak load established during one dynamic test.

Five yearly load tests – freefall lifeboats

Davits of the Freefall lifeboats also can be tested by using water bags as shown below.



Load testing of a free-fall lifeboat falls[143]

[142] https://www.nauticexpo.com/prod/doowin-underwater-lift-bags-water-weight-bags/product-196283-550911.html (Last visited 10/07/2026)

Reports and Records[144]

All reports and checklists should be correctly completed out and signed by the person who carries out the inspection and maintenance work and should also be signed by the company's representative or the ship's master.

Records of inspections, servicing, repairs and maintenance should be updated and filed on board the ship.

When repairs or servicing are completed, a statement confirming that the lifeboat arrangements remain fit for purpose should be issued by the authorised service provider.

Acceptable Equivalence to the 110% Dynamic Test[145]

If, for operational reasons, the dynamic test is not practicable, the MCA will accept the testing of lifeboats/rescue boats and davits separately, but this must be agreed in consultation with the lead surveyor for the vessel, and in accordance with the policy described below. The alternative method acceptable to the MCA is where:

- the hook release is tested under a 110 % static-load using a hydraulic-ram (not required on single hook systems used in combination with a painter),
- the lifeboat/rescue boat is statically load-tested ashore by suspending the loaded boat momentarily from its hooks (using a static-load representing the peak load that would have been experienced in a 110 % dynamic test, see details below), and
- the davit, fall wire, sheaves and winch are tested to 110 % dynamically with the use of a spreader-bar (only necessary on double-head davits) and weights.

Inspection of lifeboat embarkation ladders

Embarkation ladders used for lifeboats and life rafts shall be inspected regularly and ensure they are readily available for immediate use. Following should be considered during inspections;

- length should be sufficient to reach the water level during the lighted seagoing conditions and trims;
- rusting and corrosion of the shackles, deck eyes at the securing point of the ladder on the deck;

[143] https://my.shmgroup.com/services-lifeboats.php (Last visited 10/07/2026)
[144] Refer Resolution MSC.402(96) of IMO or the latest for further details
[145] Refer MGN 560 (M), Amendment 2 of MCA, UK or the latest for further details

- damages or stiffness of the side ropes including the seizing;
- damages or cracks on the steps including the anti-slippiness; and
- possibility of deploying the ladder by a single person in an emergency.

8) Maintenance and inspections of fixed CO_2 fire-extinguishing systems

Mainly there are two types of fixed CO_2 fire-extinguishing systems, low-pressure systems and high-pressure systems. A **low-pressure CO_2 system** stores carbon dioxide in a large, refrigerated tank at approximately 300 psi (pounds per square inch) and -20°F. The CO_2 is distributed through a network of pipes to nozzles placed in the protected area[146]. A **high-pressure CO_2 system** stores CO_2 in individual cylinders at a pressure of approximately 850-900 psi at room temperature. Each cylinder is connected to a discharge system that releases CO_2 when activated[147].

Make sure the exhaust fan is working before entering a CO_2 room whether it is for inspections or for maintenance.

Monthly inspections[148]

At least every 30 days a general visual inspection should be made of the overall system condition for obvious signs of damage, and should include verification that:

- all stop valves are in the closed position;
- all releasing controls are in the proper position and readily accessible for immediate use;
- all discharge piping and pneumatic tubing is intact and has not been damaged;
- all high-pressure cylinders are in place and properly secured; and
- the alarm devices are in place and do not appear damaged.

In addition, on low pressure systems the inspections should verify that:

- the pressure gauge is reading in the normal range;
- the liquid level indicator is reading within the proper level;
- the manually operated storage tank main service valve is secured in the open position; and
- the vapour supply line valve is secured in the open position.

[146] https://firesystems.net/2025/02/01/low-pressure-vs-high-pressure-co%E2%82%82-fire-suppression-systems-key-differences-choosing-the-right-one/ (Last visited 13/08/2026)
[147] Ibid
[148] Refer MSC.1/Circ.1318/Rev.1 by IMO or the latest for further details

Annual inspections[149]

The following minimum level of maintenance and inspections should be carried out in accordance with the system manufacturer's instructions and safety precautions:

- ensure that all the CO_2 floodable areas can be closed gas tight and no modifications made;
- CO_2 cylinders shall be inspected for any signs of damage, rust or loose connections;
- cylinders that are leaking, corroded, dented or bulging should be hydrostatically retested or replaced;
- piping should be visually inspected to check for damage, loose supports and corrosion;
- nozzles should be inspected to ensure they have not been obstructed;
- the manifold should be inspected to verify that all flexible discharge hoses and fittings are properly tightened; and
- all entrance doors to the protected space should have warning signs, which indicate that the space is protected by a fixed CO_2 system and that personnel should evacuate immediately if the alarms sound. All remote releasing controls should be checked for clear operating instructions and indication as to the space served.

Minimum recommended maintenance[150]

At each intermediate, periodical or renewal survey (refer the latest edition of Survey Guidelines under the Harmonized System of Survey and Certification) in cargo ships, the following maintenance should be carried out:

- **all high-pressure cylinders** and pilot cylinders should be weighed to confirm that the available charge in each is above 90% of the nominal charge, if not should be refilled. The liquid level of **low-pressure storage tanks** should be checked to verify that the required amount of CO_2 to protect the largest hazard is available;
- the hydrostatic test date of all storage containers should be checked. **High-pressure cylinders** should be subjected to periodical tests at intervals not exceeding 10 years:
    - ✓ At the 10-year inspection, at least 10% of the total number provided should be subjected to an internal inspection and hydrostatic test;
    - ✓ If one or more cylinders fail, a total of 50% of the onboard cylinders should be tested.
    - ✓ If further cylinders fail, all cylinders should be tested;
    - ✓ Before the 20-year anniversary and every 10-year anniversary thereafter, all cylinders should be subjected to a hydrostatic test;
    - ✓ Flexible hoses should be replaced at the intervals recommended by the manufacturer and not exceeding every 10 years;

[149] Refer MSC.1/Circ.1318/Rev.1 by IMO or the latest for further details

[150] Ibid

- ✓ When cylinders are removed for testing, the cylinders should be replaced such that the quantity of fire-extinguishing medium continues to satisfy the requirements; and

- the discharge piping and nozzles should be tested to verify that they are not blocked. The test should be performed by isolating the discharge piping from the system and flowing dry air or nitrogen from test cylinders or suitable means through the piping.

At each renewal survey (refer the latest edition of Survey Guidelines under the Harmonized System of Survey and Certification) in cargo ships, the following maintenance should be carried out by service technicians/ specialists trained to standards accepted by the Administration:

- where possible, all activating heads should be removed from the cylinder valves and tested for correct functioning by applying full working pressure through the pilot lines.

  In cases where this is not possible, pilot lines should be disconnected from the cylinder valves and blanked off or connected together and tested with full working pressure from the release station and checked for leakage.

  In both cases this should be carried out from one or more release stations when installed. If manual pull cables operate the remote release controls, they should be checked to verify the cables and corner pulleys are in good condition and freely move and do not require an excessive amount of travel to activate the system;

- all cable components should be cleaned and adjusted as necessary, and the cable connectors should be properly tightened. If the remote release controls are operated by pneumatic pressure, the tubing should be checked for leakage, and the proper charge of the remote releasing station pilot gas cylinders should be verified. All controls and warning devices should function normally, and the time delay, if fitted should prevent the discharge of gas for the required time period; and

- after completion of the work, the system should be returned to service. All releasing controls should be verified in the proper position and connected to the correct control valves. All pressure switch interlocks should be reset and returned to service. All stop valves should be in the closed position.

Five-year service[151]

At least once every five years, internal inspection of all control valves should be performed.

[151] Refer MSC.1/Circ.1318/Rev.1 by IMO or the latest for further details

9) **Gangway and accommodation ladder requirements and maintenance**

Gangways should be carried on ships of 30 metres in length or over and accommodation ladders must be carried on ships of 120 metres in length or over[152]. Gangway means a portable device, but the accommodation ladder means an integral part of a ship. Ensure the following are complied with while rigging and after rigging a gangway or an accommodation ladder.

- Gangway or the accommodation ladder and the access areas should be clean and clear of any slippery items/materials;
- Gangway or the accommodation ladder area must be sufficiently lit during dark hours;
- A lifebuoy equipped with a self-igniting light and a buoyant lifeline should be available;
- Stanchions and the net should be rigged properly. The heights of the stanchions should be at least one metre;
- Make sure the ropes are sufficiently tight, if ropes are used instead of rigid handrails;
- It should be clear of obstructions on the pier;
- Always keep the angles of inclination of a gangway or accommodation ladder within the limits for which it was designed;
- After ringing the gangway or the accommodation ladder, it should be checked by a competent person[153];
- The duty officer must ensure that the gangway or the accommodation ladder is adjusted as per the change of ship's draught or tidal levels;
- Ensure the ISPS requirements are complied with at the gangway or the accommodation ladder; and
- If a safe means of access is provided by the terminal, still it is the responsibility of the master to ensure it meets these standards.

Marking[154]

Each accommodation ladder or gangway should be clearly marked at each end with a plate showing the restrictions on the safe operation and loading, including the;

- maximum and minimum permitted design angles of inclination;
- design load; and
- maximum load on bottom end plate, etc.

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[152] Refer the latest edition of Code of Safe Working Practices for Merchant Seafarers, MCA, UK for further details

[153] 'Competent person' means someone who has sufficient training and experience or knowledge and other qualities that allow them to carry out the work in hand effectively and safely. The level of competence required will depend on the complexity of the situation and the particular work involved - Ibid

[154] Refer MSC.1/Circ.1331/Rev.1, IMO or the latest for further details

Positioning[155]

- Gangways should not be used at an angle of inclination greater than 30^0 from the horizontal and accommodation ladders should not be used at an angle greater than 55^0 from the horizontal, unless designed and constructed for use at angles greater than these and marked as such; and
- Gangways should never be secured to a ship's guardrails unless they have been designed for that purpose. If positioned through an open section of bulwark or railings, any remaining gaps should be adequately fenced.

Maintenance[156]

- Accommodation ladders and gangways, including associate winch and fittings, should be properly maintained and inspected at appropriate intervals as required by SOLAS regulation III/20.7.2, in accordance with manufacturers' instructions. Additional checks should be made each time the accommodation ladder and gangway is rigged, looking out for signs of;
  - ✓ distortion,
  - ✓ cracks and
  - ✓ corrosion.

- Bent stanchions should be replaced or repaired and guard ropes should be inspected for wear and renewed where necessary;
- Moving parts should be free to turn and should be greased as appropriate;
- The lifting equipment should be inspected, tested and maintained, paying careful attention to the condition of the hoist wire. The wires used to support the means of embarkation and disembarkation should be renewed, when necessary, as required by SOLAS regulation II-1/3-9;
- Arrangements should also be made to examine the underside of gangways and accommodation ladders at regular intervals;
- All inspections, maintenance work and repairs of accommodation ladders and gangways should be recorded in order to provide an accurate history for each appliance. The information to be recorded appropriately on board should include the:
  - ✓ date of the most recent inspection,
  - ✓ name of the person or body who carried out that inspection,
  - ✓ due date for the next inspection and

[155] Refer MSC.1/Circ.1331/Rev.1, IMO or the latest for further details
[156] Ibid

- ✓ dates of renewal of wires used to support the embarkation and disembarkation arrangement.

- The safety net and/or side net should be properly stored in ventilated places avoiding sunlight and chemical contamination. The safety net and/or side net should be checked and maintained regularly and replaced if found necessary.

Examination and operational tests[157]

Accommodation ladders

The following items should be thoroughly examined during annual surveys required by SOLAS regulations I/7 and 8 and checked for satisfactory condition of the accommodation ladder:

- steps;
- platforms;
- all support points such as pivots, rollers, etc.;
- all suspension points such as lugs, brackets, etc.;
- stanchions, safety pins, rigid handrails, hand ropes and turntables, side nets and their securing points;
- davit structure, wire and sheaves, etc.; and
- any other relevant provisions stated in these Guidelines.
- At every five-yearly survey, upon completion of the examination required above, the accommodation ladder should be statically tested with the specified maximum working load of the ladder.

Gangway

- The following items should be thoroughly examined during annual surveys required by SOLAS regulations I/7 and 8 and checked for satisfactory condition of the gangway:
  - ✓ treads;
  - ✓ side stringers, cross-members, decking, deck plates, etc.;
  - ✓ all support points such as wheel, roller, etc.;
  - ✓ stanchions, safety pins, rigid handrails, hand ropes; side nets and their securing points; and
  - ✓ any other relevant provisions stated in these Guidelines.

[157] Refer MSC.1/Circ.1331/Rev.1, IMO or the latest for further details

- At every five-yearly survey, upon completion of the examination required above, the gangway should be statically tested with the specified maximum working load of the gangway.

Winch

- During annual surveys required by SOLAS regulations I/7 and 8, the following items should be examined for satisfactory condition:
  - ✓ brake mechanism including condition of brake pads and band brake, if fitted;
  - ✓ remote control system; and
  - ✓ power supply system (motor).

- At every five-yearly survey, upon completion of the examination required above, the winch should be operationally tested by raising and lowering the unloaded accommodation ladder.

Tests

The loads used for the five yearly tests mentioned above should be:
- the design load; or
- the maximum operational load, if this is less than the design load and marked on the gangway plate; or
- the load nominated by the shipowner or operator only in those cases where the design load or maximum operational load is not known (e.g. for accommodation ladders or gangways which are provided on board ships constructed prior to 1 January 2010).

The tests should be carried out with the load applied as uniformly as possible along the length of the accommodation ladder or gangway. The ladder or gangway should be horizontal position, and the accommodation ladder should be suspended by the wire(s) and supported by the winch.

Application of weight uniformly along the length of a gangway during a five yearly test[158]

10) Pilot transfer arrangements

Following requirements will be enforced by;

- 1st January 2028 if the pilot transfer arrangements are installed on or after 1st January 2028
- the first survey on or after 1st January 2029 for pilot transfer arrangements installed before 1st January 2028

But MSC.1/Circ.1690 (Issued on 5th September 2025) requires voluntary early implementation of these amendments by flag Administrations, prior to their entry-into-force dates

Marking, tagging and documentation requirements

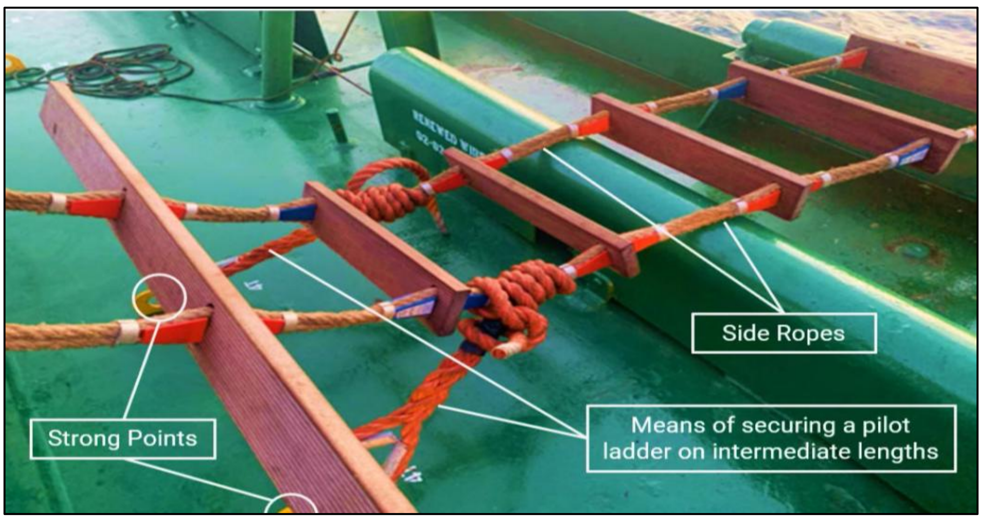
- Manropes shall be tagged or permanently marked by manufacturers with information regarding the manufacturer, manufacture date, and approval.

158 https://www.uniquegroup.com/case-studies/five-yearly-overload-test-of-gangways-and-pilot-ladders-in-singapore/ (Last visited 01/05/2026)

- Strong points (Positions available to secure the ladder. Refer the figure below) and shackles shall have breaking strength or equivalent safe working load (SWL) clearly and permanently marked.
- Documentation of the conformance of the strong points, shackles and securing ropes shall be maintained on board and available for inspection purposes.

Securing pilot ladders at intermediate lengths

There shall be a means of securing a pilot ladder at intermediate lengths, which is capable of securing the ladder to strong points on decks by gripping each set of side ropes without any slippage.



Means of securing at intermediate lengths[159]

Approval requirements

- Pilot transfer arrangements installed on or after 1 January 2028 shall be approved by the Administration.
- Regardless of the installation date, pilot transfer arrangements shall be (re)approved by the Administration following any repair, alteration, or modification.
- Means of securing at intermediate lengths, and manropes must be type-approved by the Administration and recorded in ship's safety certificate.

[159] https://www.rivieramm.com/news-content-hub/imo-updates-pilot-transfer-arrangements-to-improve-safety-86406 (Last visited 22/07/2026)

Maintenance of plot transfer arrangements

- Instructions for care, maintenance, inspection, and stowage of pilot ladders, manropes, and associated equipment shall be provided and kept on board.
- Pilot transfer arrangements shall be inspected by a responsible shipboard officer before and after each use, and thoroughly every three months.
- A maintenance plan shall be developed and made available on board. The plan shall include, among other elements:
  - ✓ a checklist;
  - ✓ a schedule for periodic inspection and maintenance;
  - ✓ maintenance and repair instructions;
  - ✓ a list of sources for spare parts or replacement items; and
  - ✓ documentation for recording inspections and maintenance activities.
- Repair or replacement of pilot ladder steps or spreader steps is prohibited.
- At least one spare set of a pilot ladder and manropes shall be provided onboard. The spare set will be also recorded in relevant SOLAS safety certificates.
- Pilot ladders and manropes, including spares, shall be replaced with new ones under the following conditions:
  - ✓ When not complying with the performance standards; and
  - ✓ Upon reaching the earlier of 30 months from the date of being put into service or 36 months from the date of manufacture.

Familiarization training

Shipboard personnel involved in the inspection, maintenance, installation, or operation of pilot transfer arrangements shall receive familiarization training appropriate to their assigned duties.

11) Paint and flammable liquid lockers

The paint locker on a vessel is the **ONLY** place to store paint and related products. This space is approved for this use and is protected by fixed fire extinguishing equipment[160]. Spaces used to store paint and flammable materials are required to have fire extinguishing system as below:

[160] https://safety4sea.com/lessons-learned-ship-store-inventories-are-important-tools-for-quality-vessel-management/ (Last visited 25/07/2026)

- if the deck area is $4m^2$ or more shall be provided with a fixed fire-extinguishing system enabling the crew to extinguish a fire from outside the space.
- If the deck area is less than $4m^2$, portable carbon dioxide or dry-powder fire extinguishers may be accepted in lieu of fixed installations.

Therefore, paint and related products shall not be stored in any other places onboard a ship. During inspections of the paint locker ensure that;

- only the paints and associated flammable liquids are stored;
- the firefighting systems are in place;
- all the containers containing paint and other flammable liquids are sealed and stowed properly;
- the ventilation system is working in order;
- no cracks or damage on the fireproof casings of the lights;
- used or contaminated cotton rags are not in the locker; and
- the locker is neat and tidy.

If any hot work to be carried out in or close to a paint locker (Ex – in a dry dock) paints and flammable liquids in the locker must be relocated to an approved safe place. Consult the dock authority and see the viability of keeping them ashore or should be moved to an approved place onboard.

12) Tank vent head inspections

Vent heads are fitted to tanks due to two reasons;

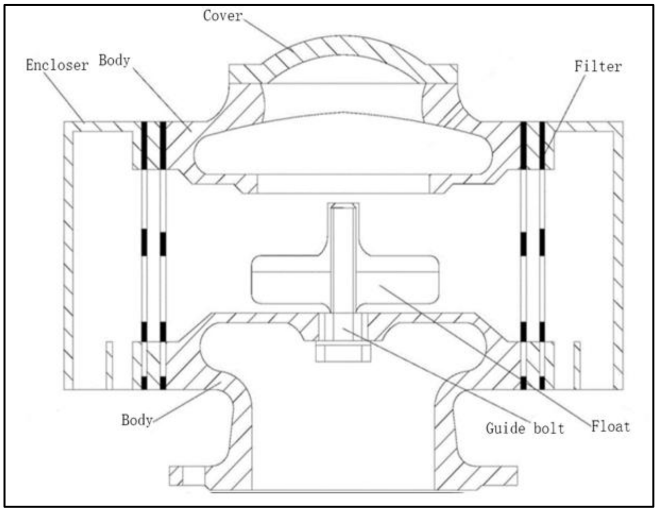
- to release air or liquid from the tanks to prevent over pressurisation during filling; and
- to avoid building up a vacuum during emptying.

These vent heads are weathertight, i.e. vent heads have a mechanism to prevent outside water going into the tanks.

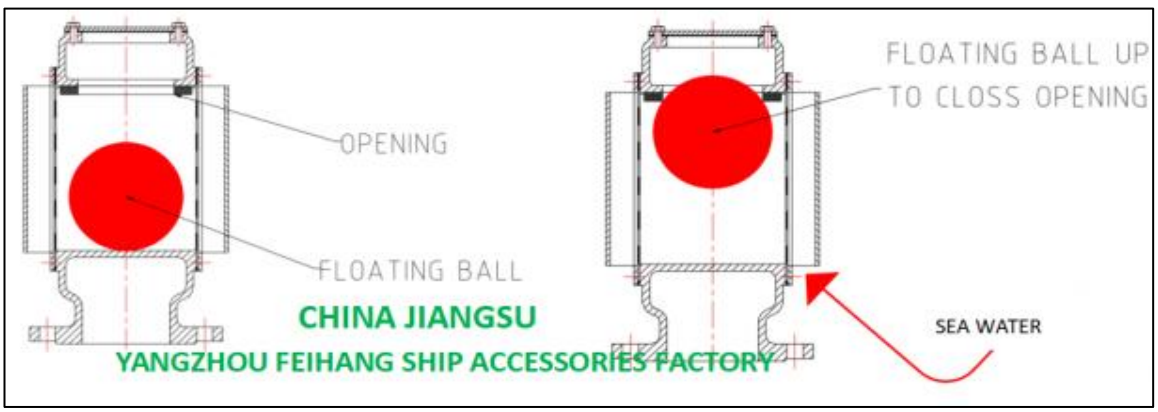
Therefore, these vent heads must be inspected regularly to ensure the objectives of having the vents are achieved and the weathertightness is maintained. Marshall Island Administration requires to **open and inspect** these vent heads every three (3) months[161] on their flagged ships. Refer the regulations of the vessel's flag state and the PMS for ship specific inspection periods.

[161] Refer Marine Safety Advisory No. 13-17 or the latest for further details

Vent heads may have different means of constructional arrangements as illustrated in the two figures below:



Vent head with a disc type of float[162]



Air vent with a ball type float[163]

Following shall be checked during an inspection:

- ensure the float is free;
- ensure the gasket is in good condition;
- ensure no rust and dirt inside;
- guiding pin/bolt in good condition;
- wire mesh should be in good condition; and
- the general condition of the vent heads should be in good condition.

162 https://en.hiseamarine.com/products/ballast-tank-air-vent-head.html (Last visited 27/07/2026)
163 https://www.fh-marine.com/sale-41419887-box-type-ball-float-air-vent-head-for-fore-peak-tank-body-carbon-steel-hot-dip-galvanizing.html (Last visited 27/07/2026)

13) Inspections of booby hatches

Booby hatches on the deck provides access to cargo holds and plays a major role in making a vessel weathertight. Following shall be ensured during the periodical inspections of booby hatches;

- gaskets for any damages and closing weather tight;
- safety pins must be in place along with the securing chain;
- hinges must be in good condition allowing a smooth opening and closing;
- no damages or cracks on the underside steps;
- securing devices must be in good condition; and
- markings on the booby hatches should be clearly legible.

SHIP'S STABILITY

1) How to manually check whether a vessel is complying with the stability criteria

A flag state may have different stability criteria than specified by the Intact Stability Code. Therefore, a chief officer needs to refer the ship's approved stability book to identify the stability criteria that the vessel is to be complied with.

At the same time, it is a usual practice that the vessel's stability book provides self-explanatory notes showing how to calculate her stability and how to evaluate the seaworthiness of her.

Generally, follow the below mentioned procedure in manual evaluating the seaworthiness of a vessel:

- By means of sounding tables, calculate the weight of ballast water, fresh water and the fuel oil onboard. Take the LCG, VCG and the FSM of these tanks from stability book, tank arrangement plans etc.;
- Take the light ship displacement, light ship KG and the light ship LCG from the stability book;
- Calculate the weight of cargo in each hold. Following formula to be used if the shipper has provided only the stowage factor (SF) of the cargo:
  - ✓ Weight = Volume / SF

- Enter the above details to "stability pro-forma" or the "loading sheet" provided in the stability book;
- Calculate the KG_s by taking moments about the keel and obtain the final KM_T from the stability book for the corresponding displacement;
- Calculate the KG_f by applying the Free Surface Correction (FSC):
  FSC = Total Free Surface Moments of the slack tanks / final displacement

- Draw a GZ curve for the departure condition by the method provided in the stability book;
- Ensure she is complying with the stability criteria provided in the stability book;
- Some ship's are provided with:
  - ✓ A minimum GM curve against the draught or the displacement or
  - ✓ A maximum KG curve against the draught or the displacement or
  - ✓ A maximum deadweight moment curve

When the above curves are provided, manual evaluation of the vessel's stability by means of GZ curve is not required. Make sure the final GM_f is above the GM provided in the curve for the respective draught/displacement or the final KG_f is below the KG provided in the curve for the respective draught/displacement or final deadweight moment (which includes the free surface moment of the vessel) is below the maximum deadweight moment provided in the curve for the respective displacement.

Other important areas to consider

- Ensure the load density is not exceeded;
- Ensure she is complying with the visibility criteria;
- Ensure she is complying with the weather criteria;
- Vessel shall not be tender or stiff;
- If the vessel is expecting to cross load line zones;
  - ✓ Take the applicable maximum displacement (summer displacement, winter displacement, tropical displacement etc.) from the stability book;
  - ✓ Calculate the amount of fuel consumption and the change of freshwater amount when crossing the load line limit;
  - ✓ Calculate the arrival displacement at the entrance to the new load line limit as below:
    - Arrival displacement at the new load line limit = departure displacement – fuel consumption + / - change of fresh water

  - ✓ If the arrival displacement at the new load line zone is below or equal to the respective displacement provided in the stability book, she is complying with the load line regulations.

- Calculate the final LCG by taking moment about the aft or midship perpendicular;
- Obtain the Hydrostatic draught, LCF, LCB and the MCTC for the final displacement;
- Calculate the Change of Trim (COT):
  - ✓ COT = W x (LCB – LCG) / MCTC
  - ✓ If the LCB > LCG, the vessel will be trimmed by stern and if the LCB < LCG, the vessel will be trimmed by head.

- Calculate the change of draft aft (T_a) and change of draft fwd (T_f) :

  T_a = COT x distance to LCF from aft perpendicular / LBP

  T_f = COT - T_a
- Calculate the departure draughts by applying T_a and T_f to the hydrostatic draughts obtained above;
- Ensure the draught restrictions are not impeded.

2) **How to check whether the vessel is complying with the stability criteria when carrying grain cargoes**

- Calculate the weight of the grain loaded in each compartment;
- Obtain the tabulated VHM for each compartment and the KG of the cargoes against the grain ullage;
- Calculate the actual VHM of each compartment by multiplying the tabulated VHM of each compartment by the correction factor. Correction factor to be used shall be decided as follows:
  - ✓ Full compartments:
    - If the **actual KG of grain** is used – correction **factor is 1.06**
    - If the **KG of the hold space** (not the cargo space) is used – correction **factor is 1.00**
  - ✓ Part full compartments (use **actual KG of the cargo**) – correction **factor is 1.12**

- Calculate the actual total VHM by adding the actual VHM of each hold;
- Calculate the final displacement and final KG_f;
- Calculate λ_0 and λ_{40}
  - ✓ $\lambda_0 = \Sigma \text{ VHM} / (\text{SF x W})$
  - ✓ $\lambda_{40} = 0.8 \text{ x } \lambda_0$

- Draw the GZ curve by the method provided in the stability book;
- On the same curve, plot λ_0 at zero degree heal and λ_{40} at 40^0 heal and join the two points.
- Obtain the angle of list due to shift of grain by referring to the interception between the GZ curve and the line joining λ_0 and λ_{40};
- Manually evaluate the stability of the vessel by referring to the stability of the vessel against the criteria provided in the stability book;
- Most of the time, the stability book may provide a table showing the 'maximum permissible grain healing moments' against various displacements along with the respective KG_f. In that case, if the actual grain heeling moment (Σ VHM) is below or equal to the 'maximum permissible grain healing moment' provided for the final displacement and the KG_f, the vessel is complying with the grain stability criteria.

3) **Calculation of draft with the change of density of water**

The following formula to be used to calculate the COT:

- **COT** = $$\mathbf{\frac{W \text{ x } (RD_1 - RD_2) \text{ x } (LCF - LCB)}{RD_1 \text{ x } MCTC_2}} \quad \text{(cm)}$$

If **LCF > LCB – trim by stern**
If **LCF < LCB – trim by head**

- By using above COT calculate T_a and T_f

- By means of the stability book, calculate the hydrostatic draught for the new density of water;

- Apply the T_a and T_f to the hydrostatic draught obtained above as appropriate.

4) Calculation of maximum amount of cargo to be loaded

The maximum amount of cargo that may be loaded can be calculated by using following methods (Method – A or Method – B or Method – C). Remember, this is only regarding the weight of the cargoes that can be loaded. Therefore, you have to carry out separate calculations to make sure the load density is not exceeded and also the individual cargo spaces (volumes) are sufficient to accommodate the cargo. This is very important when loading heavy density cargoes and volumetric cargoes. Accordingly, you may have to reduce the weight of the cargo to be loaded. **At the same time, remember, maximum amount of cargo can be loaded with an even keel condition only**.

SOLAS Chapter II-1, Part B – 1 state that the stability information shall show the influence of various trims in cases where the operational trim range exceeds +/- 0.5 of L_s.

You are not required to worry about the meaning of L_s, basically, what you need to understand is that there may be occasions where the stability book may contain stability information for various trims. In such cases, the appropriate trims shall be used in calculating the required stability information.

Method – A

This method can be considered as the least accurate method.

- Obtain the light ship displacement from the stability book.
- Calculate the amount of fuel and fresh water onboard at present.
- Calculate the amount of ballast water which is un-pumpable.
- Obtain the ship's constant.

- Get the maximum displacement for the respective load line zone from the stability book. The maximum amount of cargo to be loaded can be calculated by:

  Amount = maximum displacement for the respective load line zone – light ship displacement – fuel – fresh water – constant – un-pumpable ballast

Method – B

This method can be considered as more accurate than the Method – A above.

- Obtain the actual present draughts and calculate the arithmetic mean draught (AMD).
  AMD = (fwd draught + aft draught) / 2
- If the fwd and aft draught marks are not at the respective perpendiculars, by means of above fwd and aft draughts calculate the draughts at the fwd and aft perpendiculars.
- By means of the draughts at perpendiculars calculated above, calculate the trim at perpendiculars.
- Obtain LCF from stability particulars for above AMD.
- Calculate the true mean draught (TMD) by using the LCF obtained. If the vessel is trimmed by stern;
  TMD = draft aft – (trim at perpendiculars x LCF_{foap}) / LBP

  If the vessel is trimmed by head;
  TMD = draft aft + (trim at perpendiculars x LCF_{foap}) / LBP

- Obtain the present displacement from stability particulars against the above TMD.
- Get the maximum displacement for the respective load line zone from the stability book. The maximum amount of cargo to be loaded can be calculated by:

  Amount = maximum displacement for the respective load line zone – present displacement + ballast water that can be pumped out + cargo to be discharged

Method – C

This method can be considered as more accurate than both the methods mentioned above.

- Calculate the present displacement with the aid of a draught survey.
- Get the maximum displacement for the respective load line zone from the stability book. The maximum amount of cargo to be loaded can be calculated by:

  Amount = maximum displacement for the respective load line zone – present displacement + ballast water that can be pumped out + cargo to be discharged

5) **Calculation of maximum amount of cargo to load with a draught restriction at the port of loading**

- Obtain the maximum displacement from the stability particulars for the maximum loadable draught (after allowing for sufficient UKC) at port of loading
  Amount to load = displacement obtained above – light ship displacement – fuel – fresh water – constant – unpumpable ballast
- The vessel must complete loading with the respective even keel draught.

6) **Calculation of maximum amount of cargo to load with draught restrictions at the port of arrival**

- Obtain the maximum displacement from the stability particulars for the maximum loadable draught for the port of arrival;
- Calculate the amount of fuel oil, fresh water and the un-pumpable ballast that will be **available onboard at the port of arrival**;
  Amount to load = displacement required at the port of arrival – (fuel oil + fresh water) at the port of discharge – constant – unpumpable ballast

- When arriving at the destination, she must arrive at an even keel draught. Therefore, discuss with the chief engineer about the fuel oil tanks that he is going to use during the passage and calculate the COT that may experience due to fuel oil and freshwater consumption/production.
- Need to complete loading which a sufficient trim so that the vessel will arrive at the destination with an even keel condition.
  - ✓ If the tanks which are at the COF are used, there will be only a bodily rise. Therefore, need to complete with an even keel condition.
  - ✓ If the tanks which are abaft the COF are used, it will create a head trim. Therefore, need to complete loading with appropriate stern trim.
  - ✓ If the tanks which are forward of COF are used, the fuel consumption will create the stern trim. Which means, need to complete loading with a head trim. Sailing with head trims are not common unless slight head trim for speed and fuel optimization. Therefore, you may have to request the chief engineer to transfer fuel oil that is going to be used to stern tanks and complete loading with an appropriate stern trim.

7) **Calculation of maximum amount of cargo to load with draught restrictions at the port of arrival and with change of density of the water**

As mentioned above, with or without draught restrictions, maximum amount of cargo can be loaded only when she is to be loaded with an even keel condition. Therefore, if the draught restriction is before the change of density, the procedure mentioned **above (6)** will ensure that she is loaded with the maximum amount of cargo. But, if the draught restriction is after the change of density of water, adhere to the following procedure to ensure she enters the draught restricted area with an even keel condition.

The following procedure is recommended assuming she is **going from sea water to fresh water**.

- From hydrostatic tables obtain the displacement for the allowed maximum permissible draught at discharge port [Eg. – if the maximum allowed draught in fresh water is 8 m, obtain the displacement for 8 m draught. Remember, this displacement is for a saltwater draught of 8 m. Therefore, we will name it as "W_{sea}"];
- Therefore, by means of interpolation, calculate the displacement at the fresh water for the same draught (W_{fresh}).
  $W_{fresh} = W_{sea} \times 1.000 / 1.025$
- W_{fresh} is the displacement that she needs to have at the time of change of density (to avoid complications we will assume that there is not much distance difference between change of density and the draught restricted area);
- Displacement does not change with the density of water;
- Now, again refer the hydrostatic particulars to obtain the sea water draught for the W_{fresh};
- This is the draught she needs to have at the time of change of density;
  Cargo to load = W_{fresh} – (fuel oil + fresh water) at the time of change of density – constant – unpumpable ballast

- Calculate the change of trim due to change of density;
- Calculate the change of trim due to change of fuel and fresh water;
  Total COT = COT due to change of density +/- COT due to fuel & freshwater consumption

- She needs to have a departure trim equal and opposite to counteract the total COT calculated above.

8) **Calculation of GM by means of rolling period**

The GM of a vessel in seaway may be calculated by means of couple of methods, but only two methods are mentioned below. Refer the ship's stability book to find the exact method of GM by means of rolling period for your ship.

a) **By the formula provided in the IS Code**

Rolling period, T (in seconds) can be calculated by the following table which is in accordance with the IS Code:

$$T = \frac{2\ x\ C\ x\ B}{\sqrt{GM}}$$

Where:

$$C = 0.373 + \left(\frac{0.023\ x\ B}{d}\right) - \left(\frac{0.043\ x\ L}{100}\right)$$

B	= Moulded breadth of the ship (m)
d	= mean moulded draught of the ship (m)
L	= length of the ship at waterline (m)
GM	= metacentric height corrected for free surface effect (m)

Above formula can be modified as below;

$$\sqrt{GM} = \frac{2\ x\ C\ x\ B}{T}$$

$$GM = \left(\frac{2\ x\ C\ x\ B}{T}\right)\ x\ \left(\frac{2\ x\ C\ x\ B}{T}\right)$$

Now, calculate the value of 'C' for the present condition of the vessel, check the rolling period in seconds and apply the figures to the above formula.

Example

Calculate the GM with the aid of the Hydrostatic Table – I, for the following condition:

Draft at fwd perpendicular	= 7.224 m
Draft at aft perpendicular	= 9.053 m
Breadth moulded is	= 21.50 m
Rolling period	= 15 seconds

T m	LWL m	WLA m2	WSA m2	TCP t/cm	MCT tm/cm	CB	CW	CP	CM
8.10	139.69	2515.1	4158.0	25.8	232.4	0.7413	0.8782	0.7480	0.9911
8.11	139.68	2515.8	4161.2	25.8	232.6	0.7415	0.8784	0.7481	0.9911
8.12	139.66	2516.5	4164.4	25.8	232.7	0.7416	0.8787	0.7483	0.9911
8.13	139.64	2517.1	4167.7	25.8	232.9	0.7418	0.8789	0.7485	0.9911
8.14	139.63	2517.8	4170.9	25.8	233.0	0.7420	0.8791	0.7486	0.9911

Hydrostatic Table – I

In the above Table;

T : Draught, moulded (m)
LWL : length of water line (m)
WLA : Waterline area (m^2)
WSA : Wetted surface area (m^2)
TCP : Tonnes per centimetre (tcm^{-1})
MCT : Moment to change trim by 01 cm ($t\ m\ cm^{-2}$)
CB : Block coefficient
CW : Waterplane coefficient
CP : Prismatic coefficient
CM : Midship section coefficient

Answer

Mean draft = 8.139 m

From the table, length of water line for this mean draft = 139.632 m

$$C = 0.373 + (0.023 \times 21.5) / 8.139 - (0.043 \times 139.632) / 100$$
$$= 0.373 + 0.061 - 0.060 \quad = 0.374$$

$$GM = \frac{(2 \times 0.374 \times 21.5)}{15} \times \frac{(2 \times 0.374 \times 21.5)}{15} \quad = 1.072 \times 1.072 \quad = 1.149 \text{ m}$$

b) **Obtaining the GM for different drafts and rolling periods from tables provided in the ship's loading manual**

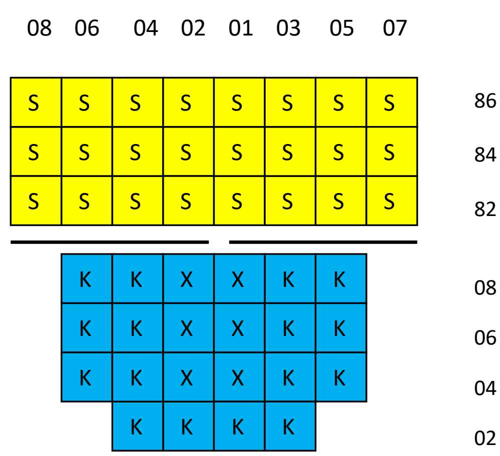
On some ships GMs for different drafts and rolling periods are provided in the loading manual in a table as below. In this case, whatever the formular used to calculate the GMs will be also given in the loading manual.

Draft (m)	8.2	8.4	8.6	8.8	9.0	9.2
T (seconds)	**GM (m)**					
9	16.076	15.801	15.541	15.294	15.059	14.836
10	13.021	12.799	12.588	12.388	12.198	12.017
11	10.761	10.578	10.403	10.238	10.081	9.932
12	9.043	8.888	8.742	8.603	8.471	8.345

Example – for a draught of 8.8 m if the rolling period is 12 seconds, the fluid (if there are slack tanks) GM is 8.603m

9) Manual stability calculation on a container ship

BAY 11 (10)



Calculation of KG_f

- Add the weights of all the containers in each tier separately. Refer the above figure as an example.
  ✓ Add the weights of all the containers (port to stbd and aft to fwd) in tier 02.
  ✓ Add the weights of all the containers (port to stbd and aft to fwd) in tier 04.

- ✓ Continue until all are added tier wise, up to the tier 86. Now, to calculate the final KG_s, take moments of each tier about the keel.

Final KG_s = (light ship Δ x light KG + ballast weight x KG + fuel weight x KG + tier 02 weight x ½container height + tier 04 weight x 1½container height + tier 06 weight x 2½container height ………..) / final Δ

- Calculate the KG_f by applying the FSC to above KG_s.

To check whether the vessel is upright or not

- Add the weights of all the containers in each row separately. Refer the above figure as an example.
- Add the weights of all the containers (from bottom to top and fwd to aft) in row 01.
- Add the weights of all the containers (from bottom to top and fwd to aft) in row 02.
- Continue until all the weights are added row wise. Now, take moments of rows about the transverse centre line of the vessel.

Port side listing moments = row 02 weight x ½container width + row 04 weight x 1½container width + row 06 weight x 2½container width ………

Similarly,
Stbd side listing moments = row 01 weight x ½container width + row 03 weight x 1½container width + row 05 weight x 2½container width ………

Final listing moment = difference between port and stbd side listing moment
Tan (list) = Final listing moment / (W x GM_f)

If the port side listing moments are equal to the stbd side listing moments, the vessel is upright.

Calculation of final draughts

- Add the weights of containers in each bay separately. As an example;
- Add the weights of all the containers in bay number 01 separately.
- Add the weights of all the containers in bay number 03 separately.

- Remember, weights of 40-footer containers may be divided into two and add to the odd number bays. In this case, weights of 40-footer containers can be divided between bay number 1 and 3.
- Continue until the weights of all the bays are calculated separately.
- Now, to calculate the final LCG take moments of bays around aft perpendicular.
- Since the final displacement is known, following can be obtained from hydrostatic particulars;
  - ✓ Hydrostatic draught of the loaded vessel
  - ✓ LCB
  - ✓ MCTC
- Now, by using the following formula, final trim can be calculated.
  Trim = Δ x ($LCB_{foap} \sim LCG_{foap}$) / MCTC

- Now calculate Ta and T_f and apply them to the hydrostatic draught to get the final draughts fwd and aft.

Even though these types of manual calculations are feasible on smaller container ships, it may not be that practicable on large container ships. But above will give you a generic idea of a manual calculation.

10) Final trimming of a bulk carrier

Usually, it is a common practice to allocate two or three holds and sufficient amount of cargo (usually the amount of cargo shall be 2% to 5% of the DWT of the vessel or more than twice the MCTC) to get the required trim and the draughts at the completion of the loading operations. The allocation of the amount of cargo and the holds for final trimming depends upon:

- Vessel’s TPC;
- Vessel’s MCTC; and
- The distances between the holds

If three holds are allocated, advisable to allocate one hold which is at the COF. The vessel can achieve the required trim by loading the allocated holds which are fwd and aft and finally, load the hold, which is at the COF, but remember to have sufficient cargo to sink body until the required draughts are achieved.

This final trimming calculation may be carried out by means of trimming tables or by taking trimming moments.

In case of taking trimming moments, take the moment about the COF instead of the aft perpendicular. No need to carry out any interpolations for hydrostatic particulars as there is no much time available. Use the hydrostatic particulars for the expected final draughts.

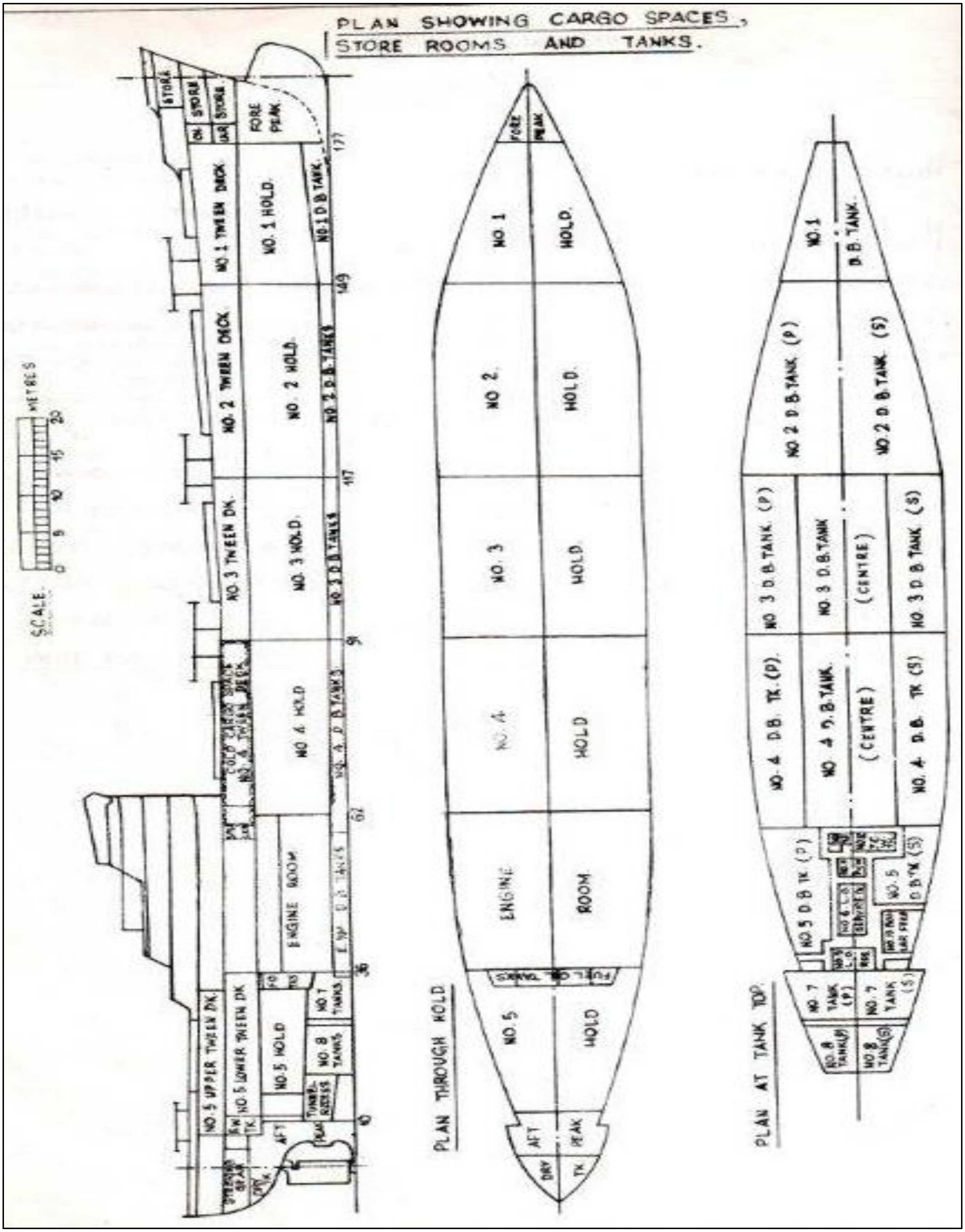
11) Use of trimming tables

Some trimming tables provide changes of draughts when a known amount of cargo (usually, 100 t of cargo) is loaded at the centre of each hatch. Some trimming tables provide changes of draughts when cargoes, again 100 t, are loaded at the different frame numbers. The latter types of trimming tables are more accurate than the former one.

For the purpose of getting used to the trimming tables refer the example provided below obtained from "stability, trim and cargo calculations on M.V. Hindship and oil tankers" (by Capt. T .K. Joseph & Capt. S. S. S. Rewari).

Example 1

M.V. Hindship floating at a draught Fwd 5.45 m, aft 6.53 m, fills up No. 1 DB tank with water ballast, discharges 120 t of cargo from No. 2 TD, 99.5 m forward of aft perpendicular and shifts a 70 t parcel of cargo from No. 2 TD to No. 4 TD. With the aid of the below trim tables, determine the final draughts forward and aft.


PLAN SHOWING CARGO SPACES, STORE ROOMS AND TANKS.
SCALE
METRES
PLAN THROUGH HOLD
PLAN AT TANK TOP
FORE PEAK
NO. 1 TWEEN DECK
NO. 1 HOLD.
NO. 1 D.B. TANK.
NO. 2 TWEEN DECK
NO. 2 HOLD.
NO. 2 D.B. TANKS
NO. 3 TWEEN DK.
NO. 3 HOLD.
NO. 3 D.B. TANKS
COLD CARGO SPACE NO. 4 TWEEN DECK
NO. 4 HOLD
NO. 4 D.B. TANKS
ENGINE ROOM
NO. 5 UPPER TWEEN DK.
NO. 5 LOWER TWEEN DK.
NO. 5 HOLD
NO. 7 TANKS
NO. 8 TANKS
STEERING GEAR
AFT PEAK
DRY TK
NO. 1 HOLD.
NO. 2 HOLD.
NO. 3 HOLD.
NO. 4 HOLD
ENGINE ROOM
FUEL OIL TANKS
NO. 5 HOLD
NO. 1 D.B. TANK.
NO. 2 D.B. TANK (P)
NO. 2 D.B. TANK (S)
NO. 3 D.B. TANK (P)
NO. 3 D.B. TANK (CENTRE)
NO. 3 D.B. TANK (S)
NO. 4 D.B. TK. (P)
NO. 4 D.B. TANK (CENTRE)
NO. 4 D.B. TK (S)
NO. 5 D.B. TK (P)
NO. 5 D.B. TK (S)
NO. 7 TANK (P)
NO. 7 TANK (S)
NO. 8 TANK (P)
NO. 8 TANK (S)

TANKS

TRIM TABLES

CHANGE IN DRAUGHTS IN CM. WHEN EACH TANK IS FILLED + IMMERSION — = EMERSION

TANKS	Content.	Capacity in Tonnes	DRAUGHTS 5.0 M.		7.0 M		9.0 M	
			Aft	Ford	Aft	Ford	Aft	Ford
Bulbous Bow (Void Space)	F.W.	182.0	—29.0	+43.7	—25.3	+40.8	—20.8	+37.0
Fore Peak Tank	W.B.	106.1	—15.1	+24.8	—14.4	+23.5	—12.1	+21.7
No. 1 D.B. Tank	W.B.	161.5	—18.3	+31.8	—16.4	+30.2	—13.8	+28.0
No 1 D.B. Tank	H.F.O.	149.7	—16.9	+29.5	—15.2	+28.0	—12.8	+26.0
No. 2 D.B. Tanks P & S	W.B.	415.0	—18.5	+54.4	—16.6	+52.5	—13.9	+49.6
No. 2 D.B. Tanks P & S.	H.F.O.	384.6	—17.1	+50.4	—15.4	+48.6	—12.9	+46.0
No. 3 D.B. Tank P & S.	W.B.	226.6	+ 4.8	+15.3	+ 4.3	+15.4	+ 3.7	+15.3
No. 3 D.B. Tank P & S.	H.F.O.	210.0	+ 4.5	+14.2	+ 4.0	+14.3	+ 3.4	+14.2
No. 3 D.B. Tank (C)	W.B.	216.0	+ 4.7	+14.7	+ 4.1	+14.7	+ 3.5	+14.6
No. 3 D.B. Tank (C)	H.F.O.	200.2	+ 4.3	+13.6	+ 3.8	+13.6	+ 3.3	+13.6
No. 4 D.B. Tank P & S.	W.B.	261.2	+23.6	+ 0.5	+21.0	+ 1.9	+17.8	+ 3.5
No. 4 D.B. Tank P & S.	H.F.O.	242.0	+22.0	+ 0.6	+19.4	+ 1.7	+16.5	+ 3.2
No. 4 D.B. Tank (C)	H.F.O.	244.5	+22.6	+ 0.1	+20.0	+ 1.4	+17.0	+ 2.9
No. 4 D.B. Tank (C)	W.B.	263.8	+24.3	+ 0.1	+21.6	+ 1.5	+18.3	+ 5.8
No. 5 D.B. Tank (P)	D.O.	73.5	+10.1	— 3.1	+ 8.9	— 2.5	+ 7.6	— 1.7
No. 5 D.B. Tank (S)	H.F.O.	46.4	+ 6.8	— 2.4	+ 6.0	— 2.0	+ 5.1	— 1.5
No. 6 D.B. Tank (C)	L.O.	17.5	+ 2.9	— 1.2	+ 2.6	— 1.0	+ 2.2	— 0.8
No. 7 D.B. Tank (P)	D.O.	100.8	+20.1	—10.1	+17.8	— 8.9	+15.1	— 7.2
No. 7 D.B. Tank (S)	D.O.	89.7	+17.8	— 9.0	+15.8	— 7.9	+13.4	— 6.4
No. 8 D.B. Tank (P)	F.W.	74.1	+16.3	— 8.9	+14.4	— 7.9	+12.3	— 6.4
No. 8 D.B. Tank (S)	F.W.	63.4	+14.0	— 7.6	+12.4	— 6.7	+10.4	— 5.6
No. 9 L.O. Reserve Tk. (C)	L.O.	19.2	+ 3.6	— 1.6	+ 3.1	— 1.5	+ 2.7	— 1.1
No. 10 Boiler Feed Tk. (S)	F.W.	14.1	+ 2.5	— 1.0	+ 2.2	— 1.0	+ 1.9	— 0.7
No. 11 Piston Cooling (C)	F.W.	6.3	+ 0.9	— 0.3	+ 0,2	— 0.2	+ 0.7	— 0.2
No. 12 Cooling Water Tk. (S)	F.W.	14.4	+ 2.0	— 0.5	— 1.7	— 0.5	+ 1.5	— 0.3
No. 13 Leakage Water Tk. (P)	F.W.	4.7	+ 0.6	— 0.2	+ 0.6	— 0.1	+ 0.5	— 0.1
Aft Peak	W.B.	120.7	+31.2	—19.0	+27.8	—16.9	+23.5	—14.2
Aft Peak	F.W.	117·8	+30.4	—18.6	+27.0	—16.6	+22.9	—13.9
Tween Deck Tank (P)	F.W.	49.7	+12.5	— 7.5	+11.3	— 6.8	+ 9.7	— 5.9
Tween Deck Tank (S)	F.W.	43.7	+11.0	— 6.6	+9.9	— 6.0	+ 8.5	— 5.2

TRIM TABLES AT VARIOUS FRAMES

CHANGE OF DRAUGHT AT A.P. & F.P. DUE TO AN ADDITIONAL LOAD OF 100 TONNES AT VARIOUS POINTS

Mean Draught = 5.0 M.: + = Immersion: — = Emersion.

Distance of CG of Load from ϕ in Mtrs.	Near Fr. No.	Sinkage in C.M.		Sinkage in Inches		Distance of CG of load from ϕ in Mtrs.	Near Fr. No.	Sinkage in Cm.		Sinkage in Inches	
		Aft.	Ford.	Aft.	Ford.			Aft.	Ford.	Aft.	Ford
Mid-ship	92	+ 5.0	+ 4.0	+1.97	+1.58						
3 A	88	+ 5.9	+ 3.1	+2.32	+1.22	3 F	96	+ 4.1	+ 4.9	+1.62	+1.93
6 A	85	+ 6.9	+ 2.3	+2.72	+0.91	6 F	100	+ 3.2	+ 5.8	+1.26	+2.29
9 A	81	+ 7.8	+ 1.4	+3.07	+0.55	9 F	104	+ 2.2	+ 6.6	+0.87	+2.60
12 A	77	+ 8.7	+ 0.5	+3.43	+0.20	12 F	107	+ 1.3	+ 7.5	+0.51	+2.96
15 A	73	+ 9.6	— 0.4	+3.78	—0.16	15 F	111	+ 0.4	+ 8.4	+0.16	+3.31
18 A	70	+10.5	— 1.3	+4.14	—0.51	18 F	115	— 0.5	+ 9.3	—0.20	+3.66
21 A	66	+11.5	— 2.1	+4.53	—0.83	21 F	119	— 1.4	+10.2	—0.55	+4.02
24 A	62	+12.4	— 3.0	+4.89	—1.18	24 F	122	— 2.4	+11.0	—0.95	+4.33
27 A	58	+13.3	— 3.9	+5.24	—1.54	27 F	126	— 3.3	+11.9	—1.30	+4.69
30 A	55	+14.2	— 4.8	+5.59	—1.89	30 F	130	— 4.2	+12.8	—1.65	+5.04
33 A	51	+15.1	— 5.7	+5.95	—2.25	33 F	134	— 5.1	+13.7	—2.01	+5.40
36 A	47	+16.1	— 6.5	+6.34	—2.56	36 F	137	— 6.0	+14.6	—2.36	+5.75
39 A	43	+17.0	— 7.4	+6.70	—2.92	39 F	141	— 7.0	+15.4	—2.76	+6.07
42 A	40	+17.9	— 8.3	+7.05	—3.27	42 F	145	— 7.9	+16.3	—3.11	+6.42
45 A	36	+18.8	— 9.2	+7.41	—3.62	45 F	149	— 8.8	+17.2	—3.47	+6.78
48 A	32	+19.7	—10.1	+7.76	—3.98	48 F	153	— 9.7	+18.1	—3.82	+7.13
51 A	28	+20.7	—10.9	+8.16	—4.29	51 F	158	—10.6	+19.0	—4.18	+7.49
54 A	25	+21.6	—11.8	+8.51	—4.65	54 F	162	—11.6	+19.8	—4.57	+7.80
57 A	21	+22.5	—12.7	+8.87	—5.00	57 F	167	—12.5	+20.7	—4.93	+8.16
60 A	17	+23.4	—13.6	+9.22	—5.36	60 F	171	—13.4	+21.6	—5.28	+8.51
63 A	13	+24.4	—14.4	+9.61	—5.67	63 F	176	—14.3	+22.5	—5.63	+8.87
66 A	8	+25.3	—15.3	+9.97	—6.03	66 F	181	—15.3	+23.3	—6.03	+9.18

TRIM TABLES AT VARIOUS FRAMES.

CHANGE OF DRAUGHT AT A.P. AND F.P. DUE TO AN ADDITIONAL LOAD OF 100 TONNES AT VARIOUS POINTS.

Mean Draught = 7.0M: + = Immersion: − = Emersion.

Distance of CG load from ϕ in Mtrs.	Near Fr. No.	Sinkage in Cm.		Sinkage in Inches		Distance of CG of Load from ϕ in Mtrs.	Near Fr. No.	Sinkage in Cm.		Sinkage in Inches	
		Aft.	Ford.	Aft.	Ford.			Aft.	Ford	Aft.	Ford
Mid-ship	92	+ 4.5	+ 4.3	+1.77	+1.69						
3 A	88	+ 5.3	+ 3.5	+2.09	+1.38	3 F	96	+ 3.7	+ 5.1	+1.46	+2.01
6 A	85	+ 6.2	+ 2.7	+2.44	+1.06	6 F	100	+ 2.8	+ 5.9	+1.10	+2.32
9 A	81	+ 7.0	+ 1.9	+2.76	+0.75	9 F	104	+ 2.0	+ 6.7	+0.79	+2.64
12 A	77	+ 7.8	+ 1.1	+3.07	+0.43	12 F	107	+ 1.2	+ 7.5	+0.47	+2.96
15 A	73	+ 8.6	+ 0.2	+3.39	+0.08	15 F	111	+ 0.4	+ 8.4	+0.16	+3.31
18 A	70	+ 9.4	− 0.6	+3.70	−0.24	18 F	115	− 0.4	+ 9.2	−0.16	+3.62
21 A	66	+10.2	− 1.4	+4.02	−0.55	21 F	119	− 1.2	+10.0	−0.47	+3.94
24 A	62	+11.1	− 2.2	+4.37	−0.87	24 F	122	− 2.1	+10.8	−0.83	+4.26
27 A	58	+11.9	− 3.0	+4.69	−1.18	27 F	126	− 2.9	+11.6	−1.14	+4.57
30 A	55	+12.7	− 3.8	+5.00	−1.50	30 F	130	− 3.7	+12.4	−1.46	+4.89
33 A	51	+13.5	− 4.6	+5.32	−1.81	33 F	134	− 4.5	+13.3	−1.77	+5.24
36 A	47	+14.3	− 5.5	+5.63	−2.17	36 F	137	− 5.3	+14.1	−2.09	+5.56
39 A	43	+15.2	− 6.2	+5.99	−2.44	39 F	141	− 6.2	+14.8	−2.44	+5.83
42 A	40	+16.0	− 7.0	+6.30	−2.76	42 F	145	− 7.0	+15.7	−2.76	+6.91
45 A	36	+16.8	− 7.9	+6.62	−3.11	45 F	149	− 7.8	+16.5	−3.07	+6.50
48 A	32	+17.8	− 8.7	+6.93	−3.43	48 F	153	− 8.6	+17.7	−3.38	+6.82
51 A	28	+18.4	− 9.5	+7.25	−3.74	51 F	158	− 9.5	+18.1	−3.74	+7.13
54 A	25	+19.3	−10.3	+7.60	−4.06	54 F	162	−10.3	+18.9	−4.06	+7.45
57 A	21	+20.1	−11.1	+7.92	−4.37	57 F	167	−11.1	+19.7	−4.37	+7.76
60 A	17	+20.9	−11.9	+8.23	−4.69	60 F	171	−11.9	+20.6	−4.69	+8.12
63 A	13	+21.7	−12.8	+8.55	−5.04	63 F	176	−12.7	+21.4	−5.00	+8.43
66 A	8	+22.5	−13.6	+8.87	−5.36	66 F	181	−13.5	+22.2	−5.32	+8.75
69 A	3	+23.3	−14.4	+9.18	−5.67	69 F	188	−14.3	+23.0	−5.63	+9.06

Answer – 1

	Fwd draft	**Aft draft**	**Mean draft**
Original drafts	5.45	6.53	5.99
Change in draft due to ballasting Interpolating for mean draft 5.99 m from tank's trim tables for 161.5 t WB in No. 1 DB tank (refer *TANK TRIM TABLES* above)	+ 0.310	- 0.174	
Change in draft due to cargo discharge Centre of gravity of no. 2 td is 99.5 m fwd of AP. Midships = 71.58 m fwd of AP. Therefore, cargo discharged from 27.92 m fwd of midships (refer *TRIM TABLES AT VARIOUS FRAMES for mean draught 5m & 7m* above)	- 0.144	+ 0.041	
Shift of cargo to be calculated in two stages (discharge 70 t from the original position and reload the same at the final position) Change in draft due to discharge of 70 t (from No. 2 TD, 32.33 m fwd of midships)	- 0.093	+ 0.032	
Change in draft due to loading of 70 t (in No. 4 TD, 14.14 m aft of midships) (refer *TRIM TABLES AT VARIOUS FRAMES for mean draught 5m & 7m* above)	+ 0.001	+ 0.062	
Final drafts	**5.524**	**6.491**	

Now, we will look at a trimming calculation by means of trim tables.

Example – 2

600 t of cargo is remaining to load when the vessel is floating at fwd draft 6.9 m and aft draft 7.1 m. The vessel is expected to complete loading with an even keel condition. Hold number one and number four are selected for final trimming. Calculate the amount of cargo to be loaded in each hold and the sailing draughts of the vessel. (use the same trimming tables provided above)

Answer – 2

As the trim tables provide change of drafts when 100 t loaded at different frame numbers, more accurate results can be obtained by referring to the frame numbers. But, remember this will not be problem for a tanker (where you can take the centre of the hold as loading point). To make the calculation easy we will take the centre of the hold as the loading point.

In accordance with the *PLAN SHOWING CARGO SPACES, STOREROOMS AND TANKS* above:

- Centre of the hold 1 is at frame number 162
- Centre of the hold 4 is at frame number 77

Fwd draft = 6.9 m
Aft draft = 7.1 m
AMD = 7.0 m

From the *TRIM TABLES AT VARIOUS FRAMES* (Mean draft 7.0 m) above;

Hold number	**4**	**1**
Frame number	77	162
Change of draft Fwd (cm)	+ 1.1	+ 18.9
Change of draft Aft (cm)	+ 7.8	- 10.3
COT each hold (cm)	6.7 (aft)	29.2 (fwd)
Total COT of the vessel (cm)	6.7 + 29.2 = 35.9	

Initial trim = 7.1 – 6.9 = 0.2 m = 20 cm
COT required = 20 cm (by fwd)

Therefore, first we will calculate how much to load in hold number one to make her even keel. The rest of the cargo can be divided between the two holds to have a bodily sinkage.

By interpolation, cargo to be loaded in hold 1 = 100 x 20 / 29.2 = 68.5 t

Balance to spread between one and four holds = 600 – 68.5 = 531.5 t

Out of 531.5 t, cargo to load in hold one (interpolation) = 6.7 x 531.5 / 35.9 = 99.2 t
Out of 531.5 t, cargo to load in hold four (interpolation) = 29.2 x 531.5 / 35.9
= 432.3 t

Therefore,
cargo to load in hold 1 = 68.5 + 99.2 t = 167.7 t
cargo to load in hold four = 432.3 t

Calculation of final drafts:

	Fwd draft	Aft draft
Initial drafts	6.9	7.1
Change of draft due to loading in hold 1	+ 0.32	- 0.17
Change of draft due to loading in hold 4	+ 0.05	+0.34
Final drafts	**7.27**	**7.27**

12) Use of various loaded 'Conditions' provided in the stability book

The final GM, LCG, draughts, displacement etc. can be calculated and seaworthiness against the stability criteria provided in the stability book also can be evaluated manually without using a stability computer. But the Shear Forces, Bending Moments and the torsional stresses cannot be verified manually. Calculation of stresses is the main purpose of a stability computer. Therefore, if the stability computer is not working, we cannot load the vessel as the stresses cannot be calculated. In such a situation, select a 'Condition' from the stability book which is similar to the amount of cargo that you are supposed to receive and distribute the cargo, fuel oil and the ballast water as provided in the selected 'Condition'. Calculate the GM, draught etc. and evaluate the seaworthiness manually, but no need to worry about the stresses as they will be more or less close to the stress levels given in the selected 'Condition'.

13) Damage stability

Damage control plan and damage control booklet

The SOLAS Chapter II-1, Regulation 19 states that:

- Plans showing all the:
  - ✓ openings,
  - ✓ means of closing them,
  - ✓ positions of any controls of them and
  - ✓ arrangements for the correction of any list due to flooding each deck and hold the boundaries of the watertight compartments shall be permanently displayed on the navigation bridge. This refers to a **damage control plan**.

- Books containing above information shall also be available. This refers to **damage calculation books**.
- Watertight doors that can be left open during navigation on passenger ships shall be clearly indicated in the stability book.
- The damage stability information which is to be provided to the master shall be in simple and easily understandable way to assess the ship's survivability in all damage cases involving a compartment or group of compartments.

The Damage Control Plan (DCP) should include inboard profile, plan views of each deck and transverse sections to the extent necessary to show the following[164]:

- The watertight boundaries of the ship;
- The locations and arrangements of all cross-flooding systems;
- Arrangements for any mechanical means to correct list due to flooding, together with the locations of their valves and remote controls, if any;
- The locations of all internal watertight closing appliances, including internal ramps or doors acting as extension of the collision bulkhead on 'Ro-Ro ships', their controls and the locations of their local and remote controls, position indicators and alarms;
- The locations of those watertight closing appliances which are not allowed to be opened during navigation, and of those watertight closing appliances which are allowed to be opened during navigation;
- The location of all doors in the shell of the ship, position indicators, leakage detection and surveillance devices;
- the locations of all external watertight closing appliances in cargo ships, position indicators and alarms;
- The locations of all weathertight closing appliances in local subdivision boundaries above the bulkhead deck and on the lowest exposed weather decks, together with locations of controls and position indicators, if applicable;
- The location of all bilge and ballast pumps, their control positions and associated valves; and
- pipes, ducts or tunnels, if any, through which limited progressive flooding has been accepted by the Administration.

A damage control manual/booklet (DCM) shall include the following[165]:

- Above information in the DCP should be repeated in detail.
- In addition, the DCM should include general instructions for controlling the effects of damage, such as:

[164] Refer MSC.1/Circ. 1245 and MSC/Circ.919 of IMO or the latest for further details
[165] Ibid

- ✓ Immediately closing all watertight and weathertight closing appliances
- ✓ Establishing the locations and safety of persons on board, sounding tanks and compartments to ascertain the extent of damage and repeated soundings to determine rates of flooding
- ✓ Cautionary advice regarding the cause of any list and of liquid transfer operations to lessen list or trim, and the resulting effects of creating additional free surfaces and of initiating pumping operations to control the ingress of water.

- The booklet should contain additional details to the information shown on the damage control plan, such as the locations of flooding detection systems, sounding devices, tank vents and overflows which do not extend above the weather deck, pump capacities, piping diagrams, instructions for operating cross-flooding systems, means of accessing and escaping from watertight compartments below the bulkhead deck for use by damage control parties, and alerting ship management and other organizations to stand by and to co-ordinate assistance, if required.

The booklet may be supplemented with copies of the general arrangement plan, tank capacity plan and piping diagram as well as information about the used abbreviations and the definition of the co-ordinate system.

The damage control plan and damage control booklet are intended to provide ship's officers with clear information on the ship's watertight compartmentation and equipment related to maintaining the boundaries and effectiveness of the compartmentation so that, in the event of damage to the ship causing flooding, proper precautions can be taken to prevent progressive flooding through openings therein and effective action can be taken quickly to mitigate and, where possible, recover the ship's loss of stability[166].

Damage stability criterion

IMO has established damage stability criteria through SOLAS chapter II-1, Part B-1 that need to be complied with and these criteria depends upon the type of the ship. Further it states:

- The master shall be supplied with such information necessary to enable him by rapid and simple process to obtain accurate guidance as to the stability of the ship under varying conditions of service. This information should include:
  - ✓ Curves or tables of minimum operational GM versus draught which assures compliance with relevant intact **and damage stability requirements**, alternatively

[166] Refer MSC/Circ.919 of IMO or the latest for further details

corresponding curves or tables of the maximum allowable KG versus draught, or with the equivalent of either of these curves;
- ✓ Instructions concerning the operation of cross-flooding arrangements; and
- ✓ **All other data and aids** which might be necessary to maintain the required intact stability **and stability after damage.**

Documents on board related to damage stability

In summarizing above, ships are required to have the following documents onboard related to damage stability:

- Damage control plan;
- Damage control manual / booklet; and
- Damage stability calculation (also called as subdivision and damage stability calculations) – this details the stability condition of a vessel when each compartment is bilged for at least two different loading situations and may have more than one volume

Intact and damage stability instruments

From 1st of January 2016, but not later than 1st January 2021, tankers (oil, chemical and gas) are required to have approved intact and damage stability instruments onboard. Need to carry a Document of Approval issued by the administration or Class as evidence for the approval received.

Damage stability assessment and general actions

Refer your ship's damage control plan and damage control manual for exact information to follow. Following points are for your general references only:

- Refer the damage control plan and damage control manual and try to restrict the damage volume by:
  - ✓ Closing of watertight openings (if opened for maintenance purposes);
  - ✓ Closing weathertight openings including ventilators; and
  - ✓ Closing of valves unless used to reduce the water ingress;

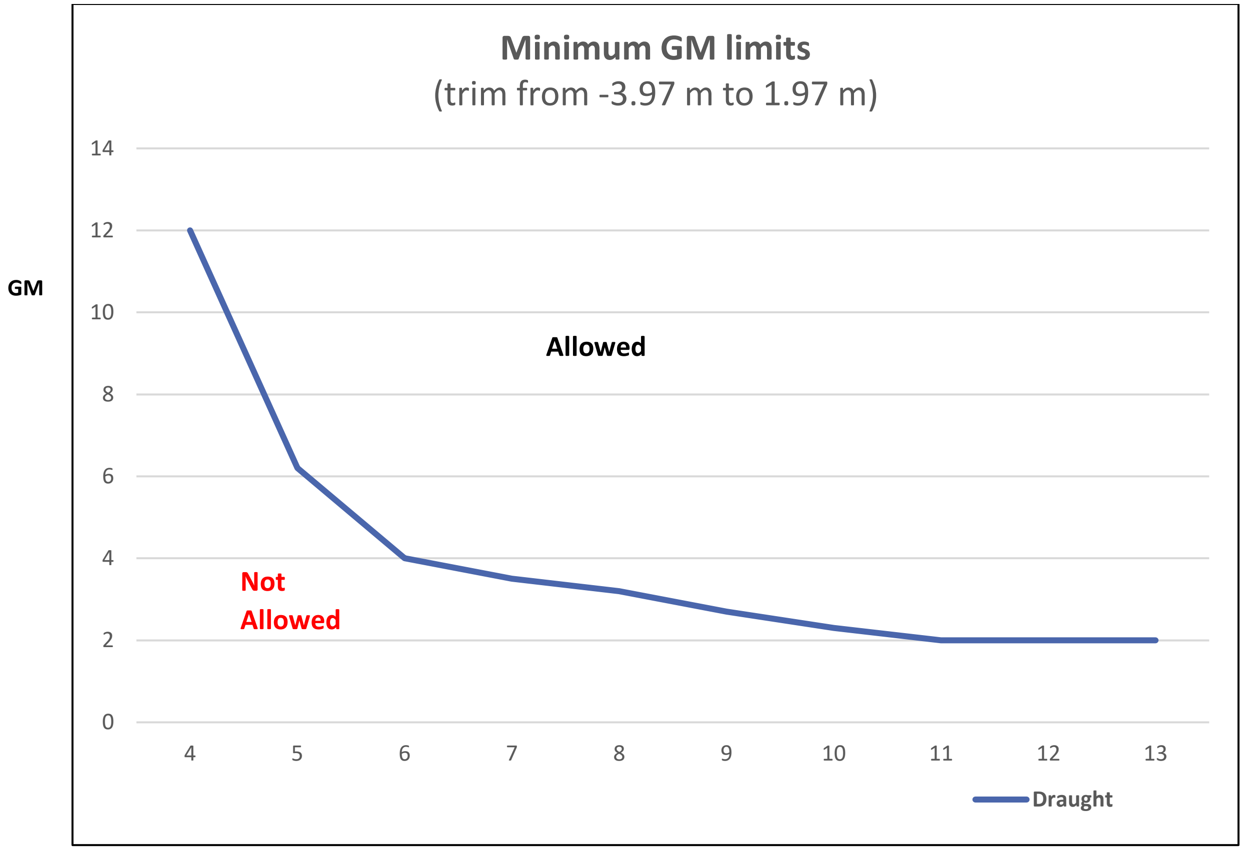
- Sound the compartments;
- Identify the extent of the damage;
- Start pumping out the incoming water by using all available means. If the water ingress rate is higher than the discharging rate, assess the final condition of the vessel;

- If a damage stability software is available, assess the stability of the vessel by using the software. If not:
  - ✓ Compare the current situation with conditions given in damage control manual and the damage calculation book (remember, this is not very accurate);
  - ✓ You may calculate the weight of the ingress water and enter the weights to the loadicator to get a rough idea.
  - ✓ Damaged fluid GM shall be above the minimum GM limits as shown in the damage control plan (refer the sample minimum GM limit curve below)

- Consider of transferring water or fuel oil internally to improve stability;
- Consider of using cross flooding arrangements or ballasting/deballasting to make the vessel upright; and
- Consider of ballasting/deballasting to improve the stability of the vessel.

Minimum GM Limits curve

Following graph shows damage stability verification by means of a "Minimum GM Limits" curve in case of damage to tanks or ER or cargo holds. If the vessel's damaged fluid GM for the corresponding damage draught is higher than the minimum given in the below table, it can be assumed that the damage vessel is in a satisfactory condition.



Remember, this will depend upon various other conditions such as weather conditions, amount of water absorption by the cargo, trim, stability condition before damage etc. This is a rough estimation only.

For some ships, the GM limit curve that is required to be complied, both in the case of intact (without damage) and damage conditions are the same and for some, may not be the same.

14) Evaluation of a ship's seaworthiness against wind heeling criterion

Wind heeling criterions are applicable to certain types of ships only. If it is applicable to your ship, it will be given in the ship's stability book. Remember, the wind heeling criterion provided in the stability book may defer from the criterion provided in the IS Code depending upon the flag state requirements.

The calculation and the evaluation method also will be provided in the stability book. At the same time, a simplified version of verifying the compliance with the criterion may also be provided.

15) How to carry out a draught survey

The main purpose of carrying out a draught survey is to calculate the accurate displacement of a vessel at the time of carrying out the survey. The following can be calculated by using this displacement:

- Ship's constant can be calculated provided the weights on board (fuel, fresh water, ballast water etc.) are known.
- Amount of cargo to be loaded can be calculated by carrying out a draught survey before loading.
- Amount of cargo loaded can be calculated by carrying out a survey before and after loading.

Comply with the following at the time of carrying out a draught survey:

- Should have calm weather (the draught readings should be accurate), advisable to use a **draught tube** if the weather is not calm;
- Should not have strong currents;
- The vessel to be upright;
- Shall have a trim within the limits of the tank calibration tables;
- Preferably, the trim should not be more than 1% of the vessel's length (the second trim correction may not be accurate if the trim exceeds this); and
- Shall have calculated the amount of ballast, fresh water, cargo and fuel oil on board.

Following information are required for the purpose of carrying out the calculation:

- The distances between the draught marks and respective perpendiculars.
- Density of sea water. Water density shall be taken from half the ship's draught. Depending upon the length of the vessel, you may take samples from fwd and also from aft.
- The draughts at fwd, amidship and aft on both (port & stbd) sides.

Following proforma may be useful in carrying out a draught survey calculations:

Draught survey calculation sheet

Information required	Formula to use	Answer
Fwd mean	Fwd (port + stbd) / 2	
Amidships mean	Mid (port + stbd) / 2	
Aft mean	Aft (port + stbd) / 2	
Apparent trim	Aft mean – fwd mean	
Length Between fwd & aft Draught Marks (LBDM)	Need to refer the ship's plans	
Correction to fwd draught	$\frac{\text{Apparent trim x distance between FP \& FDM}}{\text{LBDM}}$	
Correction to mid draught	$\frac{\text{Apparent trim x distance between MP \& MDM}}{\text{LBDM}}$	
Correction to aft draught	$\frac{\text{Apparent trim x distance between AP \& ADM}}{\text{LBDM}}$	
Draught at FP[1]	Fwd mean +/- correction to fwd draught	
Draught at MP[2]	Mid mean +/- correction to mid draught	
Draught at AP[3]	Aft mean +/- correction to aft draught	
Trim between perpendiculars (**TRIM**)	Draught at AP – Draught at FP	
Quarter mean draught (QMD)	$\frac{\text{6 x draught at MP + draught at FP + draught at AP}}{8}$	
Displacement for QMD	From tables	
TPC for QMD	From tables	
LCF for QMD	From tables	
MCTC for 50 cm + QMD	From tables ($MCTC_1$)	
MCTC for 50 cm – QMD	From tables ($MCTC_2$)	
Layer correction	$\frac{\textbf{TRIM}\text{ x Distance between amidships \& LCF}}{\text{LBP}}$	
First trim correction	Layer correction x 100 x TPC	
Second trim correction	$\frac{\textbf{TRIM}\text{ x }\textbf{TRIM}\text{ x 50 x }(MCTC_1 - MCTC_2)}{\text{LBP}}$ [4]	
Heel correction	6 x (TPC_{port} – TPC_{stbd}) x ($Draught_{port}$ – $Draught_{stbd}$)	
Displacement in SW	Displacement for QMD +/- first trim correction[5] + Second trim correction + heel correction	
Displacement if the vessel is in DW	Displacement SW x DW density / 1.025	

NOTE

FP – Fwd Perpendicular
FDM – Fwd Draught Mark
MP – Midship Perpendicular
MDM – Midship Draught Mark
AP – Aft Perpendicular
ADM – Aft Draught Mark

1 For a stern trim ship, when the FDM is aft of FP : minus
2 For a stern trim ship, when the MDM is aft of MP : minus
3 For a stern trim ship, when the ADM is fwd of AP : plus
4 The difference between the MCTCs only
5 If LCF is aft of mid ship : plus

Remember, that the draught survey calculations may not be 100% accurate due to the following problems and errors:

- Inaccuracies in draught readings (especially in heavy weather).
- Draught reading may not be accurate if the vessel is experiencing strong currant and if she is berthed in shallow water due to squat effect.
- Density of water may not be the same all around the vessel.
- The sag or hog calculations are made (the quarter mean draught formula) assuming the vessel is bend like a parabola, but it may not be.
- The ballast amounts may not be that accurate, especially when the vessel is trimmed. A sounding of zero centimetres does not necessarily mean that the tank is empty. At the same time, if the tank is ballasted until it is over flowed does not mean that is it full 100% due to air pockets inside.
- Errors of the densities of the ballast water inside the tanks.

16) Testing of a loadicator with approved test conditions

Loadicator shall be tested with the **approved test conditions** in case of the following situations:

- After the installation of the software is completed or after any updates to the software is made and should be done in the presence of a Society surveyor[167].
- At each Annual Survey by applying at least one approved test condition. If a Society surveyor is not present for the computer check, a copy of the test condition results obtained by the computer check is to be retained on board as documentation of satisfactory testing for the surveyor's verification.[168]
- At each Special Survey, for all approved test loading conditions is to be done in presence of the surveyor.[169]
- Periodically as specified by the SMS onboard, could be monthly, could be four monthly.

General procedure of testing the programme

Refer to the recommended testing procedure supplied by the software provider for the loadicator specific procedure. Following is the general procedure:

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[167] IACS, Unified requirements, Computer software for onboard stability calculations, L5, https://www.classnk.or.jp/hp/pdf/tech_info/tech_img/T722j.pdf (Last visited 25/04/2026)
[168] Ibid
[169] Ibid

- There is **approved test conditions** provided and usually they are programmed into the loadicator;
- Select one test condition except the lightship condition and run the calculation;
- Compare the results against the **class approved loadicator test condition document**. There is a document that provides test conditions and test results which is approved by the class. This is not the ship's stability book, but a separate file/document;
- Take a printout of the results and keep a record;
- Then change the DWT such as cargo weight, ballast, fuel etc. to change the draught or displacement by at least 10%;
- Review the results and ensure that the changes to draught, trim, KG, GM, list, stresses etc. are reasonable and logical;
- Take a printout as a record;
- Revise the changes made above to restore the initial test data;
- Compare the results with approved document; and
- Take a printout as a record.

IMPORTANT CASE STUDIES

Self-study the following cases as they are important not only for the purpose of getting through the examinations but, for general knowledge as well:

a) MV Herald of free enterprises
b) MT Exxon Valdez
c) MV El Faro
d) MV Cougar Ace
e) MV Derbyshire
f) MV Hoegh Osaka
g) MV Benita
h) MV Bulk Jupiter
i) MV Stellar Daisy
j) MV Costa Concordia
k) MT Sanchi
l) MV Wakashio
m) MV X-Press Pearl
n) MV Ever Given
o) MV Dali

LIST OF INCIDENTS WHICH CAUSED TO MAKE NEW CONVENTIONS/CODES, AND AMENDMENTS TO EXISTING CONVENTIONS/CODES AND SUCH AMENDMENTS MADE

The amendments in certain conventions / codes were not exactly due to the named vessel or the incident but made due to a series of similar incidents.

Name of the vessel	Date of the Incident	Requirement/regulation/amendment/Code
Titanic	14th April 1912	Implementation of SOLAS Lifeboat & life raft capacities to comply with the ship's complement
Torrey Canyon	18th March 1967	MARPOL 1973 International Convention on Civil Liability for Oil Pollution Damage 1969
Argo Merchant	15th Dec 1976	Hazardous Material Response Division (HAZMAT team) was created to provide scientific expertise during a response incident - USA 1978, adopted a protocol to the 1973 MARPOL Convention, absorbing the parent Convention Pre-arrival navigation tests - USA
Amoco Cadiz	16th March 1978	Significant updates to both MARPOL and SOLAS Expansions and addition of safety and pollution prevention to the Paris MoU Established Port State Control (initiated with Paris MoU) International Salvage Convention 1989
Derbyshire	9th Sept 1980	Compulsory daily reporting of the position of all vessels Adopted amendments and new text to SOLAS chapter XII Adopted amendments to 1988 Load Lines Protocol
Herald of free enterprises	06th March 1987	This is the nearest incident to ISM Code Indicators on the navigating bridge for all doors which, if left open, could lead to major flooding of a special category space or a ro-ro cargo space, as well as means such as monitoring to detect water leakage. Monitoring of special category and ro-ro spaces to detect undue movement of vehicles in adverse weather, fire, the presence of water or unauthorized access by passengers whilst the ship is underway.

		Supplementary emergency lighting for ro-ro passenger ships "SOLAS 90" standards Maximum angle of heel after flooding but before equalization shall not exceed 15^0 Masters to be supplied with data necessary to maintain sufficient intact stability, including information showing the influence of various trims, taking into account operational limits Cargo loading doors to be locked before the ship proceeds on any voyage and to remain closed until the ship is at its next berth Lightweight survey must be carried out to passenger ships to verify any changes in lightweight displacement and the longitudinal centre of gravity, at periods not exceeding five years From 1 February 1992 new ships have had to be equipped with power-operated sliding doors, except in specific cases, which must be capable of being closed from a console on the bridge in not more than 60 seconds. All watertight doors must be kept closed except in exceptional circumstances. "probabilistic" concept of survival on ships built after 1 February 1992 Revised SOLAS chapter VI Carriage - Code of Safe Practice for Cargo Stowage and Securing, which includes a number of annexes dealing with such "problem" cargoes as wheel-based cargoes and unit loads, both of which are carried on ro-ro ships. Large open spaces such as atriums on passenger ships built on or after 1 January 1994 were to be provided with two means of escape, one of which gives direct access to an enclosed vertical means of escape and be fitted with a smoke extraction system and with automatic sprinkler systems Modified SOLAS 90 - A/Amax (it is a simplified probabilistic approach attempting to assess the survivability standard of one ferry against another) Stockholm Agreement
Exxon Valdez	24th March 1989	Double hull requirements

		OPA 90 – US Regulations
Estonia	28th Sept 1994	A.792(19) Safety culture in and around passenger ships. A.793(19) Strength and securing and locking arrangements of shell doors on ro-ro passenger ships. A.794(19) Surveys and inspections of ro-ro passenger ships. A.795(19) Navigational guidance and information scheme for ro-ro ferry operations. A.796(19) Recommendations on a decision-support system for masters on passenger ships
Erika	12th Dec 1999	Acceleration of the schedule to phase out single-hulled tankers Amendments to CLC Convention Amendments to IOPC Fund Amendments to the guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers (resolution A.744(18)) with relation to the evaluation of the longitudinal strength of the hull girder of oil tankers
Attack on Twin towers - USA	11th Sep 2001	ISPS Code
Prestige	13th Nov 2002	extended application of the Condition Assessment Scheme (CAS) for tankers acceleration of the schedule to phase out single-hulled tankers banned the carriage of HGO in single-hull tankers of 5,000 dwt and above
Ythan	28th Feb 2004	Amendments to IMSBC Code – changes to the Code in relation to the carriage of DRI (A), (B) and (C)
Karen Danielsen	03rd March 2005	BNWAS
Star Princes	23rd March 2006	Amendments to SOLAS chapter II-2 and to the International Code for Fire Safety Systems (FSS Code) to strengthen the fire protection arrangements in relation to cabin balconies on passenger vessels
Costa Concordia	13th Jan 2012	Amendments require musters of newly embarked passengers prior to or immediately upon departure, instead of “within 24 hours of departure”. For detailed information refer – MSC.1/Circ.1446/Rev.2 issued on 08th August 2013
MSC Napoli	18th Jan 2007	Shipper to verify the gross weight of the containers from 1st of July

MOL Comfort	17th Jun 2013	2016
Bulk Jupiter	02nd Jan 2015	Bauxite which was classed as Group C (cargo may not liquefy) in the IMSBC Code. After the loss of Bulk Jupiter, some types of bauxite was re-classified as Group A (cargo which may liquefy) cargo

EMERGENCIES

Follow the procedures given in SMS, emergency manual and emergency plans onboard when handling emergencies and take decisions based on your professional judgement depending upon the situation. Following information are for your guidance only.

1) Actions to be taken during a man overboard situation

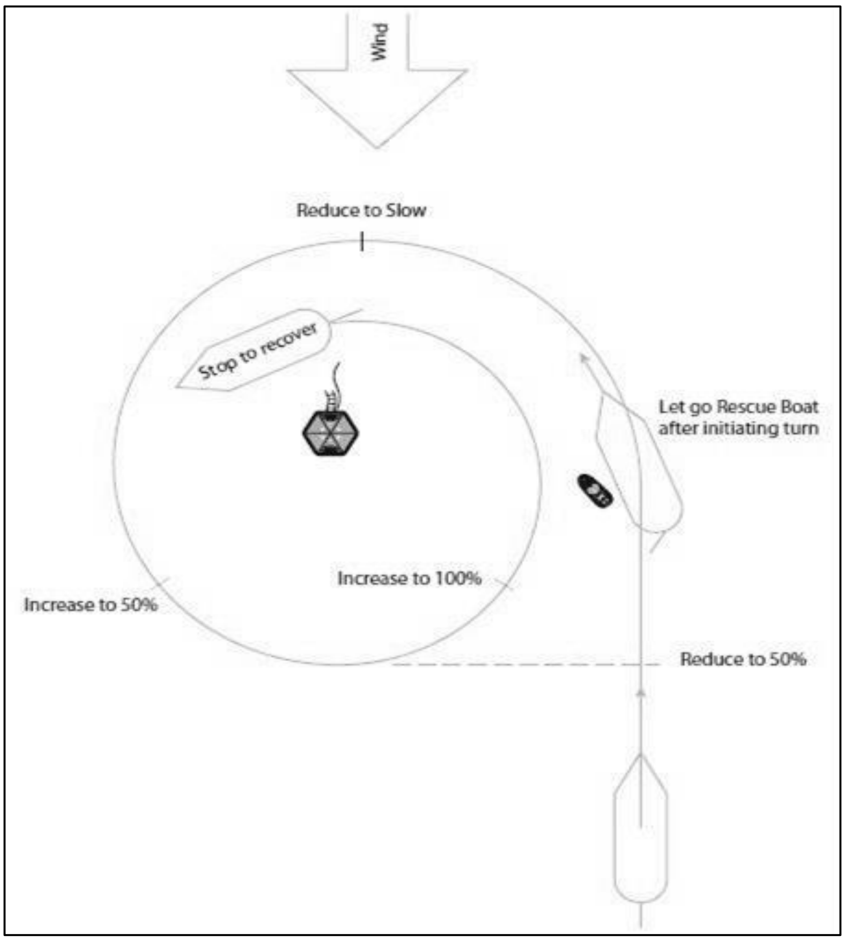
a) Sound the general emergency alarm followed by PA announcement.
b) Put the wheel hard over to the man overboard side.
c) Let go the MOB marker which is on the same side.
d) Press the MOB marker on the GPS.
e) Call up emergency stations, inform master, post lookouts and man the wheel.
f) In restricted visibility, the SART may be used to monitor the position of the MOB by dropping it along with the MOB marker, but, if the vessel's free board is very high, the SART may be damaged.
g) Put the engines standby.
h) Send a distress message.
i) Take the check list for man overboard and ensure all the actions are taken according to the check list.
j) When the heading is 60º - 80º off the initial course, put the wheel hard over to the opposite side. When the heading is coming close to the reciprocal course, steady the vessel (this is for the purpose of carrying out a Williamson turn). Any other methods recommended by the IAMSAR Volume III may be used depending upon the situation. You are required to have a good idea of the search patterns given in the IAMSAR Volume III.
k) Put the Oscar flag up.
l) Follow the guidelines provided in the '**Plans and procedures for recovery of persons from the water**'.
m) Prepare rescue boat for lowering.
n) First aid party must be ready with warm clothing and first aid kits.
o) If the rescue boat cannot be lowered due to weather conditions, keep ready cargo nets.
p) If the sea is rough and rescue boat cannot be lowered, take the victim on to the leeward side of the ship and let the vessel drifts towards the victim. If the sea condition is alright and expecting to lower the rescue boat, then take the victim on the windward side.
q) If the weather is bad, consider the use of **Loren turn**. Loren turn means circling around the datum point in order to make a relatively calm area at the datum point. Refer the IAMSAR Volume III. Loren turn will[170];
    - facilitates launch and recovery of a rescue boat;

[170] IAMSAR Volume III

- facilitates rescue work by other craft;
- circling calms the sea by interfering with wave patterns;
- the more turbulence created by the ship the better; and
- additional ships circling to windward will calm the sea further.

r) Loren Turn procedure;

- Head into the wind at full speed.
- Begin the circle and reduce to slow when the wind is abeam.
- When the wind crosses the stern to the opposite quarter, increase to half speed.
- Continue circling as long as calmer water is needed.
- Slow down, or stop, to launch and recover rescue boat on the leeward side, inside the circle.



Loren Turn[171]

[171] IAMSAR Volume III

2) Actions to be taken in an oil pollution incident

a) Ring the general alarm and call for "pollution emergency".
b) If the vessel is engaged in bunkering or loading/discharging (in case of a tanker), stop the operations immediately.
c) Take the pollution emergency check list and follow it.
d) Try to contain the pollution on board.
e) Use sawdust, Wilden pump, oil absorbent mats, cotton wastes, barrels etc. to collect the over flown oil and to clean the area.
f) Consider of isolating the electricity for the area.
g) If it flows overboard, try to contain it in a limited area by using oil booms.
h) Never use any type of sea cleaning without the permission of the local authorities.
i) Inform the required parties as per the SOPEP.
j) Never give any information to media or any outside party without the permission of the master or the designated person.

In case of an oil spill during bunkering operations

If any oil spill occurs during bunkering operations, irrespective of the party who has made the mistake (bunker spill), both the vessels (the barge and the ship who was receiving bunkers) are required to take actions together to contain and stop the pollution. This is agreed while signing the bunkering contract.

The BIMCO standard bunker contract states "In the event of any spillage causing or likely to cause pollution occurring at any stage of the bunkering operation, the Buyers and the Sellers shall jointly, and regardless as to whether the Buyers or the Sellers are responsible, immediately take such actions as are reasonably necessary to effect clean up and which shall always be conducted in accordance with such local laws and regulations which may compulsorily apply".

3) Actions to be taken when the steering system malfunctions during navigation

a) If in congested waters, sound the general emergency alarm followed by PA announcement and call for "emergency steering" stations.
b) While the people are proceeding to the emergency steering position, try out the non-follow up mode. The non-follow up mode bypasses certain functions in the normal steering system. Therefore, if the fault is in one of those units in the bypassed systems, the non-follow up mode may work.
c) Take the emergency steering check list and make sure all tasks are complied with.

d) Inform the anchor party to be standby in the forward, if there is a risk of grounding.
e) Ensure the repeater in the steering flat synchronized with the master gyro.
f) The use of walkie-talkies in the steering gear flat is not advisable as the communication may break since the steering gear flat is a confined area. Therefore, always use the emergency communication system.
g) Continue steering from the steering gear flat.

4) Rescuing large number of distress people at sea

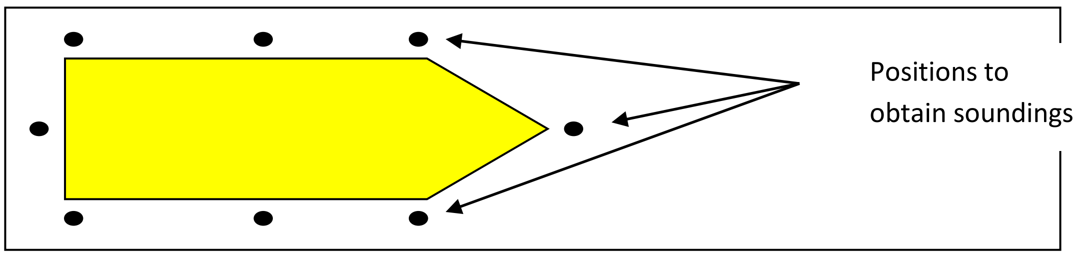
a) Remember, since you are on a cargo ship, your lifeboat capacity will not be sufficient. Therefore, you are required to report to the flag state as soon as possible and need to discharge the rescued people as soon as possible, if you happen to take them onboard. In such a case, a master may decide not to take all of them onboard but to take those who need immediate assistance and wait for the arrival of further assistances as this will put the own vessel in danger.
b) If distress alert through DSC is received, do not acknowledge as it is to be acknowledged by a coast station, but it may acknowledge only if no other station has received the alert and if the alert keeps coming continuously. In that case it may be acknowledged through the DSC for the purpose of terminating and need to inform a coast station as soon as possible by most convenient method.
c) Acknowledge the distress message and relay the message if necessary (a DSC distress relay alert may be transmitted if the distress vessel himself is not in a position to send a distress message or if the master consider further assistance is required) and plot the position of the distress vessel.
d) Calculate the stability for the purpose of picking up the large number of passengers on board and make sure that vessel will have positive stability.
e) The master has to decide whether he can go for the distress assistance without putting own vessel in distress. If the distress vessel is in a reachable distance, but cannot go for the assistance, the master has to make a log book entry with reasons for not providing assistance.
f) Establish communications and pass all the details including the ETA to the distress vessel. (Name, call sign, position, speed, ETA)
g) Keep watch on VHF channel 16 and other distress communication frequencies MF/HF frequencies.
h) While approaching, rig a GUEST WARP secure with the LIZARD LINES from bow to quarter on both side of the vessel at the water line. (For made fast the boats and rafts alongside)
i) Rigged the fire hoses and pressure up the fire mains. First aid party ready with all the equipment. Rescue boat and rafts to be prepared for immediate use.

j) Rig portable ladders scramble nets secure to the lowest point of the deck up to the water level. Line throwing apparatus, heaving lines and messenger lines kept ready for immediate use.
k) During dark hours, arrange searchlights and extra illumination.
l) Keep cranes or derricks ready for hoisting on both sides of the vessel with platforms or cargo nets to pick up the casualties.
m) Post extra lookout when approaching the area.
n) Pass all available information to the RCC and update the information as necessary.
o) Follow the guidelines provided in '**Plans and procedures for recovery of persons from the water**'.
p) Put the engines on standby and approach keeping the distress vessel on the windward side and also keep monitoring and plotting the other vessels positions around the area.
q) David launching life rafts can be used as boarding stations on the water surface alongside the own ship.
r) If there are life rafts belongs to the distressed ship, they also can be used as boarding stations.
s) After picking up all crew and passengers take final count, if anybody is missing, make search and rescue operation again and deviate to a port of refugee as soon as possible, to disembark the rescued people.
t) All the entries must be logged with the time in the GMDSS logbook and OLB as well.
u) If possible, arrange;
    - first aid facilities
    - sanitary facilities
    - fresh water
    - meals
    - accommodation etc.
v) As you and your officers are not used to manage passengers, it is always advisable to use the helps of the rescued officers of the passenger ship in managing the rescued people.
w) Survivors to be sorted out according to medical condition and prioritize them for emergency care, treatment and evacuation. This is known as '**Triage**'. Refer the IAMSAR Volume – III.

5) Actions to be taken in case of grounding

a) Stop engine and change over to hand steering.
b) Sound the general emergency alarm followed by PA announcement.
c) Inform engine room to change over low suction to high suction.
d) Retract the log sensors if fitted.
e) Display aground signals.

f) Save the data in the VDR.
g) Plot the position on the chart.
h) Keep record of all the events.
i) Send out urgency message and inform to relevant parties.
j) Render first aid to any persons onboard who suffers injuries.
k) Sound all tanks including fuel tanks and compare with last sounding records.
l) Check the external sounding and drafts of the vessel to determine the side and extent of grounding and nature of seabed. In checking the external soundings, make sure to take soundings as per the picture below. Depending upon the size of the vessel (length and breadth), the number of sounding positions may be increased.



m) Check the watertight integrity of the vessel.
n) If there is any water ingress, try to control it by means of pumping out.
o) Assess the extent of damage and assess the damage stability.
p) Check the tides and see the possibilities of refloating.
q) Master must consider whether to use own engines to refloat or call tug for assistance.
r) Obtain the latest weather reports from all available means.
s) If a fuel tank is damaged minimize the pollution by rigging oil booms & transfer fuel to empty fuel tank and standby the SOPEP team.
t) Report to appropriate authorities.

6) Master's obligations in case of a collision

Without putting own ship, crew and passengers in danger;

a) render all practicable assistance to the other vessel;
b) standby until ascertain that she does not require further assistance; and
c) take details of the other vessel (ship name, name of last port and next port).

7) Actions to be taken in case of a collision

a) Stop engines.

b) Sound the general emergency alarm followed by PA announcement.
c) Assess the situation. Depending upon the angle of collision, it may be prudent to maintain few engine revolutions on the engines to avoid the other vessel from total flooding and possible sinking when the two vessels are separated.
d) Make sure to follow the check list for collision.
e) First aid party must assist the injured persons.
f) Shut all watertight doors (in fact these doors to be kept closed during sea passage, unless opened for maintenances) and fire doors.
g) Obtain weather report and plot position on the chart.
h) Save the data on the VDR.
i) If there is a water ingress start pumping out the water.
j) Switch on deck lights and not under command (NUC) lights or NUC shapes.
k) Muster damage control parties and delegate duties.
l) Check the viability of containing the water ingress by referring to the damage control plan.
m) Prepare survival crafts and make ready for immediate launch if the situation demands.
n) Assess the damage to the vessel.
o) Check the damage stability condition of the vessel.
p) If there is a possibility of flooding and sinking, consider about passing mooring ropes between ships.

Two ships fast after collision to avoid capsizing[172]

q) Investigate the possibility of pollution and if there is any possibility, take measures for pollution prevention/reduction.

[172] https://www.rivieramm.com/news-content-hub/news-content-hub/shipping-experts-discuss-reasons-behind-2018-ship-collisions-25989 (Last visited 13/07/2026)

r) Consider of fire hazards.
s) Contact chief engineer and check the condition of the engine room.
t) Master must consider of making following reporting and call for helps,
    - Distress/urgency message
    - Calling for salvage
    - Owners, charterers, agents
    - Flag state, Coast guards, AMVER, local authorities.
    - Abandoning the ship

u) If required (specially, if the vessel is sinking) and if possible, master may consider of beaching the vessel.
v) For minor damages, consider about using collision pads.
w) Consider of listing the vessel to the opposite side to take the damage area above the water level.

8) Actions to be taken in case of hatch cover damage during heavy weather

a) Try to reduce the water ingress by rigging tarpaulins over it.
b) If the opening is not too large and if the weather permits, it can be cemented as well.
c) Master should consider about altering course to minimize the shipping seas to reduce the water ingress.
d) Check the sounding of the bilges and if it is increasing, pump it out by bilge pump.
e) Check the stability condition of the ship and assess the situation.
f) Master should consider of deviating to a port of refuge.
g) Inform classification society, administration, owners, charterers, P & I etc.
h) Since this affects the load line certificate, it should be inspected by a class surveyor. Therefore, arrange a class surveyor on arrival next port.
i) After repairs also the surveyor must approve it.
j) If surveying or repairing is not possible in that port, the master can take the vessel to another port where surveying or repairing is available, but he must ensure it is safe to do so with the help of the ship's Classification Society and need an exemption certificate or a conditional certificate from the flag state.

9) Lashing failures during heavy weather

As long as it is possible to do so, lashings of the deck equipment, cargo and safety equipment shall be checked while experiencing heavy weather. That is the reason to rig safety wires between fwd and aft so that people can go fwd and aft to check the condition of the lashings.

If any lashing damage or loose lashing is found, need to take immediate actions to reduce further damage. In doing so, generally, follow the procedure below;

- Carryout a risk assessment and make sure that it is safe to send people there.
- In consultation with the master reduce the rolling/pitching by altering the course or by reducing the speed.
- Discuss with master about how to re-arrange lashing and draft a plan. This may include re-arranging proper lashing (provided it is safe to do so and time permits) or use of temporary lashing etc.
- Cross check your plan with the cargo securing manual if it is related cargo lashing.
- Do not hesitate to call any number of crew as it is important, but better to select minimum number of SUITABLE (experienced & competent) crew.
- Brief crew about the plan.
- Ensure that they are wearing appropriate PPE. If the work to be carried out on deck, wear life jackets.
- Keep a proper communication with the bridge throughout the operation.
- Once the operation is completed, time to time check the successfulness of the operation provided it is safe to do so.

If lashing of lifeboat is parted or has loosen, follow the below guidelines in addition to those mentioned above;

- Always it is better to use only the existing lashing by tightening them and/or using wooden wedges to re-secure the lifeboat without using additional lashing. Because, in case of emergency, need to remove the additional lashing as well.
- Master's permission is required if you are going to put additional lashings and if additional lashings to be used:
  - ✓ Always better to use bottle screw/s, so that the lifeboat can be tightened properly. At the same time, wooden wedges could be used for tightening.
  - ✓ Inform all the persons onboard about the extra lashings used and how to release them.
  - ✓ Delegate the duty of removing additional lashings to one or more crews (as required) on the muster list.
  - ✓ Time to time check the successfulness of the lashings applied.

10) Actions to take if containers are lost overboard or observed drifting at sea

If containers are lost overboard

- Log the date, time and position;
- Save the VDR records;

- Save the weather reports; and
- Try to identify whether there is a fire.

When possible;

- assess the damage to the ship;
- assess the stability condition of the ship by removing the lost containers from the loadicator;
- create no-man zones in areas where there is a possibility of falling down any damaged materials;
- check whether any IMDG goods are leaking;
- check whether there is a possibility of causing fire due to damaged reefer connections and ship's electrical circuits; and
- Take photographs.

Master to report to ships around, nearest coastal state and flag. Report shall include[173]:

- Type of report: Loss of freight container (s) from a ship;
- Date and time of lost;
- Ship's identity;
- Number of containers lost;
- Position lost;
- Whether 20 footer / 40 footer / reefer;
- Type of goods / IMDG / Marine pollutants;
- Whether a cargo spillage had occurred; and
- Wind, sea condition.

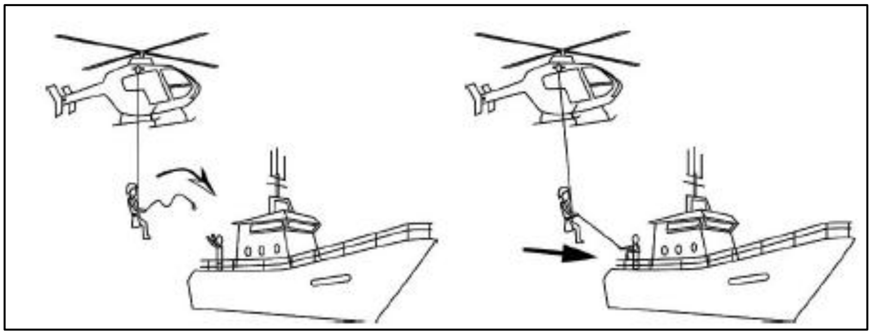
Company shall made the above report if the ship is abandoned or if the report is incomplete.

If observed drifting at sea

The master of every ship that observes freight container(s) drifting at sea, shall communicate the particulars of such an observation by appropriate means without delay and to the fullest extent possible to ships in the vicinity and to the nearest coastal State[174].

[173] Refer the Resolution MSC.550(108) of IMO or the latest for further details
[174] Refer the Resolution MSC.550(108) of IMO or the latest for further details

11) Use of Hi-Line during helicopter operations



Using a Hi-Line[175]

In certain weather conditions it may not be possible to winch a 'helicopter winchman' or a strop (rescue harness) from a position directly above a vessel to the vessels deck. Under such circumstances a rope with weight and extension to the winch wire may be lowered to the vessel. This extension is known as a Hi-Line or Heaving-in Line and is connected via a weak link to the aircrafts winch hook.

When the Hi-Line technique is used, once the weighted line is placed on the deck, one crew member must handle the line. He should take up the slack on the Hi-Line and haul in ONLY when instructed to do so by the helicopter crew by radio message or hand signal. The Hi-Line must NOT be secured to any part of the vessel. A second crew member should coil the slack line into a bucket or similar container clear of obstructions. It is advisable for the handling crew to wear protective gloves to prevent from rope burns. If the helicopter has to break away during the operation the line must be paid out or, if necessary, released completely ensuring that the line passes clear outboard.

As the Hi-Line is paid out, the helicopter will move to one side of the vessel and descend. Normally the winchman will be winched out, the ship's crew should continue to take in the slack. As the winchman or strop approach the vessel the earthing lead or hook must make contact with the vessel to discharge the static electricity before the vessels crew make contact with the wire. Considerable effort may be needed when pulling the Winchman onboard.

[175] https://www.tslrescue.com/content/uploads/2022/10/Manuel-anglais-utilisation-Sac-de-guidage-07-01-13.pdf (Last visited 13/07/2026)

12) Actions to be taken in case of dealing with emergencies arising with IMDG

- If there is spillage or fire involving IMDG, immediately need to refer the EmS Guide (emergency procedures for ships carrying dangerous goods). In fact, the chief officer must make a summary of the IMDG containers onboard along with their emergency schedules and it shall be kept in the bridge before sailing so that it can be used in an emergency.
- In case of fire:
  - ✓ Ring the fire alarm.
  - ✓ Save VDR data.
  - ✓ Consider isolating the electricity for the area.
  - ✓ Need to decide what type of extinguishing medium to be used after referring the EmS Guide.
  - ✓ Master may have to decide whether to abandon the vessel, assistance is required, or assistance is not required depending upon the type of the IMDG and the seriousness of the fire.
  - ✓ When fire is on deck:
    - ensure to wear fireman's outfit and the BA set when fighting fire at close range.
    - may have to turn the vessel such a way that the flames and the smoke are moving away from the firefighting team or to take the fire on to the leeside.

  - ✓ If the fire is under deck (in this case, it will be very difficult to identify whether the fire is caused by an IMDG cargo or some other cargo):
    - Most suitable action would be to release CO_2. Therefore, ensure to close all ventilators and openings to that hold.
    - Once it is confirmed that no one is inside the hold, flood the hold with CO_2.
    - Keep in your mind that amount of CO_2 to be released depends upon the amount of cargo inside the compartment.
    - Use of water is not advisable as it may affect the ship's stability and water is not a good extinguishing medium for some IMDGs and with some IMDGs, water may increase the fire/explosion.
    - Start boundary cooling.

  - ✓ Cooling of IMDG cargoes around the fire will be very helpful in avoiding further severe fires and expositions.
  - ✓ Refer the EmS Guide and be ready to deal with spillages beforehand.
  - ✓ Be prepared with the requirements of the MFAG.
  - ✓ Ensure to comply with the other requirements such as preparing of lifeboats, keeping good contact with bridge, arrange sufficient spare bottles for BA sets and also refilling them, arrangement of first aid party, boundary cooling etc.

- In case of a spillage:
  - ✓ As there is a high risk, sound the general emergency alarm and inform the nature of danger over the PA system.
  - ✓ Do not touch it.
  - ✓ If the cargo started leaking while the ship is in the port of loading, master must get the cargo discharged. If not, need to get the cargo discharged as soon as possible. Master has to consider of requesting from charterers and owners to divert the vessel to a port of refuge to discharge the cargo.
  - ✓ Master may have to decide whether to take advice from external services depending upon the type of the IMDG and the nature of the spillage.
  - ✓ If the vessel is in a port, it would be advisable to disembark all the cargo workers and outsiders who are onboard depending upon the type of IMDG.
  - ✓ Use chemical suits which are supposed to carry on board in accordance with the Document of Compliance for carrying IMDG cargoes while handling dangerous goods.
  - ✓ Consider of diluting the spilled material by means of water if it is not reactive with water.
  - ✓ If it is possible, try to contain the spillage on deck without letting it fall overboard or under deck.
  - ✓ If possibly, try to avoid leaking cargoes falling onto other cargoes, especially other IMDG cargoes.

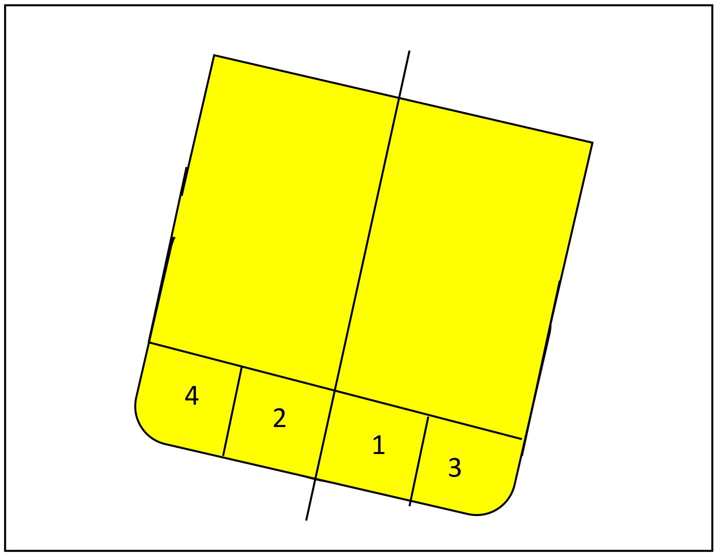
13) Actions to be taken when the vessel is in an angle of loll

If the vessel is in an 'angle of loll', actions should be taken to move the ship's COG downwards (to create a positive GM). **Remember, angle of loll is a dangerous situation and must be corrected immediately**. The position of COG can be moved down,

- by adding weights below COG (in lower holds, double bottom tanks etc.);
- by discharging weights which are already above COG (deck cargo);
- by lowering the weights which are already onboard; and
- by reducing free surfaces effect.

For discharging deck cargoes or for shifting cargoes downward or for loading under deck, ship's cargo gears shall not be used since it will increase the negative GM once the weight is taken by a ship derrick or crane.

The best practice is to ballast double bottom tanks. Ballasting should be started from the heeled side. Follow the below numbered sequence while ballasting;



Ballasting sequence of double bottoms to correct an angle of loll

This should not be started from the higher side because the off centring of COG to the higher side may cause the vessel to capsize to that side as the GM is also not positive to create a righting lever.

There may not be double bottom tanks onboard as illustrated in the above figure, therefore, start ballasting the tanks having lesser FSC, close to the ship's transverse centre line, below the COG of the vessel and on the heeled side of the vessel.

14) Dry docking with damage conditions

If the watertight integrity of the hull is not breached but if the vessel needs to be dry docked just to make repairs to the dented or buckled areas due to grounding or collision, no need to take the actions and precautions mentioned below, since the hull is intact and no stability is affected due to the incident. But the chief officer has to identify the exact areas of such damages and inform the dock master for the purpose of positioning the keel blocks and if required the shores. At the same time, if the damage is at the stern, may require having an even keel condition. This will be informed by the dock master.

If the suspected area is under water and if it cannot be seen from above water, the class surveyor may use divers to inspect the area for the purpose of identifying whether docking is required or not.

There are no internationally accepted safety procedures, practices and guidelines for dry docking a damaged vessel. This completely depends upon the extent of the damage and the vessel's stability condition. Therefore, extensive thinking and planning is required and probably, the vessel may require taking advice from external sources such as from the classification society, salvors etc.

Following to be considered in **addition to the normal dry-docking procedures mentioned earlier**:

- There shall not be any sort of pollution because any dock or port state will not accept a vessel with leaking any marine pollutants, specially, oil, noxious illiquid substances and IMDG. In that case the vessel is required to transfer the cargo or the marine pollutant before docking.
- A set of exact draughts, soundings, cargo distribution arrangement, condition of the vessel's list, extent of the damage, area of the damage to be informed to the dock.
- If the vessel is listed, consider of up righting her without making the stability condition worse. You may have to take advices from outside parties such as classification society, salvor, dock master etc.
- Consider about the ship's stability and may have to consider of discharging the cargo and / or transfer ballast water or ballast / de-ballast to improve stability so that the vessel will be stable during the critical period.
- To reduce the critical period and loss of GM at the critical instant, consider of making the vessel even keel while maintaining stability.
- If the vessel is sagged or hogged, consider of ballasting or de-ballasting or transferring of ballast to reduce the sag or hog effect.
- If the vessel is trimmed by head and if it cannot be reduced, a dock master may consider to adjust the heights of the keel blocks, in such a way that the whole vessel will touch the bottom at once.
- Consider of;
  - ✓ taking the vessel to a floating dock. The trim and list of a floating dock can be adjusted to suit the condition of your vessel.
  - ✓ carrying out repairs while the vessel is waterborne by changing the trim or list.
  - ✓ doing the repair while the dock is partly empty, so that part of the weight of the vessel will be taken by the blocks and part will be supported by buoyancy force.

15) Making a collision mat

A collision mat will not completely stop the water ingress. To stop the water ingress, the best option is to list or trim the vessel to bring the damage area above the water level. The main purpose of a collision mat is to reduce the water ingress so that the pumps can take the control over the water ingress and carrying out temporary repairs would be easy.

Collision mats are convenient only for smaller openings on the hull and if the damaged hull plates are turned out wards, it may not be viable to use a collision mat.

A collision mat may be made by sewing few layers of tarpaulin or canvas together to give it a little rigidity and framed by means of wooden battens or a wire rope. If a wire rope is used, higher the diameter of the rope, stronger the mat would be.

If the hole is on the vertical hull, a collision mat can be positioned on it by hanging it by means of ropes. To sink the mat below the water level, need to add a weight at the bottom of the collision mat such as a steal rod.

If the hole is on the bottom of the hull, a great difficulty may arise in placing the collision mat over the hole. But, when there is a severe threat to life, anything would be possible! The only way possible is by attaching four wire ropes (two on either side of the mat), lower the mat over the forecastle and drag it towards the hole. Wire ropes are required because otherwise the mat will not go under the hull, it will keep floating. At the same time all the ropes shall have lengths almost equal to the breadth plus the height of the vertical hull (breadth + draught + freeboard).

If the hole is small and if it is assessable, hole may be plugged from inside the vessel. Critical thinking is required depending upon the situation before deciding what to do and how to do.

16) Rescue of persons from enclosed spaces[176]

In general

- It is critical that the ship has an enclosed space emergency response plan, which is easily understood, regularly practised, verified as effective and followed precisely.
- Ship's crew, or any shore personnel, should **NEVER** perform rescue entering an enclosed space independently, but should always follow the agreed rescue plan.
- The urge to enter an enclosed space where an accident has occurred is immense and should be always resisted.
- If in port, a simple explanation of the enclosed space procedures placed at the entry to the ship together with an agreed emergency response plan will greatly assist the efficient rescue of any casualties following an enclosed space accident occurring on board the ship.

[176] Refer Resolution MSC.581(110) of IMO or the latest for further details

In an emergency

- alarm has been sounded and information on the specific kind of emergency, including, location of the incident has been announced;
- crew muster at their designated muster location;
- consult the Enclosed Space Register or Permit to Work, where details of the specific enclosed space in question are given. Pay particular attention to unique details of the enclosed space such as vertical ladders in the space, Australian ladders, access and egress points and any others to make rescue easier;
- as per the drill plan, the rescue team should don the self-contained breathing apparatus (SCBA) and prepare to enter the space and await instructions from the on-scene commander;
- as time is of essence in enclosed space emergencies, the master should assess whether to alert the telemedical assistance service (TMAS) or to alert other medical assistance at shore to give support for the rescue team on board and give more time for the shore-based rescue resources to arrive to ship;
- in case the ship is at sea, possible deviation to a port of refuge should also be considered;
- rescue team should have an on-scene commander, who will lead the rescue while one or more members will be assisting the commander;
- the on-scene commander assesses the risks and the conditions for the rescue team and briefs on possible dangers present such as oxygen deficiencies, slippery surface, darkness, possible fire;
- the on-scene commander should guide the team to act in the quickest but safest manner. Noting also, the actions should not lead to further casualties;
- once the casualty has been reached, they should be evacuated from the space in the quickest and safest manner possible. Should there be more than one casualty, due regard should be given to rescue them in the quickest possible manner. However, in most cases, it is only possible to rescue them one after the other. The on-scene commander should decide on the order of rescue of the casualty. The use of a safe stretcher should be considered; and
- once the casualty is clear of the danger zone, the first aid team should administer first aid and, if necessary, conduct medical procedures such as CPR to revive the casualty. Shore medical assistance should be consulted.

DRILLS ONBOARD

1) Summary of drills and safety trainings to be conducted on board

Name of the drill or safety training	Period
Fire drill & abandon ship drill for crew members	Once every month
Abandon ship drill and **fire drill** for crew members	If more than 25% of the crew have not participated in abandon ship and fire drills on board within 24 hrs of the ship leaving a port
Abandon ship drill and **fire drill** for crew members	Enters service for the first time or after major modification, before sailing
Passenger safety briefing	Newly embarked passengers shall be given safety briefing immediately before sailing or immediately after sailing
Abandon ship drill and **fire drill** for passengers	Newly embarked passengers prior to or immediately upon departure
Abandon ship drill and **fire drill** for passengers	Shall take place weekly.
Launching of Gravity launched lifeboats	Once every 3 months Ships on short international voyages may not launch the lifeboats on one side if their berthing arrangements in port and their trading patterns do not permit launching of lifeboats on that side. However, all such lifeboats shall be lowered **at least once every three months and launched at least annually**.
Launching of Dedicated rescue boats (other than those which are also lifeboats)	Monthly, if not possible, at least once every 3 months
Launching of Free fall lifeboats	Once every 6 months if not possible, Flag Sate may extend to 12 months provided suitable simulated launching practices are carried out every 06 months
Onboard training in the use of Davit-launched Life rafts	Once every 4 months. If possible, it shall include the inflation and lowering of the life raft.
Fast rescue boats (ro-ro passenger ships)	At least two crews of each fast rescue boat shall be trained & drilled regularly.
Operating of watertight Doors, Side Scuttles and Other Openings	Once every week

(passenger ships)	
All watertight doors, both hinged and power operated, in main transverse bulkheads, in use at sea	Shall be operated daily
Marine evacuation system drills	Training on procedures of deploying the system – regularly Actual deployment (onboard or ashore) – at intervals of 2 years but in no case longer than 03 years
Enclosed-space entry and rescue drill	Once every 2 months
Steering gear	Within 12 hours before departure, the ship's steering gear shall be checked and tested. Ships regularly engage on voyages of short duration shall carry out these checks and tests at least once every week.
Steering gear drill	Once every 03 months
Onboard training in the use of the ship's: • life-saving appliances; and • fire extinguishing appliances	As soon as possible but not later than two weeks after a crew member joins the ship. Thereafter, instructions shall be given at the same interval as the drills. Individual instruction may cover different parts of the ship's life-saving and fire extinguishing appliances, but all the ship's life-saving and fire-extinguishing appliances shall be covered within any period of two months.
Security drill	At least once every three months. If more than 25 % of the ship's personnel have been changed, at any one time, a drill should be conducted within one week of the change.
Drills & emergency exercises on ships which applies the IGF Code.	The IGF Code states that the drills and emergency exercises to be conducted at regular intervals

2) Important points to remember when preparing muster lists

- Ensure that the people who are responsible for the maintenance of LSA and FFA are named.
- In case of carrying passengers, crews shall be appointed to assist passengers.
- Make sure the muster list is in compliance with the latest crew list and the Minimum Safe Manning Document.
- Need to nominate person in charge (deck officer or certified person) for **each survival craft** and also nominate a second in command for **lifeboats**. In this case, a certified person means a person having a Certificate of Proficiency in survival crafts and rescue boats other than fast rescue boats.
- Nominate second in charge for the duties of the key persons.

- Crew members shall be familiarized, and prior training shall be given prior assigning any duties on the muster list.
- When assigning more than one duty to a single person, make sure it is viable for all the possible scenarios. Otherwise, more than one duty shall not be assigned to one person.
- Each lifeboat shall be appointed with a person who can carry out minor engine repairs.
- Check the operational viability of staff before assigning any duties. Example – a person with a beard may not be suitable to wear BA set. People with large BMI (Body Mass Index) may not be suitable to make enclosed space entries for rescuing purposes.
- Be aware of the competencies and the experiences of seafarers before assigning complicated duties, such as lowering of lifeboats, fighting fires with BA sets and fireman's outfits etc.
- Any duties shall not be assigned to anybody who are working or onboard as supernumeraries, riding gangs etc.
- It is better to assigned duties of individual departments to respective staff in the department itself. Examples – fighting engine room fires to be carried out by engine staff. This is because, staff members are familiar with their own environments.
- After completing the muster list, double check it, to make sure the ship's full complement is covered and make sure all the safety duties are covered.
- Change of the duties of the people already onboard is not a wise idea unless it is extremely necessary. This may not be avoidable if the new joiners are not experienced enough. Immediately inform the person concerned if a change of duty has taken place.

3) How to plan and conduct drills onboard

Points to remember when planning drills

- Need to have a knowledge of the types of the drills to be conducted and frequencies required by the vessel's flag state and by international standards (refer the drill matrix onboard vessel).
- Need to be aware of instructions, precautions provided in the SMS with regards to drills.
- Need to have a good idea of the manufacturer's instructions with regards to the operation and maintenance of safety related equipment. Make sure equipment are maintained in accordance with such instructions before operating them.
- Refer the past drill records and see whether there were any lessons to be learned. If so, plan the drill in such a way to avoid the repetition of such errors.
- **SOLAS requires that drills shall, as far as practicable, be conducted as if there was an actual emergency. This means that the entire drill should, as far as possible, be carried out like an actual drill but, without compromising the safety. Consequently,**

elements of the drill that may involve unnecessary risks need special attention or may be excluded from the drill.

- Need to carry out a risk assessment.
- Check the viability of carrying out combined drills, as this may save time and it will be closer to an actual situation. Example – carrying out fire and abandon ship drill together, carrying out the emergency steering drill and a collision drill together etc.
- Make sure to conduct the drills safely, with minimum disturbances to rest periods and without inducing fatigue.
- Drills to be conducted with maximum number of participants. Therefore, need to conduct drills when minimum number of operations are being carried out onboard as far as practicable.
- Check the past drill records and see what equipment were used to demonstrate the operational procedures and try to select different equipment each time. All the safety equipment used during drills shall be ready to use again in an emergency and shall be kept in the correct places.
- Ensure the persons who operate or demonstrate the operation of the safety equipment are familiar with such operations.
- Discuss the plan with the master.

Points to remember during and at the end of a drill

- Make sure all are familiar with the duties and the use of equipment relevant to the type of the drill.
- When giving training in the use of certain equipment, may require giving priorities to certain staff members. Example – more training shall be given to deck staff on emergency steering.
- The instructions to be given to crew includes;
  - ✓ Information with regards to personal safety,
  - ✓ Areas where special attentions are required,
  - ✓ Operation & use of safety equipment,
  - ✓ Importance of familiarization with LSA & FFA training manual,
  - ✓ Importance of following the instructions given by officers,
  - ✓ Correct use of PPE even during drills.

- Among other timings, check the time taken from the activation of the alarm to muster at the muster station and also the time taken from the time of mustering to the completion of the drill. This is one method of monitoring the efficiency and awareness of the staff.
- At the end of each drill need to carry out a debriefing and discuss the mistakes happened during the drill, the efficiency of the drill and ideas to improve the efficiencies in future.

- Make appropriate logbook entries and records, which includes the lessons learned.

4) Abandon ship drills

Each abandon ship drill shall include[177];

- summoning of passengers and crew to muster stations with the alarm required and followed by drill announcement on the public address or other communication system;
- reporting to stations and preparing for the duties described in the muster list;
- checking that passengers and crew are suitably dressed;
- checking that lifejackets are correctly donned;
- lowering of at least one lifeboat after taking necessary preparation for launching;
- starting and operating the lifeboat engine;
- operation of davits used for launching life rafts;
- a mock search and rescue of passengers trapped in their staterooms;
- instruction in the use of radio life-saving appliances; and
- different lifeboats shall, as far as practicable, be lowered.

5) Launching of lifeboats[178]

Free fall launch

- The monthly drills with free-fall lifeboats should be carried out according to the manufacturer's instructions, so that the persons who are to enter the boat in an emergency are trained to;
  - ✓ embark the boat;
  - ✓ take their seats in a correct way;
  - ✓ use the safety belts; and
  - ✓ being instructed on how to act during launching into the sea.

- When the lifeboat is free-fall launched as part of a drill, this should be carried out with the minimum personnel required to manoeuvre the boat in the water and to recover it. The recovery operation should be carried out with special attention, bearing in mind the high-risk level of this operation. Where permitted, simulated launching should be carried

[177] Refer Resolution MSC.47(66) of IMO or the latest for further details
[178] Refer MSC.1/Circ.1578 of IMO or the latest for further details

out in accordance with the manufacturer's instructions, taking due note of the Guidelines for simulated launching of free-fall lifeboats.

Simulated launching

Simulated launching is the procedure for demonstrating the operation of free-fall lifeboats without the physical activation of the free-fall release system.

Simulated launching should only be carried out with lifeboats and launching appliances designed to accommodate it, and for which the manufacturer has provided instructions. The procedure of simulated launching depends upon the lifeboat manufacturer but, in general simulated launching sequence includes the following:

a) Check equipment and documentation and make sure everything is in good working order.
b) Ensure that all personnel involved in the drill are familiar with the operating manuals, posters and signs.
c) Ensure that the restraining device(s) (The system of restraints should allow movement of the lifeboat along the launching ramp for a sufficient distance to prove freedom of movement without disengaging from the ramp) provided by the manufacturer for simulated launching are installed and secure and that the free-fall release mechanism is fully and correctly engaged.
d) Establish and maintain good communication between the assigned operating crew and the responsible person.
e) Disengage lashings, gripes, etc. installed to secure the lifeboat for sea or for maintenance, except those required for simulated free-fall.
f) Participating crew board the lifeboat and fasten their seatbelts under the supervision of the responsible person.
g) All crew disembark the lifeboat.
h) Return the lifeboat to the condition it was in prior to step provided in paragraph (d).
i) Ensure that the lifeboat is returned to its normal stowed condition. Remove any restraining and/or recovery devices used only for the simulated launch procedure.

Lifeboats lowered by means of falls

a) During drills, everyone participating should be alert for potentially dangerous conditions or situations and should bring them to the attention of the responsible person for appropriate action. Feedback and recommendations to the shipowner, the Administration and the system manufacturer are important elements of the marine safety system.

b) When drills are to be performed with persons on board the lifeboat, it is recommended that the boat be lowered and recovered without any persons on board first to ascertain that the arrangement functions correctly. In this case, the boat should then be lowered into the water with only the number of persons on board necessary to operate the boat.

c) To prevent lashings or gripes from getting entangled, proper release should be checked before swinging out the davit.

6) Fire drills

- Refer the former drill records and select a different place each time. Example – galley fire, engine room fire, cargo hold fire, accommodation fire etc.
- Watertight doors shall not be closed remotely, since there is a possibility of persons inside un-noticed.
- If there are fire doors with remote release devices, as far as possible, make a public announcement before releasing the doors.
- Instead of using smoke to generate reduced visibility environment inside the compartment, consider of using darken visors with the head protection of the fireman's outfit.

In addition to above, fire drills should be planned in such a way that due consideration is given to regular practice in the various emergencies that may occur depending on the type of ships and the cargo. Each fire drill shall include[179]:

- reporting to stations and preparing for the duties described in the muster list required;
- starting of a fire pump, using at least the two required jets of water to show that the system is in proper working order;
- checking of fireman's outfit and other personal rescue equipment;
- checking of relevant communication equipment;
- checking the operation of watertight doors, fire doors, fire dampers and main inlets and outlets of ventilation systems in the drill area; and
- checking the necessary arrangements for subsequent abandoning of the ship.

The equipment used during drills shall immediately be brought back to its fully operational condition and any faults and defects discovered during the drills shall be remedied as soon as possible.

[179] Refer Resolution MSC.47(66) of IMO or the latest for further details

7) Enclosed space entry and rescue drill

- Never hoist stretcher with people in it, use a weight having a weight similar to a person.
- The SOLAS regulation III/19.3.6 states that each enclosed space entry and recue drill to include[180]:
  - ✓ checking and use of personal protective equipment required for entry;
  - ✓ checking and use of communication equipment and procedures;
  - ✓ checking and use of instruments for measuring the atmosphere in enclosed spaces;
  - ✓ checking and use of rescue equipment and procedures;
  - ✓ instructions in first aid and resuscitation techniques;
  - ✓ providing instructions to crew with regards to the risks associated with enclosed spaces and onboard procedures for safe entry into such spaces.

- Ship's crews with rescue and first aid duties should be drilled periodically as required by SOLAS regulation III/19.3.6 in rescue and first aid procedures. Training should include as a minimum[181]:
  - ✓ identification of the hazards likely to be faced during entry into enclosed spaces and whilst within the space, in particular:
    - the rapidity with which oxygen may be depleted in a space by corrosion or biological means especially in higher ambient temperatures or other characteristics or properties of the contents or structure of the space; and
    - how the pace at which oxygen is depleted will increase exponentially when ventilation is stopped or when hatch covers are closed.

  - ✓ identification and use of the various sources of information on the hazards associated with individual solid bulk and liquid bulk cargoes, and the precautions to be adopted when entering spaces containing such cargoes, or their residues;
  - ✓ awareness of the fact that when a person or persons in an enclosed space shows signs of adverse health effects, that they should always assume that these effects are due to an oxygen-depleted or toxic atmosphere in the space, and that they should not enter it themselves;
  - ✓ recognition of the signs of adverse health effects caused by exposure to hazards during entry;
  - ✓ knowledge and experience in the use of personal protective equipment required for entry;
  - ✓ rescue, first aid, Cardio Pulmonary Resuscitation (CPR) techniques and evacuation procedures;
  - ✓ knowledge and experience in the use of communication equipment and procedures;

180 Refer Resolution MSC.350(92) of IMO or the latest for further details
181 Refer Resolution MSC.581(110) of IMO or the latest for further details

- ✓ knowledge and experience in the use of instruments for measuring the atmosphere;
- ✓ knowledge and experience in the use of rescue equipment and procedures;
- ✓ knowledge of the IMO/WHO/ILO Medical First Aid Guide for Use in Accidents involving Dangerous Goods (MFAG), where appropriate; and
- ✓ knowledge of use of emergency and the first aid equipment for chemical tankers (IBC Code section 14.3) and for gas carriers (IGC Code section 14.3), where appropriate.

HEALTH AND SAFETY ON BOARD

The chief officer must be aware of the general safety practices and safety procedures onboard his/her ship. The following safety precautions, practices and procedures were obtained from the relevant sections of reputed documents issued by flag states, ILO etc. Remember that the documents issued by flag states are applicable on merchant ships flying that particular flag only. Therefore, the chief officer must refer the company SMS and flag state regulations to learn about the ship specific safety precautions, practices and procedures. Remember, some companies and flag states may have higher regulations than mentioned below.

1) **Working in ship's galleys, pantries and other food handling areas** [182] [You are also encouraged to refer MLC 2006 for further details]

   a) **Refrigeration chambers**

   - Doors to be fitted with a device strong enough to hold them open in a seaway;
   - Doors to be fitted with a means of opening them from the inside;
   - Rooms should have a means of sounding the alarm both from inside and outside;
   - The exit area from the chamber should have a slip-resistant surface;
   - If found any leaking of refrigerants or suspected, no body shall enter the chamber and a warning sign to be posted with regards to this effect;
   - If the chamber is padlocked, the person entering the chamber shall keep the padlock with him; and
   - People who are entering the chamber shall be trained in above; they shall be familiar with the alarm bells and door opening systems from inside.

   b) **Preparation of food**

   - When meat is being chopped:
     - ✓ the chopping block should be firm;
     - ✓ the cutting area of the meat should be well on the block;
     - ✓ make sure the fingers, arms and legs are clear of the line of strike;
     - ✓ protective gloves shall be worn; and
     - ✓ a protective apron should be worn.

[182] ILO, Accident prevention onboard ship at sea and in port

- When foodstuffs are being chopped or cut with a knife, fingers should be bent inwards towards the palm of the hand with the thumb overlapped by the forefinger;
- All cuts (injuries), skin exposures to heat or concentrated cleaning liquids however small, should be reported immediately and treated for infection;
- Such cuts should be covered by a waterproof dressing when food is being handled;
- Care should be taken never to leave pans with fat unattended in an oven or on a heating stove, nor to allow water to come into contact with hot fat;
- All seafarers working in the galley should be trained in the use of appropriate fire-fighting equipment, including the use of a smothering blanket and appropriate type of fire extinguisher;
- Seafarers working in catering operations should wear clean clothing, particularly when handling food and preparing meals, and should wash hands and clean fingernails before handling food and after using the toilet;
- Particularly when purchased in a hot climate, vegetables to be used in salads should always be thoroughly washed in clean running fresh water before being served. Fruits should preferably be washed and peeled before being eaten;
- Seafarers should not be permitted to handle food or cooking utensils, etc., when suffering from dysentery, diarrhoea or stomach disorders of an infectious nature;
- They should report any such complaints, spots or rashes to a competent officer onboard;
- All accommodation areas and particularly places where food is stored or prepared should be inspected regularly to ensure cleanliness and freedom from insects, mice and rats;
- Cracked or chipped crockery and glassware should be discarded;
- Any food which has been in contact with broken glass or crockery should be thrown out;
- Smoking should be prohibited in kitchens, galleys, pantries, storerooms or other places where food is stored, handled or prepared and notices to this effect should be displayed; and
- Concentrated cleaning liquids to be used only for the intended use recommended by the manufacturer and protective gloves to be worn.

c) Working in galleys, pantries and serving food

- Cleaned cloths to be worn;
- Suitable protective footwear of a type that fully covers the foot, with slip resistant soles, should be worn at all times;
- Decks should be mopped clear and surplus water removed after washing;
- Any defects in equipment or utensils should be reported to the responsible officer, who should arrange for their repair or replacement as soon as possible;
- The defective item should be taken out of service;

- The users should be trained and properly instructed:
  - ✓ in the use of any mechanical or electrical equipment which they may be required to use or operate; and
  - ✓ in the dangers of cutting instruments and slicing, mincing and chopping machines.

- Sharp knives, saws and choppers should be safely stowed in a proper rack, and they should not be left lying around or in washing-up water.

2) General duties and responsibilities of the shipboard safety committee, safety officer and safety representatives[183]

a) Shipboard safety committee

- The company must appoint a safety committee on every ship with five or more seafarers. The committee must be chaired by the master, and members will include, as a minimum, the safety officer and any elected safety representatives.
- The master must record the appointment of a safety committee in writing. This should normally be in the official logbook or minutes of the committee's meetings.
- The safety committee is a forum for consultation between the master, safety officials and others of matters relating to health and safety.
- Do not use safety committee meetings for instruction or training.
- The frequency of meetings will be determined by circumstances, but the committee should meet regularly, considering the pattern of operation of the ship and the arrangement for manning, and frequently enough to ensure continuous improvement in safety.
- In particular, a meeting should also take place after any serious incident or accident on the ship, if the normal meeting is not due within a week.
- Circulate an agenda (together with any associated documents and papers, and the minutes of the previous meeting) to all committee members, giving them enough time to read the contents and prepare for the meeting.
- The first item on the agenda should be the minutes of the previous meeting. This allows any correction to the minutes to be recorded and gives the opportunity to report any follow-up action taken.
- The last but one item should be 'any other business'. This enables last-minute items to be introduced, and prevents the written agenda being a stop on discussion.
- The last item on the agenda should be the date, time and place of the next meeting.

[183] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details

- In the minutes of each meeting record concisely the business discussed and conclusions reached. Give a copy to each committee member. Agree the minutes as soon after the meeting as possible, or amend them if necessary.
- Keep a minutes file or book together with a summary of recommendations recording the conclusions reached.
- Keep all seafarers informed on matters of interest that have been discussed; for example, by posting summaries or extracts from the minutes on the ship's noticeboards.
- Send the relevant extracts from the agreed minutes via the master to the company and, where appropriate, to individual employers, even when the matters referred to have already been taken up with them. Keep a record of the response or action taken by the company.

b) Safety officer

- On every seagoing ship employing five or more seafarers, the company must appoint a safety officer. The master must record the appointment of a safety officer in the official logbook.
- A safety officer's appointment ends when the officer ceases to work in the particular ship or their appointment is otherwise terminated.
- Although not prohibited by the regulations, it is not advisable to appoint the master as the safety officer.
- If possible, the company should avoid appointing as safety officer anyone to whom the master has delegated the task of giving medical treatment.
- The safety officer must maintain a good working relationship with the safety representatives by, for example, inviting them to join in regular inspections of each part of the ship or, while carrying out an investigation, consulting them on safety matters and arrangements, and in particular on any follow-up action proposed.
- The objective is to become the ship's adviser on safety, who the master, officers and all seafarers will naturally turn to for advice or help on safe working procedures. Safety officer should:
  - ✓ look out for any potential hazards and the means of preventing incidents;
  - ✓ carry out risk assessment and risk management;
  - ✓ where unsafe practice is observed, approach the individual or responsible officer concerned to suggest improvements in working methods or use the safety committee to discuss examples of dangerous or unsafe practices in a particular area. If this brings no improvement, the safety officer should approach the head of department or, as a last resort, the master to use their influence;
  - ✓ ensure that each worker joining the ship is instructed in all relevant health and safety arrangements, and of their importance, before starting work;

- ✓ where possible, ensure that arrangements are made for each new entrant to work with a safety-conscious seafarer; and
- ✓ remind experienced seafarers joining the ship for the first time of the importance of a high level of safety consciousness and of setting a good example to less experienced seafarers.

- The safety officer should also promote safety on board, subject to the agreement of the master, by:
  - ✓ arranging the distribution of booklets, leaflets and other advisory material on safety matters;
  - ✓ supervising the display of posters and notices, replacing and renewing them regularly;
  - ✓ arranging for the showing of films on safety publicity and, where appropriate, organising discussions on the subjects covered;
  - ✓ encouraging seafarers to send in ideas and suggestions for improving safety and getting their support for any proposed safety measures which may affect them; and
  - ✓ effectively communicating new requirements or advice in relevant shipping legislation, marine notices and company and ship's rules and instructions relating to safety at work on the ship.

- The safety officer must investigate notifiable accidents or dangerous occurrences affecting people on board ship or during access, as well as potential hazards to health and safety and any reasonable complaints made by any personnel.
- They must make recommendations to the master. They should record and investigate, as appropriate, all incidents reported by personnel or passengers.
- The safety officer must ensure that each accessible[184] part of the ship has a health and safety inspection at least once every three months, or more frequently if there have been substantial changes in the conditions of work.
- Before beginning any inspection, read previous reports of inspections of the section, together with the recommendations made and the subsequent action taken. Read the control measures identified in any relevant risk assessment, and check compliance with them during the inspection.
- Deciding whether 'substantial changes in the conditions of work' have taken place is a matter of judgement.
- Safe access, the environment and working conditions are major items to consider.
- To fulfil this function properly, the safety officer needs to be familiar with the appropriate regulations.
- The safety officer must maintain a record of all accidents and dangerous occurrences in line with procedures in the ship's safety management system.

[184] 'Accessible' means all parts of the ship to which any seafarer has access without prior authority.

- The safety officer must stop any work in progress which they reasonably believe may cause an accident and immediately inform the master.
- Above does not apply to an emergency action to safeguard life, even though the action itself may involve a risk to life. These regulations do not require the safety officer to carry out their duties to inspect, keep records or make recommendations at a time when emergency action to safeguard life or the ship is being taken.

c) Safety representatives

- On every ship on which five or more seafarers are working, the company must arrange for the election of safety representatives.
- The number of safety representatives to elect will vary according to the number of seafarers on board and, where appropriate, the number of different departments or working groups. As far as practicable, seafarers at all levels and in all departments should have effective representation.
- They must be above 18 years of age, must have at least two years of experience at sea and in case of tankers, must include at least six months experience on tankers;
- The appointment of a safety representative cannot be terminated by the company, employer or master. The representative can resign or seafarers can elect a replacement. Otherwise, they remain a safety representative for as long as they serve on the ship.
- The master should organise the election of a safety representative within three days of being requested to do so by any two persons entitled to vote.
- The master must record the election or appointment of every safety representative in writing. This should be either in the official logbook or in the minutes of safety committee meetings.
- When there is a substantial change in seafarers working on board, the master should remind them of their right to elect new safety representatives.
- Unlike the safety officer, the safety representative has powers, not duties, although membership of the safety committee imposes certain obligations.
- Safety representatives may, with the agreement of the safety officer, participate in investigations and inspections carried out by the safety officer or, after notifying the master or a nominated deputy, may carry out their own investigation or inspection.
- They may also make representations to the company or the relevant employer on potential hazards and dangerous occurrences, and to the master, company or employer on general health and safety matters, such as the findings of the risk assessment, health and safety training, and the introduction of new technology.
- They may request, through the safety committee, that the safety officer investigates and reports back to them, and may inspect any of the records the safety officer is required to keep under the regulations. They should ensure that they see all incident reports

submitted to the MAIB (Marine Accident Investigation Branch, UK) under the accident reporting regulations.

- Safety representatives should be familiar with the relevant safety regulations and guidance. They should:
  - ✓ put forward their views and recommendations in a firm but reasonable and helpful manner;
  - ✓ be sure of the facts;
  - ✓ be aware of the legal position; and
  - ✓ be conscious of what is reasonably practicable.

- If a safety representative finds that their efforts are being obstructed, or they are denied facilities, they should bring the matter to the attention of the safety officer or of the master through the safety committee. They should aim to settle any difficulties on board ship or through the relevant employer or the company. If this proves impossible, the problem should be referred to the trade union or to the MCA (Maritime Coastguard Agency, UK).

3) Permit to work system[185]

A permit to work provides an organised and predefined safety procedure. It does not in itself make the job safe but ensures that you follow measures for safe working. Your ship's SMS will tell you when to use a permit to work and will provide the form for it. Each permit to work should be relevant and as accurate as possible for the task.

Keep the following in mind when a permit to work is to be used:

- Before signing the permit, the authorised officer should ensure that all safety precautions and measures specified as necessary have been taken, or that procedures are in place.
- The authorised officer is responsible for the work until they have either closed the permit or formally transferred it to another authorised officer and fully briefed them on the situation.
- Anyone who takes over from the authorised officer, either routinely or in an emergency, should sign the permit to indicate transfer of full responsibility.
- The competent person responsible for carrying out the specified work should countersign the permit to indicate that they understand the safety precautions and measures to be observed.
- When the work is complete, the competent person should notify the authorised officer and ensure that the authorised officer has closed the permit.

[185] MCA, Code of Safe Working Practices for Merchant Seafarers, 2025 edition

Permits to work are normally required for the following categories of work:

- entry into an enclosed space
- any work requiring use of gas testing/equipment
- any work requiring isolation of machinery or power system
- hot work
- working at height/over the side
- general electrical (under 1000 volts)
- electrical high voltage (over 1000 volts)
- working on deck during adverse weather
- lifts, lift trunks and machinery.

This list is not exhaustive; permits to work, following a similar format, may be required and developed by the company for other categories of work.

4) Work at height[186]

Anyone working where there is a risk of falling may be regarded as working at height. In addition to work on ladders, staging and scaffolding, this includes work inside a tank, near an opening such as a hatch, or on a fixed stairway.

Working at height (also known as working aloft) should be risk assessed and suitable control measures should be taken to protect people who may be at risk. Depending on the severity of the risk, a permit to work may be required. Following should be considered when working at height:

- Only competent people should do any activity relating to work at height or use equipment for work at height. Where a seafarer is being trained to do such work, they must be supervised by another seafarer who is competent both to supervise and undertake that activity.
- Only following company risk assessment and under supervision by a competent person should anyone under 18 years of age be working at height.
- Personnel under 18, or with less than 12 months' experience at sea, should not work at height unless it forms part of their planned training, and unless they are supervised by a competent person.
- Work at height should be subject to risk assessment, and suitable control measures should be taken to protect those who may be put at risk.
- Use a stage, ladder, scaffolding, aerial work platform, bosun's chair or secured scaffold tower when working beyond normal reach. Inspect any equipment before use to ensure it is in a good state of repair.

[186] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details

- Personnel working at height where there is a risk of falling should wear a safety harness with a lifeline or other arresting device at all times. A safety net should be rigged where necessary and appropriate. Additionally, where work is done overside, they should wear a working lifejacket (personal flotation device) or buoyancy garments. Keep a lifebuoy with sufficient line attached ready for immediate use. Personnel should be observed by a person on deck.
- Other than in emergency situations, personnel should not work overside while the vessel is under way. If such work is necessary, rescue boats should be ready for immediate use. A responsible person should closely monitor any such work.
- Before working near the ship's whistle, the officer responsible should ensure that it is isolated and that warning notices are posted on the bridge and in the machinery spaces.
- Before working on the funnel, the officer responsible should inform the duty engineer to ensure that the emission of steam, harmful gases and fumes is reduced as much as possible.
- Before working near radio frequency emitting devices, the officer responsible should inform the radio room or person in charge of radio equipment that no transmissions should be made while there is a risk to personnel. To prevent use place a warning notice on the communications equipment or isolate it.
- Where work is to be done near the radar scanner, the officer responsible should inform the officer on watch so that the radar and scanner are isolated. Place a warning notice on the radar equipment until the necessary work has been completed. Officer on watch shall be informed on completion of the work.
- Do not work at height near cargo working unless it is essential. Take care to avoid risks to anyone working or moving below. Erect suitable barriers and display warning notices.
- Tools and stores should be sent up and lowered by line in suitable containers. Secure tools with a tool lanyard of the appropriate length and strength rating, connected to a suitable anchor point. Secure heavy tools to an adequately strong structure; do not attach them to the user. Have a clearly signposted exclusion zone at the base of the work area so tools cannot accidentally fall on someone below.

5) Use of portable ladders[187]

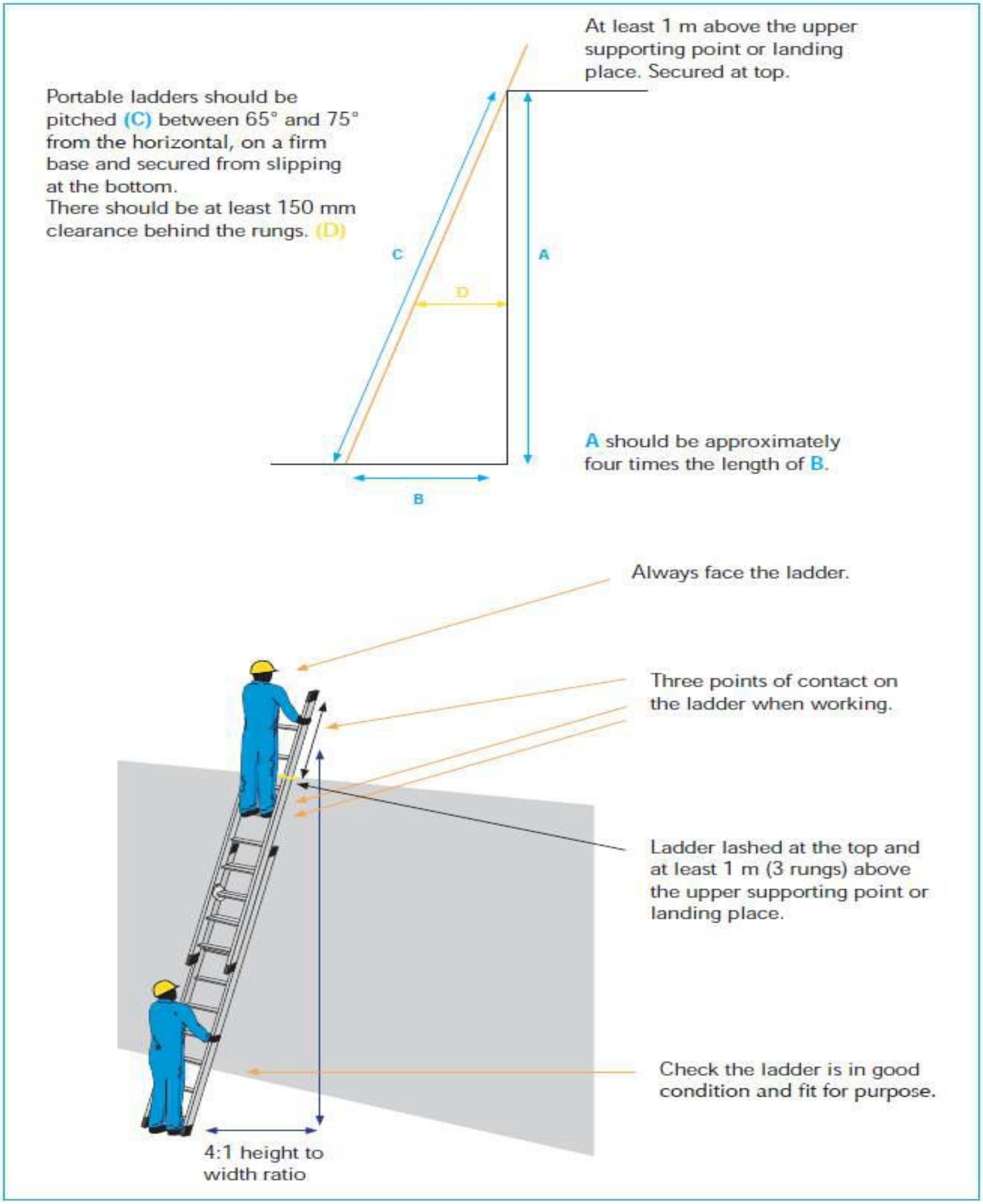
- Avoid working from ladders as far as possible. Use them only for low-risk, short-duration work where personnel can maintain three points of contact (both feet and a handhold) on the ladder at all times.
- Where necessary, personnel must use a safety harness with a lifeline secured above the work position, where practicable.
- Use portable ladders only where the motion of the ship does not present a hazard.

[187] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details

- Use a portable ladder only where no safer means of access is reasonably practicable. The ladder should be suitable for the work and in a safe condition. Only use ladders that:
  - ✓ have no visible defects;
  - ✓ have an up-to-date record of inspection by a competent person; inspect them on a schedule according to the manufacturer's instructions;
  - ✓ are suitable for their intended use; i.e. strong and robust enough; and
  - ✓ have been stored and maintained according to the manufacturer's instructions.

- A competent person should inspect the condition of the ladder regularly in accordance with the manufacturer's instructions, as well as before use, and keep a record. Look out for:
  - ✓ damaged or worn ladder feet;
  - ✓ twisted, bent or dented stiles;
  - ✓ cracked, worn, bent or loose rungs;
  - ✓ missing or damaged tie rods; and
  - ✓ cracked or damaged welded joints, loose rivets or damaged stays.

- Pitch portable ladders at 75° from the horizontal and on a firm base, as shown in Figure below Secure them firmly against slipping or shifting sideways and allow a clearance of at least 150 mm behind the rungs. Where practicable, the ladder should extend to at least 1 metre above any upper landing place, unless there are other suitable handholds.
- When using portable extending ladders there should be sufficient overlap between the extensions.
- Personnel should use both hands when ascending or descending a ladder and not try to carry tools or equipment in their hands.
- Do not support planks on the rungs of ladders to be used as staging, and do not use ladders horizontally for such purposes.
- Portable ladders shall rest on footing that is stable, firm, of sufficient strength and of suitable size and composition safely to support the ladder so that its rungs or steps remain horizontal.
- The feet of a portable ladder shall be prevented from slipping.
- A mobile ladder shall be prevented from moving before it is stepped on.


At least 1 m above the upper supporting point or landing place. Secured at top.
Portable ladders should be pitched (C) between 65° and 75° from the horizontal, on a firm base and secured from slipping at the bottom.
There should be at least 150 mm clearance behind the rungs. (D)
C
A
D
A should be approximately four times the length of B.
B
Always face the ladder.
Three points of contact on the ladder when working.
Ladder lashed at the top and at least 1 m (3 rungs) above the upper supporting point or landing place.
Check the ladder is in good condition and fit for purpose.
4:1 height to width ratio

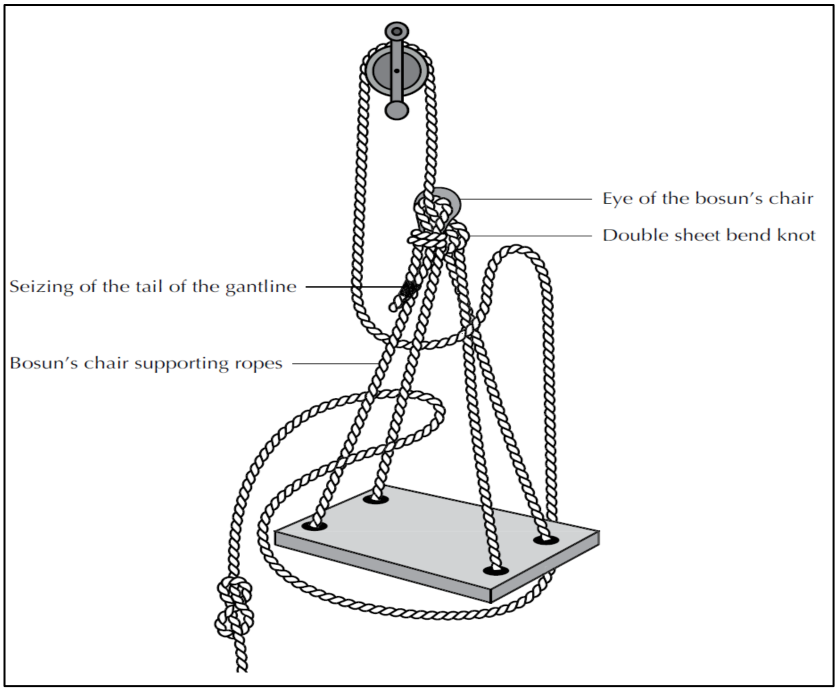
6) Cradles and stages[188]

- Cradles should be at least 430 mm (17 inches) wide and fitted with guardrails or stanchions with taut ropes to a height of 1 metre (39 inches) from the floor. Intermediate rails or taut ropes and toe-boards should be fitted.
- Examine planks and materials used for the construction of ordinary plank stages carefully to ensure they are strong enough and free from defects.
- Stow wooden components of staging in a dry, cool, ventilated space.
- Examine ancillary equipment such as lizards, blocks and gantlines thoroughly before use.
- When rigging a stage overside, the two gantlines used in its rigging should be at least long enough to trail into the water to provide additional lifelines if a person should fall. Keep a lifebuoy and line ready nearby.
- Do not use gantlines for working at height for any other purpose and keep them clear of sharp edges when in use.
- The anchoring points for lines, blocks and lizards must be strong enough and, where practicable, permanently fixed to the ship's structure. Test integral lugs with a hammer. Do not use portable rails or stanchions as anchoring points.
- Always secure stages and staging that are not suspended against movement. Restrict hanging stages against movement as far as practicable.
- Where personnel working from a stage have to raise or lower themselves, they must keep movements of the stage small and closely controlled.

7) Bosun's chair[189]

- When using a bosun's chair with a gantline, secure it to the gantline with a double-sheet bend and seize the end to the standing part with adequate tail (see Figure below).

[188] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details
[189] Ibid



Rigging a Bosun's chair[190]

- Do not use hooks to secure bosun's chairs unless they are of the type that, because of their special construction, cannot be accidentally dislodged, and unless they have a marked safe working load that is adequate for the purpose.
- When rigging a bosun's chair for use examine the chair, gantlines and lizards thoroughly and renew them if there is any sign of damage. Load test them to at least four times the load they will be required to lift before hoisting a person.
- When using a chair for riding topping lifts or stays, it is essential that the bow of the shackle, and not the pin, rides on the wire. In any case seize the pin.
- When it is necessary to haul a person aloft in a bosun's chair, it is generally done by hand rather than by using a winch.
- If a seafarer is required to lower themselves while using a bosun's chair, they should first frap both parts of the gantline together with a suitable piece of line to secure the chair before making the lowering hitch. It is dangerous to hold on with one hand while making the lowering hitch with the other. Another person should stand by to tend the lines.

8) Biological agents[191]

Biological agent means micro-organisms, including those which have been genetically modified, cell cultures and human endoparasites, which may be able to provoke any infection, allergy or

[190] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details
[191] Ibid

toxicity[192]. Biological agents such as bacteria, viruses or other microorganisms, that can cause infection, an allergic reaction or are toxic. Biological risks also include the transmission of disease between humans (HIV, Hepatitis, influenza etc.) or between animals and humans (malaria, dengue fever, weil's disease etc.)[193]

- Biological agents are classified in groups 1 to 4 as mentioned below:

Group	Description
Group 1	Unlikely to cause human disease.
Group 2	Can cause human disease and may be a hazard to employees; it is unlikely to spread to the community and there is usually effective prophylaxis or treatment available.
Group 3	Can cause severe human disease and may be a serious hazard to employees; it may spread to the community, but there is usually effective prophylaxis or treatment available.
Group 4	Causes severe human disease and is a serious hazard to employees; it is likely to spread to the community and there is usually no effective prophylaxis or treatment available.

- Employers must keep a list of personnel exposed to biological agents of group 3 or higher.
- Any worker involved with the handling of, or being exposed to, biological agents should have appropriate training and advice.
- Before any work takes place, carry out a risk assessment and put procedures in place for any potential accident to minimise its effects.
- The most likely areas for contamination by biological agents are as follows:
  - ✓ food preparation;
  - ✓ contact with animals and/or products of animal origin;
  - ✓ health care;
  - ✓ work with air-conditioning and water-supply systems; and
  - ✓ work involving waste disposal and the sewage plant.

[192] Refer MSN 1889 (M+F), Amendment 1 or the latest by MCA for further details
[193] https://www.ilo.org/topics-and-sectors/occupational-safety-and-health-guide-labour-inspectors-and-other/harmful-chemical-and-biological-agentssubstances (Last visited 15/07/2026)

9) Guarding of openings[194]

- Guardrails or fencing should consist of an upper rail at a height of 1 m and an intermediate rail at a height of 0.5 m. The rails may consist of taut wire or taut chain.

10) Enclosed spaces[195]

Enclosed space register

Company should carryout a risk assessment to identify all enclosed spaces onboard and the identified enclosed spaces shall be recorded in the Enclosed Space Register, which should be maintained on board the ship as well as ashore.

This Enclosed Space Register and risk assessment should be kept up to date as appropriate to ensure its continued validity, particularly after loading and during the carriage of cargoes which may adversely affect the safety of the atmosphere within a space.

A reassessment should also be made when the contents of the space change, such as in case a ship stores treated sewage or grey water temporarily in its ballast water tanks. The company should consider the use of appropriate technology to assist in the hazard identification and mitigation.

The Enclosed Space Register and risk assessment should form the basis of the development of the enclosed space emergency response plan. It is recommended that the enclosed space emergency response plan be reviewed after each drill so that its effectiveness can be assessed and, if necessary, improvements made.

The Enclosed Space Register should contain:

- physical layout of the space and access and egress points, including of connected spaces, if any;
- physical hazards in the space, e.g. vertical ladders, unguarded openings, poor lighting, wet or slippery conditions, excessive heat;
- connection to adjacent spaces;
- specific hazards within the space, for example, the effect of ballast water treatment method on the atmosphere within ballast tanks;

[194] Refer Code of Safe Working Practices for Merchant Seafarers, 2026, by MCA or the latest for further details
[195] Refer Resolution MSC.581(110) of IMO or the latest for further details

- if used, information related to additional technology, helping to determine enclosed space condition;
- information related to fixed and portable ventilation systems including equipment and where the equipment is stored;
- estimated time taken to achieve the air changes for safe entry, using forced or natural ventilation;
- lighting and means for temporary lighting including intrinsically safe lighting where appropriate;
- means for atmosphere testing;
- any pertinent information that would assist the risk assessment process;
- locking and "Safe to enter"/"Unsafe to enter" signage arrangements; and
- the equipment necessary to facilitate emergency rescue from the space.

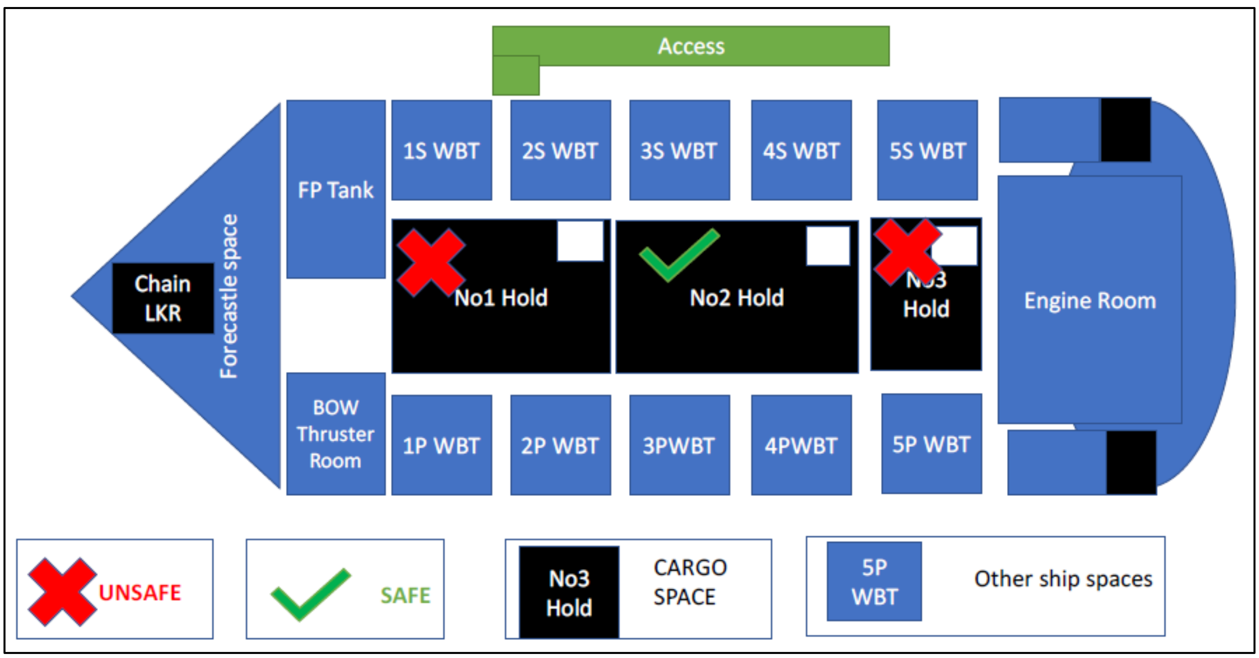
Enclosed space entry procedure in general

- No person should open or enter an enclosed space unless authorized by the master or a responsible person nominated by the master and the appropriate safety procedures laid down for the particular ship have been followed.
- A competent person should make an assessment of any potential hazards. In case of shore personnel are required to enter such spaces (such as cargo spaces) and when hazards are identified;
  - ✓ a joint risk assessment with terminal representatives responsible for operations on board the ship, or with other appropriate shore personnel, should be conducted; and
  - ✓ identify and agree to the precautions required during entry and enclosed space entry permit arrangements to be used.

- The procedures to be followed for testing the atmosphere in the space and for entry should be decided on the basis of the assessment.
- Entry into enclosed spaces should be planned and the use of an entry permit system, which may include the use of a checklist, should always be used where the assessment identifies any risk to health or life. The validity of the permit should be specified based on the risk assessment and **should never be longer than eight hours**.
- Prior to the entry of a space, an enclosed space entry permit should be issued by the master or the responsible person nominated by the master, and complied with at all times by the competent person included in the work especially those who enter the space. The validity of the permit should be specified based on the risk assessment and should never be longer than eight hours.
- Additional permits may be required depending upon the ship's safety management system (SMS) and the activity being planned within the enclosed space. These permits may include:

- ✓ energy isolation permits,
- ✓ electrical isolation permit,
- ✓ hot work permit,
- ✓ working at height permit or
- ✓ the completion of documents such as Job Hazard Analysis.

- Shore personnel should be provided with information on the hazards associated with enclosed spaces that may be present aboard the ship.
- Access to enclosed spaces should be carefully managed on ships where shore personnel regularly enter cargo spaces to load and discharge cargoes. It is recommended that a basic schematic plan of the ship's spaces should be placed at the gangway or at other access points of the ship clearly indicating which spaces are safe to enter, and which spaces are not. The plan should be time-stamped and dated and amended as necessary by the responsible person.



Simplified diagram to be placed at the ship's access

- Entry doors or access hatches leading to enclosed spaces should at all times be secured against entry unless the spaces have been risk assessed, atmospherically tested as required and declared safe for entry.

Example of an enclosed space warning sign

- Above signs should be updated when the space becomes safe for entry or when a safe space becomes unsafe.

Example of a sign when the space becomes safe for entry

- It is recommended to station an attendant at the entrance or use a mechanical or physical barrier, such as a locked bar or chain positioned across the opening with an attached warning sign, to prevent accidental entry.
- The master or the responsible person should determine that it is safe to enter an enclosed space by ensuring that:
  - ✓ potential hazards have been identified in the risk assessment and as far as possible isolated or made safe;
  - ✓ the space has been thoroughly ventilated by natural or mechanical means;

- ✓ the atmosphere of the space has been tested using certified and calibrated instruments to ascertain that the space contains 20.9% oxygen;
- ✓ the space has been declared safe for entry and properly illuminated;
- ✓ a suitable system of communication and evacuation signals agreed between all parties;
- ✓ if the person responsible considers it necessary, personnel entering space should wear personal gas detection equipment;
- ✓ if the person responsible considers it necessary, an attendant should be stationed at the entrance and properly instructed;
- ✓ if the person responsible considers it necessary, rescue and resuscitation equipment should be positioned, tested and ready for immediate use at the entrance to the space and a rescue plan detailing the rescue arrangements should be agreed;
- ✓ where ship or shore personnel are working in more than one cargo space at the same time:
  - the rescue equipment should be positioned at a designated central location; and
  - in the event of an emergency in any one space, all personnel working in other spaces should be instructed to stop work immediately and exit the space.

- ✓ personnel are provided with the appropriate personal protective equipment for the entry and subsequent tasks; and
- ✓ the required permits have been issued, authorizing entry.

- Only trained and authorized personnel should be assigned the duties of entering, functioning as attendants or acting as members of rescue teams.
- As far as practicable, enclosed space entry should be carried out during hours of daylight or normal working hours of the ship to ensure ready availability of reserve personnel in the event of an emergency.

Testing of the atmosphere

- The gas detection equipment should be appropriate for the cargo that the ship has carried and is carrying considering information provided in the shipper's declaration, the Safety Data Sheets (SDS), the IMDG Code, the IMSBC Code, International Bulk Chemical Code (IBC Code) and the IGC Code. The gas detection equipment, including devices for testing CO_2, should be capable of operating correctly even in oxygen-depleted atmosphere.
- Appropriate testing of the atmosphere of a space should be carried out with properly calibrated equipment by persons trained in the use of the equipment.
- Testing of the atmosphere of a space should be carried out before any person enters the space and at regular intervals thereafter until all work is completed.

- Where appropriate, the testing of the atmosphere of a space should be carried out at as many different levels and areas as is necessary to account for gas stratification, and obtain a representative sample of the atmosphere in the space.
- All ships should carry at least two sets of gas detection equipment as required by SOLAS regulation XI-1/7, taking into account the *Guidelines to facilitate the selection of portable atmosphere testing instruments for enclosed spaces as required by SOLAS regulation XI-1/7* (MSC.1/Circ.1477). Any ship which may carry a cargo capable of generating hazardous vapours and which requires regular entry into the cargo space for cleaning or inspection should carry two sets of gas detection equipment in addition to those required by SOLAS regulation XI-1/7 for assessing the risk to personnel entering the space.
- After completion of a suitable risk assessment targeted to the space to be entered steady readings of all of the following should be obtained:
  - ✓ 20.9% oxygen by volume;
  - ✓ the level of carbon dioxide has been checked and is less than 0.5% by volume (5,000 ppm);

    Note: National requirements may differ when determining the safe atmosphere range for gases stated above.

  - ✓ less than 1% of lower flammable limit (LFL) on a suitably sensitive combustible gas indicator, where the assessment has determined that there is potential for flammable gases or vapours; and
  - ✓ less than 50% of the occupational exposure limit (OEL) of any toxic vapours and gases.

- If these conditions cannot be met, additional ventilation should be applied to the space and retesting should be conducted after a suitable interval. Entry should be allowed only after all the above conditions are met.
- Any gas testing should be carried out with ventilation to the enclosed space stopped, and after conditions have stabilized, in order to obtain accurate readings.
- Where the assessment has determined that there is potential for the presence of toxic gases and vapours, appropriate testing should be carried out, using fixed or portable gas or vapour detection and/or monitoring equipment. The readings obtained by this equipment should be below the occupational exposure limits for the toxic gases or vapours given in accepted national or international standards.

Precautions during entry

- All equipment used in connection with entry should be in good working condition and inspected and tested prior to use.

- The atmosphere should be tested frequently whilst the space is occupied, and persons should be instructed to leave the space should there be any sign of deterioration in the conditions.
- Persons entering enclosed spaces should be provided with calibrated and tested personal gas detection instrument or instruments that monitor the levels of oxygen, carbon dioxide, flammable gases or vapours, toxic gases (including carbon monoxide), and any other gases identified in the risk assessment.
- Ventilation should be maintained while the space is occupied. After a break and before re-entry, the atmosphere must be retested, the results verified as being acceptable then recorded. In the event of failure of the ventilation system, any persons in the space should leave immediately.
- Particular care should be taken when working on piping and valves within the space which may contain hazardous gases, vapours or liquids. If conditions change during the work, increased frequency of testing of the atmosphere should be performed. Examples of changing conditions are as follows:
  - ✓ increase or decrease in ambient temperature,
  - ✓ the need to use oxygen fuel torches or other welding equipment,
  - ✓ the need to use a mobile plant,
  - ✓ other activities in the space that may involve development of vapour such as cleaning debris, collecting sediments,
  - ✓ painting within the enclosed spaces,
  - ✓ changes in the ship's trim and list while working within the enclosed space.

- Conditions can also deteriorate during work breaks because of changes to the ventilation, the disturbance of bilge contents, sludge or stagnant water, or the leakage of external contaminants into the space.
- In the event of an emergency, under no circumstances should the attendant enter the space before help arrive. Only properly trained and equipped personnel should perform rescue operations in enclosed spaces.

Additional precautions for entry into a space where the atmosphere is known or suspected to be unsafe

- Entry into enclosed spaces where the atmosphere is known or suspected to be unsafe requires very careful consideration, including an assessment of the hazards, residual risks and mitigations that need to be undertaken.
- When considering the planned work activity within an enclosed space where the atmosphere is known or suspected to be unsafe, suitably designed and constructed breathing apparatus of positive pressure type should always be worn, and only personnel trained in its use should be allowed to enter the space.

- Air-purifying respirators, dust masks and canister face masks do not provide a supply of clean air from a source independent of the atmosphere within the space and should not be used.
- Emergency Escape Breathing Devices (EEBDs) are not suitable to use for entry into enclosed spaces.
- Persons entering should be provided with calibrated and tested personal gas detector suitable for the gas or gases assessed as likely to occur in the space.
- Rescue harnesses should be worn and unless impractical, lifelines should also be used.
- A means to facilitate evacuation from the enclosed space should be available and ready for use, as per emergency response plan.
- Appropriate protective clothing should be worn, particularly where there is any risk of toxic substances or chemicals coming into contact with the skin of those entering the space.

POLLUTION PREVENTION

14) MARPOL

a) **Annex – I** (Regulations for the prevention of pollution by oil)

- **Application**

  These regulations are applied on oil tankers of 150 GT or more and other vessels of 400 GT or more.

- **List of special areas**

  - ✓ Mediterranean Sea
  - ✓ Baltic Sea
  - ✓ Black Sea
  - ✓ Red Sea
  - ✓ Gulf areas (Persian Gulf)
  - ✓ Gulf of Aden
  - ✓ Antarctic area
  - ✓ NW European Waters
  - ✓ Oman area of the Arabian Sea
  - ✓ Southern South African waters

- **Cargo pump room bilges may be pumped out under following conditions, but, except in Arctic waters:**

  - ✓ Not in special area;
  - ✓ More than 50 nm from nearest land;
  - ✓ En route;
  - ✓ Instantaneous rate of discharge of oil does not exceed 30 litres per nm;
  - ✓ Total quantity of the particular cargo of which the residue formed a part shall not exceed:
    - 1/15000 (ships delivered on or before 31 Dec 1979
    - 1/30000 (ships delivered after 31 Dec 1979)

  - ✓ Equipped with Oil Discharge Monitoring and Control System (ODMCS) and a slop tank arrangement

- **Machinery space bilges may be pumped out in outside special areas under the following conditions (except in Arctic waters):**

- ✓ En route;
- ✓ Processed through an oil filtering equipment;
- ✓ Oil content without dilution does not exceed 15 ppm ;
- ✓ Not originated from cargo pump room bilges on oil tankers; and
- ✓ Not mixed with oil cargo residues on tankers.

- **Machinery space bilges may be pumped out within the special areas under the following conditions:**

  - ✓ En route;
  - ✓ Processed through an oil filtering equipment which has an alarm & auto stopping device if exceeds 15 ppm;
  - ✓ Oil content without dilution does not exceed 15 ppm;
  - ✓ Not originated from pump room bilges on oil tankers;
  - ✓ Not mixed with oil cargo residues on tankers; and
  - ✓ *ANY DISCHARGE OF OIL OR OILY MIXTURES INTO THE SEA OF ANTARCTIC AREA FROM ANY SHIP SHALL BE PROHIBITED.*

- **For ships of less than 400 GT in all areas except in Antarctic and Arctic waters**

  - ✓ En route;
  - ✓ Approved filtering equipment by the Administration to ensure the oil content of the effluent without dilution does not exceed 15 ppm;
  - ✓ Not originated from pump room bilges on oil tankers; and
  - ✓ Not mixed with oil cargo residues on tankers.

- **Use or carriage of oils in the Antarctic area**

  Carriage as bulk cargo, use as ballast, or carriage and use as fuel of the following is prohibited except in the case of vessels engage in securing the safety of ships or in a search and rescue operation:
  - ✓ Crude oils having a density at 15^0 C higher than 900 kg/m^3;
  - ✓ Oils, other than crude oils, having a density at 15^0 C higher than 900 kg/m^3or a kinematic viscosity at 50^0 C higher than 180 mm^2/s; or
  - ✓ Bitumen, tar and their emulsions.

If above types of oils were carried in the previous voyage, the cleaning or flushing of tanks or pipelines is not required.

- **Regulations concerning STS operations**

STS regulations will not be applied for the following;

- ✓ for bunkering operations;
- ✓ when vessels are engaged with securing the safety of a vessel or saving life or pollution prevention operations; and
- ✓ if either of the ships involved is a warship or a vessel used for non-commercial service by a government.

Vessels engage in STS operations at sea shall comply with the following requirements:

These regulations are applicable to oil tankers of 150 GT & above engage in the transfer of oil cargoes between oil tankers at sea:

- ✓ shall have an approved STS operation Plan onboard and shall comply with the plan;
- ✓ STS operations Plan may be incorporated into the SMS;
- ✓ The person in overall advisory control of STS operations shall be qualified to perform all relevant duties;
- ✓ Records of STS operations shall be retained onboard for three years; and
- ✓ Shall be readily available for inspection by a state party to the Convention.

Notifications by vessels expecting to carryout STS operations

Both oil tankers expecting to carryout STS operations within the territorial sea, or the EEZ of a Party to the present Convention are required to inform the coastal state 48 hrs before starting the STS operation with the following data.

In an exceptional case, if all the below data cannot be provided 48 hrs before the STS operation, the discharging tanker shall notify the coastal state, 48 hrs before the operation that an STS operation will occur and the below information shall be provided to the coastal state at the earliest opportunity. The information to be reported includes:

- ✓ Name, flag, call sign, IMO Number and estimated time of arrival;

- ✓ Date, time and position of the location of the STS operation;
- ✓ Whether the STS operations are to be conducted while underway or at anchor;
- ✓ Type of oil and quantity;
- ✓ Planned duration of the STS operation;
- ✓ Identification of STS operations service provider or person in overall advisory control and contact information; and
- ✓ Confirmation that the oil tanker has on board approved STS operations Plan.

If the ETA of an oil tanker changes by more than 06 hours, the master, owner or agent of that tanker shall provide a revised ETA to the coastal state.

b) Annex – II (Regulations for the control of pollution by noxious liquid substances in bulk)

- **Application**

  Applies to all the vessels certified to carry noxious liquid substances in bulk.

- **List of special areas**

  - ✓ Antarctic area

- **Discharge regulations for Category – X cargoes:**

  - ✓ Tanks shall be pre-washed; and
  - ✓ Once pre-washed, residues shall be discharged to a reception facility until the concentration is 0.1% or below by weight. Then continue to discharge until the tank is empty. Any water introduced after that can be discharged under following conditions:
    - En route at least at 7 knots;
    - Discharge below water line not exceeding the maximum rate for which the underwater discharge outlet is designed;
    - At least 12 nm from the nearest land;
    - In depths of not less than 25 m; and
    - Refer the discharging procedure manual for further details.

- **Discharge regulations for Category – Y and Z cargoes:**

  ✓ Tanks shall be pre-washed; and
  ✓ If unloading is not carried out according to the Manual (discharge procedure manual), a pre-wash shall be carried out and any water introduced after that can be discharged under following conditions:
    - En route at least at 7 knots;
    - Discharge below water line not exceeding the maximum rate for which the underwater discharge outlet is designed;
    - At least 12 nm from the nearest land;
    - In depths of not less than 25 m; and
    - Refer the discharging procedure manual for further details.

- **Exemption for pre-wash**

  No ships are allowed to sail from the port of discharge, unless one of the following situations are being complied with:
  ✓ Unloaded tank is to be loaded with same cargo without washing/ballasting, or
  ✓ The tank is not to be washed/ballasted at sea. It is to be prewashed in another port provided that it is confirmed in writing that a reception facility is available at that port, or
  ✓ The residues will be removed by ventilation.

c) Annex – III (Regulations for the prevention of pollution by harmful substances carried by sea in packaged form)

- Designates no “special areas” and contains no provisions relating to discharges or disposal at sea.
- Harmful substances are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code). Need to comply with the requirements of the IMDG Code.
- IMDG Code applies to all ships carrying harmful substances carried by sea in packaged form.
- The requirements of this Annex do not apply to ship's stores and equipment.

d) Annex – IV (Regulations for the prevention of pollution by sewage from ships)

- **Application**

  Applies to following ships engage in international waters:

  ✓ Ships of less than 400 GT which are certified to carry more than 15 persons; and
  ✓ Passenger ships carrying more than 12 passengers.

- **List of special areas**

  ✓ Baltic sea

- **Discharge regulations**

Type of ships	Inside special area	Outside special area
Passenger ships	Prohibited[1]	1) comminuted and disinfected sewage (using an approved system by Administration) 3' from land 2) not comminuted or disinfected 12' away from land 3) Sewage in holding tanks or sewage from living animals, shall not be discharged instantaneously 4) *en route at least at* 4 knts 5) rate of discharge to be approved by the Administration based upon IMO standards **OR** The ship has an approved sewage treatment plant which has been certified by the Administration & the effluent shall not produce visible floating solids or discoloration of the water.
Other vessels	Same as outside special areas	Same as above

[1] Except when the ship has in operation an approved sewage treatment plant which has been certified by the Administration to meet the operational requirements, and the effluent shall not produce visible floating solids nor cause discoloration of the surrounding water. The sewage treatment plant installed on a passenger ship intending to discharge sewage effluent in Special Areas should additionally meet the nitrogen and phosphorus removal standards when tested for its Certificate of Type Approval by the Administration.

e) Annex – V[196]

- **List of special areas**

  - ✓ Mediterranean Sea
  - ✓ Baltic Sea
  - ✓ Black Sea
  - ✓ Red Sea
  - ✓ Gulfs Area (sea area between Iran, Bahrain, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE)
  - ✓ North Sea
  - ✓ Antarctic area (south of latitude 60^0 south)
  - ✓ Wider Caribbean region including the Gulf of Mexico and the Caribbean Sea

- **Definitions**

Dishwater means the residue from the manual or automatic washing of dishes and cooking utensils which have been pre-cleaned to the extent that any food particles adhering to them would not normally interfere with the operation of automatic dishwashers.

Grey water means drainage from dishwater, shower, laundry, bath and washbasin drains. It does not include drainage from toilets, urinals, hospitals, and animal spaces, as defined in regulation 1.3 of MARPOL Annex IV (sewage), and it does not include drainage from cargo spaces. Grey water is not considered garbage in the context of Annex V.

Garbage means all kinds of **food wastes**, **domestic wastes** and **operational wastes**, all **plastics**, **cargo residues**, **incinerator ashes**, **cooking oil**, **fishing gear**, and **animal carcasses** generated during the normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other Annexes to the present Convention. Garbage does not include fresh fish and parts thereof generated as a result of fishing activities undertaken during the voyage, or as a result of aquaculture activities which involve the transport of fish including shellfish for placement in the aquaculture facility and the transport of harvested fish including shellfish from such facilities to shore for processing.

[196] Resolutions MEPC 201(62) & MEPC 219(63) and Resolution MEPC.277(70), IMO

- **Categorization of garbage**

  MARPOL Annex V categorises shipboard generated garbage as follows:

  A) **Plastics** – Garbage that consists of or includes plastic in any form, including synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products.

  B) **Food wastes** – Spoiled or unspoiled food substances and includes fruits, vegetables, dairy products, poultry, meat products and food scraps generated aboard ship.

  C) **Domestic Wastes** – Garbage generated mainly in the accommodation spaces on board the ship (e.g. drinking bottles, papers, cardboard etc). Domestic wastes does **not include grey water**.

  D) **Cooking Oil** – Edible oil or animal fat used for the preparation or cooking of food, but does not include the food itself that is prepared using these oils.

  E) **Incinerator ashes** – Ash and clinkers resulting from shipboard incinerators used for the incineration of garbage.

  F) **Operational wastes** – Solid wastes (including slurries) that are collected on board during normal maintenance or operations of a ship, or used for cargo stowage and handling. Operational wastes also includes cleaning agents and additives contained in cargo hold and external wash water that may be harmful to the aquatic environment. Operational wastes does not include grey water, bilge water, or other similar discharges essential to the operation of a ship.

     Examples of operational wastes:

     Following are considered as operational wastes and therefore categorized as garbage

     ✓ Ash and clinkers from shipboard incinerators and coal-burning boilers
     ✓ cleaning agents and additives contained in hold washwater, and deck and external surface washwater

     Following are not considered as operational wastes and not considered as garbage:

- ✓ grey water,
- ✓ bilge water
- ✓ boiler/economizer blowdown;
- ✓ boat engine wet exhaust;
- ✓ chain locker effluent;
- ✓ controllable pitch propeller and thruster hydraulic fluid and other oil to sea interfaces (e.g. thruster bearings, stabilizers, rudder bearings, etc.);
- ✓ distillation/reverse osmosis brine;
- ✓ elevator pit effluent;
- ✓ firemain systems water;
- ✓ freshwater layup;
- ✓ gas turbine washwater;
- ✓ motor gasoline and compensating discharge;
- ✓ machinery wastewater;
- ✓ pool, spa water and recreational waters;
- ✓ sonar dome discharge; and
- ✓ welldeck discharges.

G) **Animal Carcasses** – Bodies of any animals that are carried on board as cargo and that die or are euthanized during the voyage.

H) **Fishing Gear** – Physical device that may be placed on or in the water or on the sea-bed with the intended purpose of capturing marine or fresh water organisms.

I) **E-Waste** – Any electronic equipment, including its components, sub-assemblies and consumables, when disposed of as a waste (e.g. electronic cards, gadgets, instruments, equipment, computers, printer cartridges, etc.)

J) Cargo residues not harmful for the marine environment (non-HME)

K) Cargo residues harmful for the marine environment (HME)

Solid bulk cargoes, other than grain, shall be declared by the shipper as to whether or not they are harmful to the marine environment.

- **Summary of garbage disposal at sea**

Type of garbage	**Ships outside special areas**	**Ships within special areas**
Food waste comminuted or ground (25 mm or less)	≥ 3 nm from the nearest land, en route[3]	≥12 nm from the nearest land, en route [3,5]
Food waste not comminuted or ground	≥12 nm from the nearest land, en route[3]	**Discharge prohibited**
Cargo residues[4] not contained in wash water	≥12 nm from the nearest land, en route	**Discharge prohibited**
Cargo residues[4] contained in wash water	≥12 nm from the nearest land or the nearest <u>ice shelf</u>, en route	≥12 nm from the nearest land or the nearest ice shelf, en route & subject to 2 additional conditions[2]
Whatever the cargo residues[4] which are harmful to the marine environment	Discharge prohibited	Discharge prohibited
Cleaning agents and additives[1] contained in cargo hold wash water	Discharge permitted	≥12 nm from the nearest land, en route & subject to 2 additional conditions[2]
Cleaning agents and additives[1] in deck and external surfaces wash water	Discharge permitted	Discharge permitted
Animal Carcasses (should be split or otherwise treated to ensure the carcasses will sink immediately)	Must be en route and as far from the nearest land as possible. Should be >100 nm and maximum water depth	Discharge prohibited
All other garbage including plastics, synthetic ropes, fishing gear, plastic garbage bags, incinerator ashes, clinkers, cooking oil, floating dunnage, lining and packing materials, paper, rags, glass, metal, bottles, crockery, e-waste and similar refuse	Discharge prohibited	Discharge prohibited
Mixed garbage	When garbage is mixed with or contaminated by other substances prohibited from discharge or having different discharge requirements, the more stringent requirements shall apply.	

[1] These substances must not be harmful to the marine environment.

[2] Discharge shall only be allowed if:

a) both the port of departure and the next port of destination **are within the special area, and the ship will not transit outside the special area between these ports** and

b) if **no adequate reception facilities** are available at those ports.

[3] The ***en route*** *requirements shall not apply* where it is clear the retention on board of these food wastes presents an imminent health risk to the people on board.

[4] Cargo residues means only those cargo residues that cannot be recovered using commonly available methods for unloading.
[5] The discharge of introduced avian products in the Antarctic area is not permitted unless incinerated, autoclaved or otherwise treated to be made sterile. In polar waters, discharge shall be made as far as practicable from areas of ice concentration exceeding 1/10; in any case food wastes shall not be discharged onto the ice.

- **Handling of used cooking oil and tetra packs onboard**

Handling of used cooking oil

There are generally two methods of handling used cooking oil onboard:

- ✓ Store them onboard according to the garbage management plan and deliver ashore or
- ✓ Incinerate it in an approved incinerator.

However, operators must ensure that no water/oil drainage facility flows back into the engine room bilge system[197].

On some ships, there was a routine to mix cooking oil with sludge and treat it as sludge. However, MEPC 68 decided that this practice was not in line with MARPOL Annex V (MEPC 68/21, paragraph 12.14, MEPC, 2015). The reason for this decision was that in this case, Annex V waste is being mixed with oils specified in MARPOL Annex I, making it impossible for the Oil Water Separator to effectively treat cooking oil[198].

Handling of tetra packs

Tetra packs contain paper, plastics and aluminium. As mentioned above, MARPOL Annex V states that, when garbage is mixed with or contaminated by other substances prohibited from discharge or having different discharge requirements, the more stringent requirements shall apply. Therefore, tetra packs should be considered as plastics.

[197] https://safety4sea.com/cm-garbage-handling-in-the-galley-what-you-need-to-know/ (Last visited 31/07/2026)
[198] Ibid

- **Garbage record book**

A garbage record book must be maintained on ships of 100 GT or more. This record book contains two Parts and the records shall be maintained as follows:

Part I

A Plastic
B Food wastes
C Domestic wastes
D Cooking oil
E Incinerator ashes
F Operational wastes
G Animal carcasses
H Fishing gear
I E – waste

Part II

J Cargo residues which are NOT HARMFUL to the marine environment
K Cargo residues which are HARMFUL to the marine environment

Entries in a garbage record book

Occasion	Date & time of;	Name or place by;	Categories of cargo	Amount (m^3);	Signature	Remarks
Delivered to reception facility	Delivery[199]	Name of port or facility or vessel	Yes	For each category	Yes	No
When incinerated	Starting & stopping of incinerator	Lat & Long at starting & stopping incinerator	Yes	For each category	Yes	No
Discharged Accidentally or complying with regulations	Discharge	Lat & Long In case of cargo residues, positions of discharge start & stop	Yes	For each category	Yes	No
Accidental or other exceptional discharges	Occurrence	Port or Lat/Long & water depth (if possible)	Yes	For each category	No	Reasons for discharge/loss Reasonable precautions taken to minimize/prevent & Other remarks

[199] Need to keep evidences or proof of delivery stating the amount of garbage delivered & such receipts must be kept with the garbage record book

Sample of a garbage record book (Part I & Part II)[200]

"RECORD OF GARBAGE DISCHARGES

PART I
For all garbage other than cargo residues as defined in regulation 1.2 (Definitions)

(All ships)

Ship's name	Distinctive number or letters	IMO number

Garbage categories

A-Plastics	B-Food waste	C-Domestic wastes	D-Cooking oil	
E-Incinerator ashes	F-Operational wastes	G-Animal carcasses	H-Fishing gear	I–E-waste

Discharges under MARPOL Annex V regulations 4 (Discharge of garbage outside special areas), 5 (Special requirements for discharge of garbage from fixed or floating platforms) or 6 (Discharge of garbage within special areas) or chapter 5 of part II-A of the Polar Code

Date/ Time	Position of the ship (latitude/longitude) or port if discharged ashore or name of ship if discharged to another ship	Category	Estimated amount discharged		Estimated amount incinerated (m^3)	Remarks: (e.g. start/stop time and position of incineration; general remarks)	Certification/ Signature
			Into sea (m^3)	To reception facilities or to another ship (m^3)			
/ :							

Exceptional discharge or loss of garbage under regulation 7 (Exceptions)

Date/ Time	Port or position of the ship (latitude/ longitude and water depth if known)	Category	Estimated amount lost or discharged (m^3)	Remarks on the reason for the discharge or loss and general remarks (e.g. reasonable precautions taken to prevent or minimize such discharge or accidental loss and general remarks)	Certification/ Signature
/ :					
/ :					

Master's signature:__________________________ Date: ____________________

[200] Refer Resolution MEPC.277(70) of IMO or the latest for further details

PART II
For all cargo residues as defined in regulation 1.2 (Definitions)

(Ships that carry solid bulk cargoes)

Ship's name	Distinctive number or letters	IMO number

Garbage categories

J- Cargo residues (non-HME)	K- Cargo residues (HME)

Discharges under regulations 4 (Discharge of garbage outside special areas) and 6 (Discharge of garbage within special areas)

Date/ Time	Position of the ship (latitude/ longitude) or port if discharged ashore	Category	Estimated amount discharged		Start and stop positions of the ship for discharges into the sea	Certification/ Signature
			Into sea (m^3)	To reception facilities or to another ship (m^3)		

Master's signature:______________________ Date: ___________________"

These records are required to be retained onboard for a period of 2 years from the date of last entry.

How to measure distance away from land in disposing Annex I, Annex II, Annex IV & Annex V at sea

MARPOL states that the garbage or other material may be discharged so many miles away "from the nearest land". The term "from the nearest land" means from the **baseline** from which the **territorial sea** of the territory in question is established in accordance with international law except in the case of north-east coasts of Australia which is measured from a line drawn from a point on the coast of Australia as provided in Annex V.

Normal baseline

This is the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State.

Straight baseline

In localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity, the method of straight baselines joining appropriate points may be employed in drawing the baseline.

Mouths of rivers

If a river flows directly into the sea, the baseline shall be a straight line across the mouth of the river between points on the low-water line of its banks.

Bays

If the distance between the low-water marks of the natural entrance points of a bay does not exceed 24 nautical miles, a closing line may be drawn between these two low-water marks, and the waters enclosed thereby shall be considered as internal waters.

Where the distance between the low-water marks of the natural entrance points of a bay exceeds 24 nautical miles, a straight baseline of 24 nautical miles shall be drawn within the bay in such a manner as to enclose the maximum area of water that is possible with a line of that length.

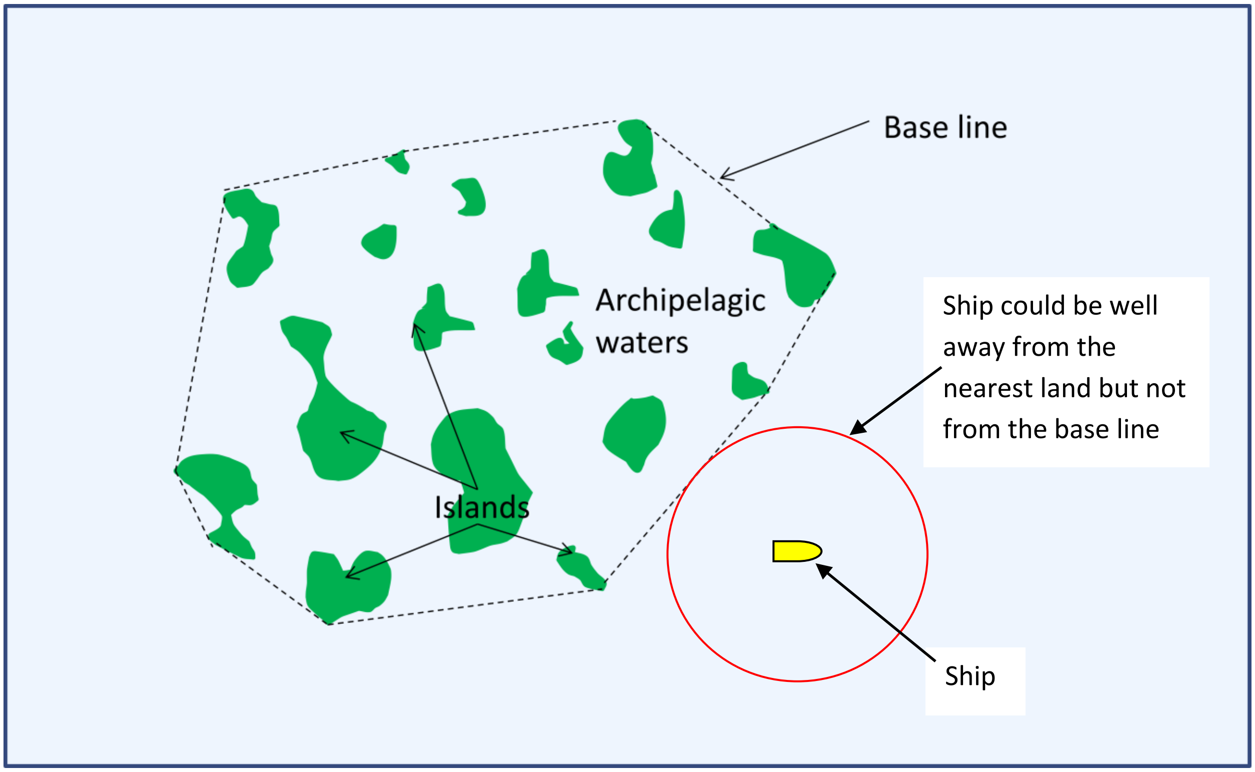
Archipelagic baselines[201]

An archipelagic State may draw straight archipelagic baselines joining the outermost points of the outermost islands and drying reefs of the archipelago provided that within such baselines are included the main islands and an area in which the ratio of the area of the water to the area of the land, including atolls.

Refer the below examples for a better knowledge:

Your vessel is closer (not inside) to an archipelagic water, you may be well away from the charted coast but may not be away from the "baseline". Because, in case of archipelagic waters, the baseline is measured joining the outermost islands in the archipelagic state. Refer the figure below:

[201] http://www.un.org/depts/los/convention_agreements/texts/unclos/part4.htm (Last visited 16/07/2026)



Therefore, in case of measuring the distance off from the nearest land, need to use the baseline instead of the land.

A similar situation may exist if your vessel is close to a bay as well. In case of a bay, a straight base line is drawn joining the low-water marks of the natural entrance points to the bay. Refer the figure below:

Base line of Bohai Sea[202]

Bohai Sea is considered as inland waters of China, since the straight base line is drawn between Longkou and Lushun. A vessel may be well away from the land but, not from the baseline. All the distances are to be measured from the 'baseline'.

Identification of baselines by referring to the nautical charts alone, is little complicated. This can be clarified by referring to the Admiralty Annual Summary of Notices to Mariners Part I.

f) Implementation of garbage management onboard

In most of the companies, the chief officer is the garbage management officer onboard. Therefore, it is your responsibility to implement the garbage management system onboard. First, you are required to have a good knowledge of the contents of the vessel's garbage management plan and make sure:

- the following documents are onboard:
  - ✓ garbage management plan;
  - ✓ garbage record book;
  - ✓ company placards;

[202] https://gard.no/en/insights/bohai-sea-china-fines-for-discharge-pollutants/ (Last visited 16/07/2026)

- ✓ documentary evidence for the garbage delivered ashore;
- ✓ operational manuals of the garbage handling equipment such as incinerators, compactors etc.; and
- ✓ type approval certificates of the incinerator.

- company placards and notices are displayed in correct places;
- the chief officer's instructions are clearly given to crew;
- the duties of garbage handling which includes incinerations, disposal properly etc. are delegated in accordance with the garbage management plan and they are properly trained;
- the crew is given appropriate training in reduction, re-cycling, segregation, storage of garbage;
- the garbage bins are colour coded as per the plan;
- the segregation and the storage are done in accordance with the garbage management plan;
- the navigating officers are having a good knowledge of the special areas and the areas where the garbage can be disposed at sea; and
- proper record keeping is maintained.

Time to time, randomly check the garbage bins to make sure the segregation is done in accordance with the instructions provided.

g) Annex – VI (Regulations for the prevention of air pollution from ships)

- **List of pollutants**

  - ✓ NOx
  - ✓ SOx
  - ✓ Ozone – depleting substances
  - ✓ Volatile Organic Compounds (VOC)
  - ✓ Particulate matter (PM)
  - ✓ CO_2

- **Emission control areas**

  - ✓ Baltic sea (NOx and SOx)
  - ✓ North Sea (NOx and SOx)
  - ✓ North America – this includes the Pacific coasts of the United States and Canada (PM, NOx and SOx)

- ✓ US Caribbean Sea area (PM, NOx and SOx)
- ✓ Mediterranean Sea (SOx and PM)
- ✓ Canadian Arctic (PM, NOx and SOx)
- ✓ Norwegian Sea (PM, NOx and SOx)

- **SOx regulations**

  - ✓ SOx emissions are a function of the sulphur content of fuel. Reduction of sulphur content will also result in lower particulate matter emissions.
  - ✓ Sulphur content of any fuel oil used on board ships (outside ECA) shall not exceed **0.5% m/m.**
  - ✓ Sulphur content of fuel oil used on board ships in Emission Control Areas (ECA) shall not exceed **0.1% m/m**.
  - ✓ Ships may also meet the SOx requirements by using:
    - gas as a fuel or
    - an approved equivalent method (example, exhaust gas cleaning systems or "scrubbers")

- **Regulations on ozone depleting substances**

  - ✓ Deliberate emissions of ozone depleting substances shall be prohibited. Deliberate emissions include emissions occur during maintenance, servicing, repairing or disposing etc.
  - ✓ Equipment containing HCFC are prohibited on ships constructed after 01/01/2020.
  - ✓ Annex VI does not apply to ozone-depleting substances which contain in permanently sealed equipment where there are no refrigerant charging connections or potentially removable components containing ozone-depleting substances.
  - ✓ Each ship with an IAPP certificate shall have a list of equipment containing ozone depleting substances.
  - ✓ Each ship having an IAPP certificate which has a rechargeable system that contains ozone-depleting substances shall have an ozone-depleting substances record book. Entries in the record book shall be completed without delay on each occasion in respect of the following:
    - Recharging full or partial, of equipment containing ozone-depleting substances;
    - Repair or maintenance of equipment containing ozone-depleting substances;

- Discharge of ozone-depleting substances to the atmosphere both deliberate and non-deliberate;
- Discharge of ozone-depleting substances to land based reception facilities; and
- Supply of ozone-depleting substances to the ship.

- **VOC regulations**

  ✓ Applies only to tankers.
  ✓ Applies only when entering VOC emission-controlled areas.
  ✓ If a port is expecting to control VOC emissions, IMO shall be informed 6 months before the expected date of implementation.
  ✓ Such ports may accept existing tankers which are not fitted with vapour collection systems for a period of 3 years after the effective date.
  ✓ Tankers entering such ports shall have a vapour collection system in operation during loading.
  ✓ Every tanker carrying crude oil is required to have on board and implement a **VOC Management Plan**, approved by the Administration.

- **Regulations regarding incineration onboard**

  Following incinerations are prohibited on board:

  ✓ Annex I, II & III cargo residues and related contaminated packing materials;
  ✓ PCBs (polychlorinated biphenyls);
  ✓ Garbage containing more than traces of heavy metals;
  ✓ Refined petroleum products containing halogen compounds;
  ✓ Sewage sludge & sludge oil neither of which is not generated onboard the ship; and
  ✓ Exhaust gas cleaning system residues.

  Following incinerations are allowed under certain conditions:

  ✓ Sewage sludge & sludge oil generated during normal operation of a ship may also take place in the main or auxiliary power plants, but in those cases, shall not take place inside ports, harbours and estuaries; and
  ✓ PVCs (polyvinyl chlorides) shall be prohibited, unless the incinerator is having an IMO type approval certificate.

- **Regulations on greenhouse gas (GHG) emissions**

✓ **EEDI (Energy Efficiency Design Index)**

- EEDI is a measure of GHG emissions per ton per nautical mile. Lower the EEDI, higher the efficiency of the vessel.
- This is mandatory on new ships of 400 GT or more.
- Actual EEDI of a vessel is called the "**attained EEDI**" and it is calculated by using IMO guidelines.
- The "**required EEDI**" is the EEDI that a vessel to be designed at the time of construction and in compliance with the IMO guidelines for various ship types and their tonnages.
- The "**Attained EEDI**" shall be **below** the "**required EEDI**".
- A **technical file** shall be maintained;
  - It shall include calculation method of the "attained EEDI"; and
  - The technical file is subjected to the **verification by the flag state**.

- EEDI may be reduced by various methods such as advanced technologies, alternative fuels, deadweight increase, economical speed etc.

✓ **EEOI (Energy Efficiency Operational Indicator)**

EEOI is developed by the IMO in order to allow shipowners to measure the fuel efficiency of a ship in operation[203]. Vessel operators can use this as an internal tool to monitor efficiencies of their vessels. It is calculated based on the actual ship's fuel consumption, cargo carried, and distance travelled during a specific period[204].

- Lower the EEOI, higher the efficiency of the vessel.
- This is not mandatory.
- This a mechanism to measure the energy-efficiency of each voyage.
- An evaluation of operational performances will be carried out by owners, operators or charterers depending upon the data provided by the individual ships.
- Individual ships can be continuously monitored by the owners / operators to ensure the GHG are reduced and the efficiency is increased.

[203] https://www.wartsila.com/encyclopedia/term/energy-efficiency-operating-indicator-eeoi (Last visited 08/09/2026)

[204] https://www.wilhelmsen.com/ship-management/technical-management/wilhelmsen-spark-ship-energy-efficiency-application/ (Last visited 08/09/2026)

- ✓ **SEEMP (Ship Energy Efficiency Management Plan)**

The Ship Energy Efficiency Management Plan (SEEMP) is an operational mechanism to improve the energy efficiency of a ship in a cost-effective manner. The SEEMP urges the ship owner and operator at each stage of the plan to consider new technologies and practices when seeking to optimise the operational performance of a ship. The SEEMP also provides an approach for shipping companies to manage ship and fleet efficiency performance over time using recognized monitoring tools[205]. SEEMP contains three parts[206]:

- **SEEMP Part I** – Ship management plan to improve energy efficiency (400 GT & above)
- **SEEMP Part II** – Fuel oil consumption data collection (5000 GT & above)
- **SEEMP Part III** – Ship operational carbon intensity plan (5000 GT & above)

Guidance on best practices for fuel efficient operations

IMO Resolution MEPC.346(78) addresses various methods of fuel-efficient operations as well. Few such methods are listed and described below generally, which are important for a chief officer. Remember, refer the SEEMP onboard for ship specific measures of fuel-efficient operations.

- Optimum trim

  Most ships are designed to carry a designated amount of cargo at a certain speed for a certain fuel consumption. This implies the specification of set trim conditions. Loaded or unloaded, trim has a significant influence on the resistance of the ship through the water and optimizing trim can deliver significant fuel savings. For any given draft there is a trim condition that gives minimum resistance. In some ships, it is possible to assess optimum trim conditions for fuel efficiency continuously throughout the voyage. Design or safety factors may preclude full use of trim optimization.

205 https://www.imo.org/en/ourwork/environment/pages/improving%20the%20energy%20efficiency%20of%20ships.aspx (Last visited 17/07/2026)

206 Refer Resolution MEPC.346(78) or the latest by IMO for further details

- Optimum ballast

  Ballast should be adjusted taking into consideration the requirements to meet optimum trim and steering conditions and optimum ballast conditions achieved through good cargo planning.

  When determining the optimum ballast conditions, the limits, conditions and ballast management arrangements set out in the ship's Ballast Water Management Plan are to be observed for that ship.

  Ballast conditions have a significant impact on steering conditions and autopilot settings, and it needs to be noted that less ballast water does not necessarily mean improved energy efficiency.

- Hull maintenance

  Docking intervals should be integrated with the company's ongoing assessment of ship performance. Hull resistance can be optimized by new technology-coating systems, possibly in combination with cleaning intervals. Regular in-water inspection of the condition of the hull is recommended.

  Propeller cleaning and polishing or even appropriate coating may significantly increase fuel efficiency. The need for ships to maintain efficiency through in-water hull cleaning should be recognized and facilitated by port States.

  Consideration may be given to the possibility of timely full removal and replacement of underwater paint systems to avoid the increased hull roughness caused by repeated spot blasting and repairs over multiple dockings.

- Improved cargo handling

  Cargo handling is in most cases under the control of the port or terminal operators and optimum solutions matched to ship and port or terminal requirements should be explored. However, in cases where ships use their own cargo handling equipment (e.g. cargo cranes, self-unloading booms, cargo pumps (tankers)), procedures should be in place to efficiently utilize the energy produced from any additional generators required to operate the equipment.

Apart from the methods listed above in the said Resolution and requirements of the ship specific SEEMP, as a chief officer you may consider of the following in making the vessel fuel-efficient.

- Training and guidance for junior officers and ratings:
  - ✓ To switch off unnecessary lights.
  - ✓ Avoid unnecessary uses of cargo gears, mooring winches, windless and other deck machinery.
  - ✓ When there are delays (as an example – when the cargo operations are ceased for shift change or tea or breakfast or lunch or dinner or due to rain) switch to standby mode or switch off the relevant machinery provided it is safe to do so.
  - ✓ Proper use of auto pilot to reduce unnecessary rudder movements.

- If possible, keep the use of deck machinery at a minimum at any given time to avoid starting additional generators.
- Ensure the deck machineries are maintained in accordance with the vessel's PMS which will increase not only the safety but the efficiency as well by reducing resistances or frictions.
- Reduce the use of ballast pumps by ballasting or de-ballasting by gravity provided it is safe to do so.

2) International convention for the control and management of ships' ballast water and sediments

a) Application

Applies to all ships with little exclusion such as war ships, vessels not going out of a party's waters etc.

b) Ballast water controlling methods

- Avoid or reduce taking ballast water
- Exchange methods
- Treatment methods
- Reception facilities for ballast water & sediments

c) **Warning concerning up taking of ballast water**

A party may prohibit the uptake of ballast water if;

- known to contain outbreaks, infestations, or populations of Harmful Aquatic Organisms and Pathogens or
- near sewage outfalls or
- where tidal flushing is poor or times during which a tidal stream is known to be more turbid.

d) **Exchange methods (Regulation-D1)**

The International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004 (BWM Convention), defines two ballast water management methods, D-1 and D-2.

The D-1 standard requires ships to conduct an exchange of ballast water such that at least 95% of water by volume is exchanged far away from the coast. The D-2 standard specifies the maximum amount of viable organisms allowed to be discharged, including specified indicator microbes harmful to human health[207]. Ballast water treatment systems were introduced in order to comply with D-2 standards. Applicable ships are required to have approved ballast water treatment systems onboard by 08th September 2024.

Still, may need to comply with the D-1 standards in case of the ballast water treatment facility break down and if recommended by the ship's approved ballast water management plan (BWMP). All ways follow the safety procedures provided in the ship's SMS and the ship's BWMP.

The necessary stability calculations to be carried out at each intermediate step of the ballast water operation to ensure:

- Adequate intact stability is maintained;
- The permissible *seagoing* SWSF and SWBM are not exceeded;
- For each cargo hold and block of cargo hold(s), the combined weight of the cargo in the hold(s) and the water ballast in the double bottom and hopper wing ballast tanks directly in way of that hold(s) does not exceed the allowable *Seagoing* limits for all

[207] https://www.imo.org/en/mediacentre/hottopics/pages/implementing-the-bwm-convention.aspx (Last visited 20/06/2026)

intermediate draught conditions (local loading criteria explained above for each hold shall not be exceeded); and

- The present and forecasted sea and swell conditions must be favourable to ensure that no significant sloshing loads, which could cause structural damage to holds or tanks, could be developed.

To minimise the risk of structural damage, the exchange of water ballast at sea should always be carried out in calm weather conditions. All available weather forecasting should be utilised to determine that the weather condition is likely to stay calm within the '*weather window*' of the ballast water exchange operation. This '*weather window*' should be determined based upon the ballast water exchange sequence and the achievable ballasting/deballasting rates. A sufficient time margin should always be included to allow for any unexpected circumstances such as the breakdown of ballast pumps etc.

Ballasting and deballasting of each pair of symmetrical port and starboard wing and double bottom ballast tanks should always be carried out simultaneously, such that the amount of water ballast carried in each tank is always the same.

The progress of the ballast/deballast operation and the weather and sea condition should be closely monitored throughout the ballast exchange operation. The ballast water management manual may specify the upper limits of wind forces, swell heights and sea states where the ballast water exchange is not to be carried out.

The ballast water Convention describes three methods to exchange ballast water at sea as described below;

<table>
<tr><th>Methods</th><th>Procedures</th><th>Remarks</th></tr>
<tr><td>Sequential method</td><td>Tank is first emptied and then refilled with replacement ballast water to achieve at least a 95% volumetric exchange</td><td></td></tr>
<tr><td>Flow-through method</td><td>Ballast water is pumped into ballast tanks which are already full, allowing water to overflow</td><td rowspan="2">The flow-through method and the dilution method are considered as "pump through" methods.

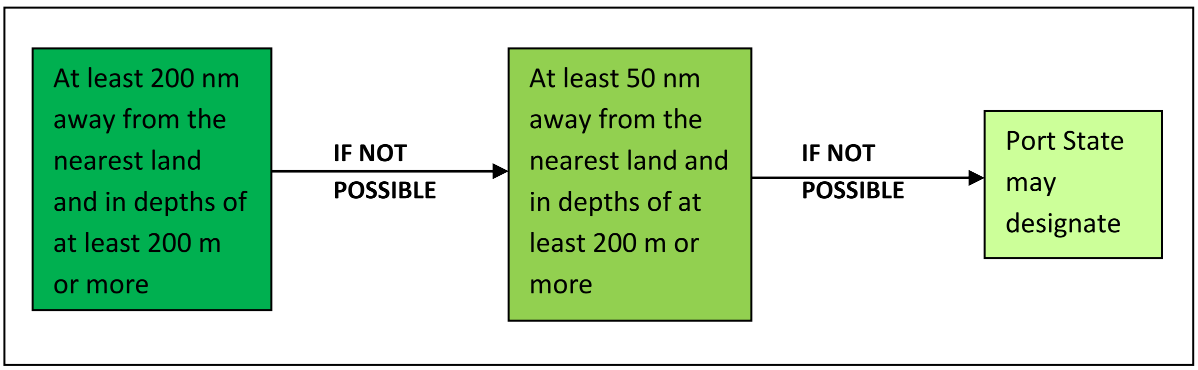
Pumping through to be continued until three times the volume of the tank is overflown</td></tr>
<tr><td>Dilution method</td><td>Ballast water is filled through the top of the ballast tank with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange operation</td></tr>
</table>

Refer the ballast water management manual of the vessel to identify the ballast water exchange methods which are allowed for your vessel. **No other methods to be used.**

If there is any difficulty in establishing a safe ballast exchange sequence, or if there is any doubt in the interpretation of an approved procedure or the stress limits imposed on the ship, **no attempt should be made to exchange water ballast at sea.**

Ensure not to reduce the draughts fwd and aft less than the minimum values stipulated in the ballast water management manual.

e) Areas where the ballast water exchange may be carried out



Application of D – 1 standard depending on depth of sea & distance from land

f) Ballast water management system (D-2 standards)

D2 standard specify the maximum amount of viable organisms allowed to be discharged, including specified indicator microbes harmful to human health. Usually involves installing ballast water management system[208]. This will kill or filter the harmful marine life from ballast water before it is discharged while deballasting, which involves installing a ballast water treatment facility. Ballast water management system shall be approved by the flag state.

208 https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/BWM%20infographic_FINAL.pdf (Last visited 18/07/2026)

g) If Challenging water quality is impacting ballasting operations[209]

Challenging water quality (CWQ) refers to ambient uptake water having quality parameters [including but not limited to high total suspended solids (solids means solids in water that can be trapped by a filter), or turbidity] that cause a properly installed, maintained and operated type-approved BWMS to be temporarily inoperable due to an operational limitation or an inability to meet operational demand. However, temperature and salinity are not parameters that define CWQ.

CWQ may be impacting ballasting operations if the BWMS is not functioning at its expected treatment rated capacity, and alarms indicating an operational limitation arise or the BWMS is not meeting operational demand.

If CWQ is impacting ballasting operations, then the crew should implement ship-specific troubleshooting procedures set out in the BWMP and the OMSM (Operations, Maintenance and Safety Manual) to ensure the system is being operated in accordance with proper procedure and the manufacturer's instructions. For example, this may include steps such as verifying the correct alignment of valves, that the BWMS is in the correct mode, and fully addressing any BWMS warnings and alarms.

The crew should also follow ship-specific procedures in the BWMP and the OMSM to verify that the BWMS has been properly maintained. For example, these procedures may include ensuring that any necessary reagents have been introduced into the BWMS, that any cleaning cycles have been run, and that no mechanical or electrical failures are present.

If the steps above indicate that the BWMS has been properly operated and maintained, the crew should follow procedures in the BWMP and the OMSM to deploy mitigating measures that assist the system in treating the water successfully. For example, these may include manually operating any backflushing controls, applying suitable backpressure at high differential filter pressures, maximizing UV intensity in the presence of turbid water or low UV transmittance, progressively reducing ballast water flow rate to the point of operational demand or operational limitation.

h) Management of sediments contain in ballast water

All ships shall remove and dispose of Sediments from spaces designated to carry Ballast Water in accordance with the provisions of the ship’s Ballast Water Management plan.

209 Refer Resolution MEPC.387(81) of IMO or the latest for further details

i) Exemptions granted by Administrations

Administrations are allowed to grant exemptions for certain regulations of the Convention and if so granted, shall be recorded in the ballast water record book.

j) Exemptions from these regulations

Vessels are exempted from complying with these regulations in below cases;

- The uptake or discharge of Ballast Water and Sediments necessary for the purpose of ensuring the safety of a ship in emergency situations or saving life at sea; or
- The accidental discharge or ingress of Ballast Water and Sediments resulting from damage to a ship or its equipment:
  - ✓ provided that all reasonable precautions have been taken before and after the occurrence of the damage or discovery of the damage or discharge for the purpose of preventing or minimizing the discharge; and
  - ✓ unless the owner, Company or officer in charge wilfully or recklessly caused damage; or

- The uptake and discharge of Ballast Water and Sediments when being used for the purpose of avoiding or minimizing pollution incidents from the ship; or
- The uptake and subsequent discharge on the high seas of the same Ballast Water and Sediments; or
- The discharge of Ballast Water and Sediments from a ship at the same location where the whole of that Ballast Water and those Sediments originated and provided that no mixing with unmanaged Ballast Water and Sediments from other areas has occurred.

k) Documents required relevant to the convention

- With regards to treatment facilities[210];
  - ✓ **Copy of the type Approval certification of the treatment plant –** a certificate to be issued by the flag administration or a recognised organisation indicating the compliance with IMO standards.
  - ✓ Operation, maintenance and safety manual.
  - ✓ Installation specifications (installation drawings, piping diagrams).
  - ✓ Installation commissioning procedures.

[210] Refer MEPC 72/17/Add.1 or the latest of IMO for further details

- **Approved Ballast Water Management Plan (BWMP) -** approved by the flag administration or a recognised organisation (sometimes this is also called as 'ballast water manual').
- **Ballast Water Record Book -** in paper format or an electronic format approved by the administration.
- Ballast water reporting form.
- **International Ballast Water Management Certificate (IBWMC)** – every ship over 400 GT will be required to undergo an initial survey and be issued with an International Ballast Water Management Certificate (IBWMC).
- **Document of Compliance** – vessels flying the flag of non-ratified countries are required to have this without the IBWMC.

l) Approved Ballast Water Management Plan (BWMP)

An approved BWMP may contain;

- Name and the responsibilities of the person who is responsible for ballast water handling;
- Methods available for ballast water exchange;
- When and where to exchange ballast;
- Handling of ballast sediments;
- Training of crew;
- Format of a ballast water reporting form;
- Format of a ballast water handling log (recording form);
- Format for sediment removal log;
- Plans and drawings of the ballast water treatment systems;
- General arrangement plan;
- Ballast tank arrangement plans;
- Ballast line diagrams;
- Ballast water sampling points; and
- Safety precautions and limitations applicable for ballast water handling.

m) Responsibilities of the officer in charge of ballast water handling

- Need to have a good knowledge of:
  - ✓ regulations concerning the handling of ship's ballast water, which includes local regulations and international regulations;
  - ✓ ballast water handling procedure; and

- ✓ ballast water handling equipment.

- He/she shall obtain local regulations which are to be complied with from port authorities or other relevant parties prior visiting port/coastal states.
- Ensure the ships stability is maintained when ballasting or deballasting.
- Decide when and where to undertake ballast water exchanges by consulting the master.
- Ensure to comply with the ship's ballast water management plan when ballasting, de-ballasting and exchanging ballast water.
- Ensure to make available the ballast water reporting form to local authorities when required.
- Provide required assistances to officials from local authorities with regards to ballast water handling.
- Maintain ballast water and sedimentation handling records.
- Training of crew with regards to handling of ballast water and sediments.

n) Ballast water record book[211]

A diagram identifying the ballast tanks of the ship, corresponding to the Ballast Water Management Plan, including any multi-use tank, space or compartment designed to allow carriage of ballast water, is integral to and shall be a part of this Ballast Water Record Book and following entries shall be made:

(A) When ballast water is taken on board from the aquatic environment (ballasting operation)

.1 Start time and location (port of uptake or latitude/longitude);
.2 Completion time and location (port of uptake or latitude/longitude and minimum depth of water during uptake);
.3 The identity of the tanks affected;
.4 Estimated volume of uptake and final total quantity retained in cubic metres;
.5 Whether conducted in accordance with the approved Ballast Water Management Plan; and
.6 Ballast water treatment method.

(B) When ballast water is discharged into the aquatic environment (deballasting operation)

.1 Start time and location (port of discharge or latitude/longitude);

[211] Refer the Resolution MEPC.369(80) or the latest by IMO for further details

.2 Completion time and location (port of discharge or Latitude/longitude and minimum depth of water during discharge);
.3 The identity of the tanks affected;
.4 Estimated volume of discharge and final total quantity retained in cubic metres;
.5 Whether conducted in accordance with the approved Ballast Water Management Plan; and
.6 Ballast water treatment method.

(C) Whenever ballast water is exchanged, treated through internal circulation or treated in tank

1 Ballast water exchange

.1 Start time and location (latitude/longitude);
.2 Completion time and location (latitude/longitude);
.3 Minimum distance from the nearest land and minimum depth of water during the exchange or, if applicable, identify the designated exchange area in accordance with regulation B-4.2;
.4 Whether conducted in accordance with the Ballast Water Management Plan and state the ballast water exchange method (Sequential or Flow-through or Dilution) used;
.5 The identity of the tanks affected;
.6 Total quantity exchanged and final total quantity on board in cubic metres; and
.7 Treatment method for the incoming ballast water.

2 Ballast water internal circulation for treatment or in-tank treatment

.1 Start time;
.2 Completion time;
.3 The identity of the tanks affected (identifying source and destination tanks, if applicable);
.4 Total quantity treated (through circulation or in tank) in cubic metres; and
.5 Ballast water treatment method.

(D) Uptake or discharge of ballast water from/to a port-based or reception facility

.1 Start time and location of uptake/discharge (state facility name);
.2 Completion time;
.3 Operation carried out (whether uptake or discharge);
.4 The identity of the tanks affected;
.5 Total quantity in cubic metres and final quantity retained on board;

.6 Whether conducted in accordance with the approved Ballast Water Management Plan;
.7 Onboard ballast water treatment method;

(E) Accidental discharge/ingress or other exceptional uptake or discharge of ballast water

.1 Start time and location of ingress/uptake/discharge (port name or latitude/longitude);
.2 Completion time;
.3 Operation carried out (whether ingress, uptake or discharge);
.4 The identity of the tanks affected;
.5 Total quantity of ballast water in cubic metres; and
.6 State the circumstances of ingress, uptake, discharge or loss, the reason thereof, any treatment method used and general remarks.

(F) Failures and inoperabilities[212] of the ballast water management system

.1 Time and location (port name or latitude/longitude) of failure of the ballast water management system;
.2 Operation carried out (state whether uptake or discharge);
.3 Description of the issue (e.g. kind of alarm or other description of circumstances); and
.4 Time and location (port name or latitude/longitude) when the ballast water management system has been made operational.

(G) Ballast tank cleaning/flushing, removal and disposal of sediments

.1 Time and ship's location on commencement of ballast tank cleaning/flushing, removal or disposal of sediments (port name or latitude/longitude);
.2 Time and ship's location on completion of ballast tank cleaning/flushing, removal or disposal of sediments (port name or latitude/longitude);
.3 Tank(s) identification (name of the ballast tanks as per the Ballast Water Management Plan);
.4 Discharge or disposal to a reception facility (state quantity in cubic metres and name of the facility); and
.5 Disposal or discharge to the aquatic environment as per Ballast Water Management Plan (state quantity in cubic metres, minimum distance from the nearest land in nm and minimum depth of water in metres).

[212] Failures and inoperabilities include malfunctions, shutdowns or critical alarms indicating a failure of the ballast water management system which may indicate non-compliance with the D-2 standard (except routine information and warnings).

(H) Additional operational procedures and general remarks

Sample Ballast Water Record Book Page

Name of ship: ....

IMO number, distinctive numbers or letters: ....

Date	Code (letter)	Item (number)	Record of operations/signature of officer in charge

Signature of the master ...."

o) Ballast water reporting form

Some countries may require the vessels coming into their ports to complete a ballast water reporting form. A general reporting form (which is provided below) and the guidelines to complete is provided by the IMO but individual countries may have different formats.

Appendix 1 - BALLAST WATER REPORTING FORM (TO BE PROVIDED TO PORT STATE AUTHORITY UPON REQUEST)

1. VESSEL INFORMATION / **2. BALLAST WATER**

Vessel Name:	Type:	IMO Number:	Specify Units: m^3, MT, LT, ST
Owner:	GT:	Call Sign:	Total Ballast Water on Board:
Flag:	Arrival Date:	Agent:	
Last Port and Country:		Arrival Port:	Total Ballast Water Capacity:
Next Port and Country:			

3. BALLAST WATER TANKS BALLAST WATER MANAGEMENT PLAN ON BOARD? YES___ NO___ HAS THIS BEEN IMPLEMENTED? YES___ NO___

TOTAL NO. OF TANKS ON BOARD___ NO. OF TANKS IN BALLAST___ IF NONE IN BALLAST GO TO NO. 5

NO. OF TANKS EXCHANGED___ NO. OF TANKS NOT EXCHANGED___

4. BALLAST WATER HISTORY: RECORD ALL TANKS THAT WILL BE DEBALLASTED IN PORT STATE OF ARRIVAL; IF NONE GO TO NO. 5

Tanks/Holds (list multiple sources/tanks separately)	BW SOURCE				BW EXCHANGE : circle one: Empty/Refill or Flow Through					BW DISCHARGE			
	DATE ddmmyy	PORT or LAT. LONG	VOLUME (units)	TEMP (units)	DATE ddmmyy	ENDPOINT LAT. LONG.	VOLUME (units)	% Exch.	SEA Hgt. (m)	DATE ddmmyy	PORT or LAT. LONG.	VOLUME (units)	SALINITY (units)

Ballast Water Tank Codes: Forepeak=FP, Aftpeak=AP, Double Bottom=DB, Wing=WT, Topside=TS, Cargo Hold=CH, O=Other

IF EXCHANGES WERE NOT CONDUCTED, STATE OTHER CONTROL ACTION(S) TAKEN: ___

IF NONE, STATE REASON WHY NOT: ___

5. IMO BALLAST WATER GUIDELINES ON BOARD (RES. 868(20))? YES___ **NO**___

RESPONSIBLE OFFICER'S NAME AND TITLE (PRINTED) AND SIGNATURE: ___

Sample of ballast water reporting form[213]

[213] https://www.westpandi.com/globalassets/news/imo-ballast-water-reporting-form.pdf (Last visited 18/07/2026)

p) Surveys required by the convention

The initial survey will confirm that an approved Ballast Water Management Plan and Ballast Water Record Book are on board, and that the arrangements for ballast water management are as shown in the BWMP. The survey will also verify that the ballast water treatment system is operational. Following surveys are also required:

- An annual survey within +/- 03 months of the Anniversary date
- An intermediate survey within +/- 03 months of the 2nd Anniversary date or within +/- 03 months of the 3rd Anniversary date
- A renewal survey at intervals not exceeding 05 years

The annual, intermediate and renewal surveys are conducted to ensure that:

- there have been no changes to the ballast water management arrangement since the last survey;
- an approved BWMP is on board;
- the ballast water record book has been maintained and has up to date entries;
- the treatment system is in good condition and has been operated and maintained in accordance with the manufacturer's instructions; and
- there are sufficient consumables and spares on board as recommended by the manufacturer.

3) Anti-fouling Convention

The compounds contain in antifouling paints slowly "leach" into the sea water, killing barnacles and other marine life that have attached to the ship. But the studies have shown that these compounds persist in the water, killing sea life, harming the environment and possibly entering the food chain. One of the most effective anti-fouling paints, developed in the 1960s, contains the organotin tributylin (TBT), which has been proven to cause deformations in oysters and sex changes in whelks[214].

All ships shall not apply or re-apply organotin compounds which act as biocides in anti-fouling systems.

Ships of above 400 gross tonnage and above engaged in international voyages will be required to undergo an initial survey before the ship is put into service or before the International Anti-fouling System Certificate is issued for the first time; and a survey when the anti-fouling systems are changed or replaced.

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[214] https://www.imo.org/en/about/conventions/pages/international-convention-on-the-control-of-harmful-anti-fouling-systems-on-ships-(afs).aspx (Last visited 18/07/2026)

Ships of 24 m or more in length but less than 400 gross tonnage engaged in international voyages will have to carry a Declaration signed by the owner or authorized agent. The Declaration will have to be accompanied by appropriate documentation (such as a paint receipt or contractor invoice) or contain appropriate endorsement.

4) Biofouling[215]

Introduction

Invasive species could be transferred to a new environment through biofouling as well like transferring of invasive species through ship's ballast water. Therefore, IMO developed 2011 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES and adopted in July 2011. This was revoked by 2023 guidelines. These guidelines are not compulsory to comply with but countries like Australia, New Zealand etc. have already adopted similar requirements making it compulsory to comply for the vessels touching their ports. Therefore, chief officers are required have a good knowledge of biofouling.

Definitions

AFC means Anti Fouling Coating.

AFS means Anti Fouling System.

Biofouling means the accumulation of aquatic organisms such as micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling.

BFMP means Biofouling Management Plan.

Capture is the process of containment, collection and removal of biofouling material and waste substances detached from submerged surfaces during cleaning in water or in dry dock.

Macrofouling means fouling is visible to naked eye, refer the pictures below:

[215] Refer IMO, Resolution MEPC.378(80) or the latest for further details

Microfouling is biofouling caused by bacteria, fungi, microalgae, protozoans and other microscopic organisms that creates a biofilm also called a slime layer.

MGPS means Marine Growth Prevention System is an AFS used for the prevention of biofouling accumulation in niche areas or other surface areas but may also include methods which apply surface treatments (anodes).

Niche areas means areas other than submerged main hull area and bottom area. Example – sea chests, cooling water outlets, bow thruster areas, bulbous bow area, bilged keel etc.)

Proactive cleaning means maintaining the biofouling rating 0 to 1, without allowing for macrofouling. Description on biofouling rating is given below.

Reactive cleaning means cleaning of the hull and niche areas after the growth of macrofouling. That means when the biofouling rate is more than one.

Rating of biofouling on the hull

During an inspection, niche areas in the ship-specific BFMP should be inspected as a priority. All inspected areas should be allocated a fouling rating number in line with the extent of fouling as defined in table below:

Rating	Description	Macrofouling cover of area inspected (visual estimate)	Recommended cleaning
0	**No fouling** Surface entirely clean. No visible biofouling on surfaces.	____	____
1	**Microfouling** Submerged areas partially or entirely covered in microfouling. Metal and painted surface may be visible beneath the fouling.	___	Proactive cleaning may be recommended. Proactive meaning means maintaining the rating 0 to 1, without allowing for macrofouling
2	**Light macrofouling** Presence of microfouling and multiple macrofouling patches. Fouling species cannot be easily wiped off by hand.	1-15% of surface	Cleaning with capture is recommended. It is recommended to shorten the interval until the next inspection. If the AFS is significantly deteriorated, dry-docking with maintenance and reapplication of the AFS is recommended.
3	**Medium macrofouling** Presence of microfouling and multiple macrofouling patches.	16-40% of surface	
4	**Heavy macrofouling** Large patches or submerged areas entirely covered in macrofouling.	41-100% of surface	

Pictorial guide on biofouling rating[216]

Rating	Description of fouling	Sample picture
0	No fouling	
1	Microfouling	
2	Light macrofouling	
3	Medium macrofouling	
4	Heavy macrofouling	

Compiler's note – Some countries may have different rantings of bio fouling. As an example, New Zealand has categorized bio fouling rating from 0 to 5. These pictures were taken from a document which is applicable to New Zealand.

[216] https://www.nrc.govt.nz/media/igbn3s0s/level-of-fouling-lof-guidance-and-schematics-cawthron.pdf (Last visited 13/09/2026)

Recommended biofouling rating

The purpose of the BFMP is to contribute to the aim of maintaining a recommended fouling rating of **less than or equal to 1**[217] in the above scale.

Biofouling management plan

Through the above resolution, IMO encourages all the ships to have biofouling management plan and a biofouling record book to ensure biofouling is eliminated or reduced from ships.

Biofouling management plan is a ship specific document, **no approvals** required and can be updated when required. It should contain at least;

a) identification of the officer, or the position (e.g. chief engineer), responsible for the BFMP, ensuring that the plan is properly implemented;
b) details of the AFS installed and where it is installed;
c) details of the recommended operating conditions which are suitable for the selected AFS to avoid deterioration of AFC, including recommended conditions such as temperature, salinity, speed;
d) details of expected AFC efficacy throughout AFC lifetime including the need for inspection or maintenance, if relevant;
e) description of monitoring on biofouling risk parameters;
f) regime for cleaning, if any;
g) details of hull and niche areas where biofouling may accumulate;
h) schedule for fixed inspections of areas;
i) procedures for reactive cleaning actions that should be performed if triggered by inspection results;
j) contingency action plan based on specific triggers from monitoring of biofouling risk parameters;
k) regime for repairs, maintenance and renewal of AFS, when relevant, in accordance with the manufacturer's instructions;
l) process for monitoring and maintenance of MGPS as per the manufacturer's instructions to ensure their effectiveness in minimizing biofouling; and
m) details of the documentation/reports required to document biofouling activities.

Such management practices can also improve a ship's hydrodynamic performance, as hull fouling leads to significant increases in ship resistance, which in turn has a severe impact both on fuel costs and on emissions of air pollutants and greenhouse gases. Therefore,

[217] https://gard.no/en/insights/hull-biofouling-key-recommendations/ (Last visited 29/06/2026)

biofouling management can be an effective tool in enhancing energy efficiency and reducing air emissions from ships[218].

Biofouling record book

May have either a hard copy or an electronic copy but encouraged to have in electronic form. A biofouling record book may have two parts;

- PART I – Biofouling management activities
- PART II – Monitoring of biofouling risk parameters

List of items to be recorded in the Part I of biofouling record book

Biofouling Record Book Part I contains many references to observations regarding fouling rating. These observations may be included in separate reports including observations of subsections and corresponding photos/video. The entries in Biofouling Record Book Part I may be a summary only including a conclusion on whether the activity is in line with the BFMP. Biofouling Record Book Part I should be kept on board the ship in a place where it is readily available for inspection at all reasonable times and for the life of the ship. Any inspection of Biofouling Record Book Part I should be performed as expeditiously as possible without causing the ship to be unduly delayed.

(A) In the case of proactive cleaning

1) Date and location of ship when proactive cleaning occurred.
2) General observations with regard to biofouling prior to cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).
3) Records of permits required to undertake in-water proactive cleaning, if applicable.
4) Details of hull and niche areas cleaned.
5) General observations with regard to biofouling after the cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).
6) Reference to any supporting evidence/reports of the cleaning (e.g. report from supplier, photographs/videos and/or receipts), if any.
7) Method, manufacturer and model of proactive cleaning method used, if not given in BFMP.
8) Reference to test standard for which the method has been tested, if not given in BFMP.
9) Name, position and signature of the person in charge of the activity.

[218] http://www.imo.org/en/OurWork/Environment/Biofouling/Pages/default.aspx

(B) In the case of inspections

1) Date and location of inspection.
2) Methods used for inspection (including inspection tools/devices).
3) Areas inspected of the ship.
4) Observations with regard to biofouling (extent of microfouling and macrofouling in line with the defined fouling rates).
5) Observations with regard to AFS condition.
6) Reference to any supporting evidence/reports of the inspection.
7) Name, position and signature of the person in charge of the activity.

(C) In the case of reactive cleaning

1) Date and location of ship when cleaning occurred.
2) Records of permits required to undertake in-water cleaning, if applicable.
3) Description of hull and niche areas cleaned.
4) Methods of reactive cleaning used.
5) Estimation of overall biofouling after cleaning in line with the defined fouling rates.
6) Reference to any supporting evidence/reports of the activity.
7) Receipt or other documenting evidence of collection/delivery of the wastes.
8) Name, position and signature of the person in charge of the activity.
9) Manufacturer and model of cleaning and capture device as well as cleaning company executing the cleaning.
10) Reference to test standard for which the method has been tested, if relevant.

(D) Additional operational procedures and general remarks

Format of the Part I of the biofouling record book

Name of ship ....

IMO number, distinctive numbers or letters ....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of activity / signature of officer in charge

Signature of master ....

List of items to be recorded in the Part II of biofouling record book

Biofouling Record Book Part II should be provided to every ship with a Biofouling Management Plan, to record when the ship is at higher risk of biofouling accumulation given by monitoring of biofouling risk parameters. Relevant contingency actions should also be recorded.

Biofouling Record Book Part II may contain many references to contingency actions. When actions include inspection, maintenance and/or cleaning, these may be recorded in Biofouling Record Book Part I. Part II should be kept on board the ship for the life of the ship and should contain the following:

(I) When the ship operates outside the expected operating profile specified in the BFMP (e.g. speed, temperature or salinity)

1) Duration and dates when ship is not operating in line with its BFMP.
2) Reason for departure from normal operation.
3) Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections) taken in the period when the ship is operating outside the expected operating profile.
4) Time and location (port name or latitude/longitude) when the ship operates again as specified in the BFMP.

(J) Maintenance/service or damage to AFC

1) Date/period and description of any observed reduction of the efficacy, damage or deviation from maintenance/service to AFC during its lifetime.
2) Date/period and description of any operation beyond expected lifetime.
3) Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).
4) Date/period and location where any AFC maintenance or repair was performed (e.g. in dry dock).
5) Description of any AFC, including patch repairs, that was applied during maintenance. Detail the type of AFC, the area and locations it was applied to (including the location of dry-dock support blocks if relevant), an estimated percentage cover of reapplication of the AFC, the coating thickness achieved and any surface preparation work undertaken (e.g. complete removal of underlying AFC or application of new AFC over the top of existing AFC).
6) Reference to any supporting data for AFC maintenance (e.g. AFC technical file).
7) Name, position and signature of the person in charge of the activity.

(K) Maintenance/service or downtime/malfunction of MGPS

1) Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of marine growth prevention system (MGPS) during its lifetime.
2) Date/period and description of operation beyond the expected lifetime.
3) Date and location of any instances when the system was not operating in line with the BFMP.
4) Records of maintenance (including regularly monitoring the electrical and mechanical functions of the systems, calibration, or adjustment of treatment dosages).
5) Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).
6) Name, position and signature of the person in charge of the activity.

(L) Maintenance/service or downtime/malfunction of other AFS

1) Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of other AFS during its lifetime.
2) Date/period and description of operation beyond expected lifetime.

3) Date and location of any instances when the system was not operating in line with the Biofouling Management Plan.
4) Records of maintenance.
5) Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

(M) Deviation from regular use of expected proactive cleaning as specified in the BFMP

1) Date and location where ship did not conduct proactive cleaning as specified.
2) Contingency actions taken to minimize biofouling accumulation (e.g. inspections of biofouling and/or reactive cleaning before returning to proactive cleaning activity).
3) Records of maintenance, if any.
4) Date when ship returned to normal activities with proactive cleaning.

(N) Deviation from necessary reactive cleaning as specified in the BFMP

1) Date and location where ship was inspected and reactive cleaning found necessary.
2) Contingency actions taken until reactive cleaning, including scheduling of reactive cleaning activity.
3) Date when ship completed the reactive cleaning and reference to relevant recording in Part I.

(O) When the ship is idle (berthed, anchored, moored) for a longer period

1) Date and location where ship was laid up, including general description of biofouling pressure, e.g. temperature and distance to the coastline.
2) Contingency actions taken to minimize biofouling accumulation (e.g. inspections, sea chests blanked off or short voyages taken prior to and following the period laid up).
3) Precautions taken to minimize biofouling accumulation (e.g. short voyage).
4) Date when ship returned to normal operations.

(P) When the ship has performance loss as per Performance Monitoring System for a period beyond the expected period as specified in the BFMP

1) Date and location where ship started with performance loss beyond the expectations.

2) Inspections or biofouling management actions taken prior to and following the period with performance loss.
3) Contingency actions taken to minimize biofouling accumulation.
4) Date when ship returned to normal performance.

(Q) Other deviations

Format of the Part II of the biofouling record book

Name of ship ....

IMO number, distinctive number or letters ....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of risk / signature of officer in charge

Signature of master ....

Ship maintenance procedures to eliminate biofouling

a) Ship owners to select proper anti fouling system depending upon the planned periods of dry docking, ship speed, trade route etc.
b) When installing, or repairing anti-fouling systems make sure proper surface preparation is done, especially in niche areas such as sea chests, bow / stern thruster areas, edges & weld joints etc.
c) During dry docking;
    - ensure that areas covered by blocks are painted with anti-fouling, at least at alternate dry-dockings;
    - Inspections & proper maintenance of bow / stern thruster areas to be done;
    - Recesses within rudder hinges and behind stabilizer fins need to be carefully and effectively cleaned and re-coated;

- If anodes are flush-fitted to the hull, a rubber backing pad should be inserted between the anode and the hull or the gap should be caulked.
- The lifespan of an AFS should be considered in combination with dry-docking schedules. AFC lifespan and lifetime of MGPS (e.g. anodes) should exceed the period between dry-dockings.

d) Periodical in water inspections, cleaning and maintenance recommended.
e) Ships' masters and crew should be trained in:
   - maintenance of appropriate records and logs;
   - impacts of invasive aquatic species from ships' biofouling;
   - benefits to the ship of managing biofouling and the threats posed by not applying management procedures;
   - biofouling management measures and associated safety procedures; and
   - relevant health and safety issues.

f) Comply with the reequipments of the BFMP and port/coastal state requirements.

Example - Australian regulations[219]

Vessels expecting to enter Australian waters have three options of compliances:

Option 1: Implement an effective biofouling management plan and record book

If you report that you have implemented an effective biofouling management plan and record book for the vessel, you must be able to provide the authorities:
- a biofouling management plan (BFMP).
- a biofouling record book (BFRB).

The biofouling management plan and biofouling record book must meet the minimum standards set out by Australian authorities to satisfy the requirements of option 1.

Option 2: Clean all biofouling within 30 days prior to arriving in Australian territory

If you report that the vessel has been cleaned of all biofouling within 30 days prior to arrival in Australian territorial seas, the following documents must be provided:
- a cleaning report; and

[219] https://www.agriculture.gov.au/biosecurity-trade/aircraft-vessels-military/vessels/marine-pest-biosecurity/biofouling/biofouling-commercial-vessels (Last visited 29/06/2026)

- supporting photographs and/or video.

The cleaning report and supporting evidence must meet the minimum standards set out by Australian authorities to satisfy the requirements of option 2.

Option 3: Alternative biofouling management method approved by the department

If you report that the vessel has an alternative biofouling management method, it must be approved by the department, and you must provide:

- department-issued written approval, specific to the vessel and voyage; and
- any specified documents in the department issued approval.

Approval of the alternative biofouling management method must be obtained from the department prior to arrival to meet the requirements of option 3.

Vessel operators that cannot demonstrate proactive biofouling management practices

A vessel operator that cannot demonstrate proactive biofouling management practices using one of the three accepted management options will be required to provide additional information in their pre-arrival report.

Authorities will use these responses to make a preliminary assessment of the biosecurity risks associated with the biofouling management practices on the vessel. This will determine the actions taken by the department on arrival into Australia.

ISM Code

ISM Code was adopted with the aim of eliminating collisions, occupational accidents, groundings, pollutions etc. which occur due to human errors. The closest reason for implementing the ISM Code was the loss of RO-RO vessel Herald of Free Enterprise.

It is the responsibility of the master to implement ISM Code onboard. But chief officer also needs to have a good knowledge and understanding of the ISM Code since it is required to eliminate human errors and, he/she is the second in command.

After an ISM audit onboard, auditors may give their recommendations as 'Observations' or 'Non-conformities' or 'Major non-conformities'. Therefore, chief officers are required to have a good idea about the meaning of observation, non-conformity and major non-conformity, they are explained below with the actions to be taken if they are raised.

a) Observation

Observation is a statement or fact made during a safety management audit and substantiated by objective evidence.

In practice, an observation is not as severe or vital as a non-conformity and it does not require immediate actions. More specifically, an observation is an item for improvement so as not to result in a non-conformity[220].

b) Non-conformity

This is an observed situation where objective evidence indicates NON-FULFILMENT of specified requirement of the ISM code or the company SMS or situation of failure which resulted or could result in an accident or hazardous occurrence or failure to meet the SMS standards.

Actions to be taken when NCR are received

- Inform relevant parties.
- It has to be closed within the time frame given to close it by the auditor or maximum within three months.
- Look into other areas where similar NC may be available.
- Carryout a root cause analysis.
- Take appropriate corrective actions for the prevention of reoccurrence.

[220] https://safety4sea.com/cm-ism-code-how-to-handle-non-conformities/ (Last visited 18/07/2026)

Once it is rectified, no specific onboard audits are required to close the NCR, but it may be checked during the next audit.

The actions to be taken when a NCR is received is also provided in the ship's SMS, therefore, refer your ship's SMS for further details.

A DOC or SMC may be issued, endorsed or renewed before all identified non-conformities have been rectified provided that a schedule has been agreed between the Company and the auditor(s) for the implementation of the necessary corrective actions.

Additional audit(s) may be necessary to confirm the validity of a DOC and/or SMC depending on the nature of any non-conformities identified. The Company is responsible for applying for any follow-up audit/s required by the auditor.

c) Major non-conformity

Major NC means identifiable deviation which creates a serious threat to safety of the people or ship or serious risk to the environment & required immediate corrective action.
Eg; Expired statutory certificates of the vessel
Un-qualified seafarers working onboard

Major non-conformities shall be rectified or down grade to NCRs before sailing. No ships are allowed to sail with a major NC. Onboard verification is required once it is rectified.

d) Chief officer's duties in implementing the ISM Code onboard

In accordance with the chief officer's 'job description' provided in the SMS, the chief officer has to play an important role in implementing ISM Code onboard. Chief officer shall ensure that;

- he/she is aware of the onboard safe operation procedures as addressed by the SMS;
- all the deck officers and ratings are aware of their duties and responsibilities in accordance with the ship's SMS;
- the placards, posters and notices are posted in accordance with the SMS;
- the company policies are understood by crew & officers;
- the muster lists are prepared;
- all are aware of their duties in emergencies;
- drills are conducted as per the drill matrix of the ship;

- risk assessment procedures are implemented onboard;
- the deck filling system is arranged in accordance with the SMS;
- the operational procedures and the safety checklists used for operations which are given in the SMS are compatible with the actual jobs to be done;
- the watch schedules are posted, and work and rest hour requirements are complied with;
- the safety, security and pollution prevention trainings are given;
- the relevant records are maintained; and
- actively coordinate with the master when he/she is reviewing the onboard SMS periodically.

e) How to assist the master in the periodical reviewing of the SMS onboard

Master is required to review the SMS periodically to ensure the objectives of the ISM Code are achieved. The company to be notified, if any deficiencies are found along with the proposals to rectify the matters and recommendations to improve the system. The chief officer can assist the master with his periodical review by addressing the below, but, in fact, a chief officer is responsible to give suggestions to improve the SMS. Remember, the important and urgent matters to be rectified as soon as possible, rather than waiting till the periodical review.

- With regards to training onboard (in fact, the urgent areas to be addressed as soon as possible and rectified);
  - ✓ Efficiency and sufficiency of training;
  - ✓ New trainings to be added;
  - ✓ Adequacy of posters, CD's, videos and computer-based training programmes; and
  - ✓ Problems involved with cadet training programme of the company.
- Adequacy of risk matrix and any suggestions to improve the risk management system onboard.
- Raise any difficulties encountered with safety checklists and procedures provided in the SMS.
- The efficiency and the problems encountered with the PMS.
- Any unidentified potential ship hazards associated with the deck operations to be addressed.
- Sufficiency of available manpower onboard.
- Adequacy of pollution prevention measures.
- Comments on food and freshwater safety plans.
- Handing over and taking over procedures.
- Any other areas that effect safety, security and pollution prevention.

ISPS Code

The ISPS Code was adopted due to the attack on the Twin Towers, USA in the month of September 2009. The Code was adopted through SOLAS chapter XI part 2 and it is applicable to all ships of 500 GT or more engage on international voyages. The Code states that the applicable vessels to have a Ship's Security Officer (SSO) onboard. It is the responsibility of the company to appoint a SSO onboard. Responsibilities and the duties of a SSO are listed below, since you must be aware of them, if your company has appointed the chief officer as SSO:

- Carryout regular security related inspections and checks on board the vessel.
- Maintenance and updating of security measures and SSP (Ship Security Plan).
- Co-ordination between the ship and ports.
- Proposing modifications for the SSP to the company security officer.
- Co-ordination between the ship and the company security officer.
- Reporting of security related incidents.
- Training of onboard personnel.
- Maintenance of security equipment.

The SSO shall ensure that the following documents which are related to ISPS Code are maintained:

- Records of training and drills.
- Records of security threats and incidents.
- Records of breaches of security.
- Records of changes of security levels.
- Reports of communications related to security.
- Reports of audits and reviews of security activities.
- Records of periodical reviews of ship security assessment and ship security plan.
- Records of implementation of amendments to the plan.
- Records of maintenance, testing and calibration of security equipment.

a) Declaration of Security (DoS)

This is a document completed to ensure both the parties (ship/port or ship/ship interfaces) are following their security plans to reach the objectives of the ISPS Code. Refer the below sample of a DoS to see the contents of a DoS[221].

[221] https://www.classnk.com/hp/pdf/activities/statutory/isps/flag/tuvalu/MC-02201002ANNEX.pdf (Last visited 18/07/2026)

APPENDIX TO PART B

APPENDIX 1

Form of a Declaration of Security between a ship and a port facility[8]

DECLARATION OF SECURITY

Name of Ship :	
Port of Registry :	
IMO Number:	
Name of Port Facility :	

This Declaration of Security is valid from .... until …………………….. , for the following activities ....

(list the activities with relevant details)

under the following security levels

Security level(s) for the ship :	
Security level(s) for the port facility :	

The port facility and ship agree to the following security measures and responsibilities to ensure compliance with the requirements of Part A of the International Code for the Security of Ships and of Port Facilities.

	The affixing of the initials of the SSO of PFSO under these columns indicates that the activity will be done, in accordance with relevant approved plan by	
Activity	**The port facility:**	**The ship:**
Ensuring the performance of all security duties		
Monitoring restricted areas to ensure that only authorized personnel have access		
Controlling access to the port facility		
Controlling access to the ship		
Monitoring of the port facility, including berthing areas and areas surrounding the ship		
Monitoring of the ship, including berthing areas and areas surrounding the ship		
Handling of cargo		
Delivery of ship's stores		

[8]This form of Declaration of Security is for use between a ship and a port facility. If the Declaration of Security is to cover two ships this model should be appropriately modified.

Handling unaccompanied baggage		
Controlling the embarkation of persons and their effects		
Ensuring that security communication is readily available between the ship and port facility		

The signatories to this agreement certify that security measures and arrangements for both the port facility and the ship during the specified activities meet the provisions of chapter XI-2 and Part A of Code that will be implemented in accordance with the provisions already stipulated in their approved plan or the specific arrangements agreed to and set out in the attached annex.

Dated at .... on the ....

Signed for and on behalf of	
The port facility:	The ship:
(signature of Port Facility Security Officer)	(Signature of Master or Ship Security Officer)

Name and title of person who signed	
Name:	Name:
Title:	Title:

Contact details (to be completed as appropriate) (indicate the telephone numbers or the radio channels of frequencies to be used)	
for the port facility:	for the ship:
Port Facility:	Master:
	Ship Security Officer:
Port Facility Security Officer:	Company:
	Company Security Officer:

DoS must be completed when;

- a vessel has a security level higher than a port or
- a port requires it as per their security plan or
- a port facility security officer requires depending upon the occasion or
- a ship requires it as per their security plan or
- an Administration requires (may not be required as per the plan).

When vessels are entering into ports, most of the contracting port states require the previous port's DoS. Therefore, even though the above-mentioned conditions are not met, it is advisable to complete a DoS in each port.

If there are any changes to the relevant security levels as mentioned on DoS, a new DoS must be completed, or the existing DoS to be revised.

b) Can a vessel maintain a different security level than a port?

A vessel can maintain a higher security level than a port. In such a case, a DoS must be completed. A vessel cannot maintain a lower security level than a port. In such a case, the vessel has to increase the security level up to the security level of that port.

When the ship's security level is lower than the arrival port's security level

- SSO has to report the matter to the CSO and take necessary actions to increase the security level up to the level maintained in the port.
- Inform the flag state, if the flag state regulations require to inform the same to them.
- Inform all the ship staff that the security level is increased.
- Refer the SSP and take necessary actions to comply with the new security level (such as new watch schedules, closing of entry restricted areas, restrictions on access to the vessel etc.).

c) Access to the SSP

Section 9.8.1 of the ISPS Code states "If the officers duly authorized by a Contracting Government have clear grounds to believe that the ship is not in compliance with the requirements of chapter XI-2 or part A of this Code, and the only means to verify or rectify the non-compliance is to review the relevant requirements of the ship security plan, limited access to the specific sections of the plan relating to the noncompliance is exceptionally allowed, but only with the consent of the Contracting Government of, or the master of, the ship concerned. Nevertheless, the provisions in the plan relating to section 9.4 subsections .2, .4, .5, .7, .15, .17 and .18 of this Part of the Code are considered as confidential information and cannot be subject to inspection unless otherwise agreed by the Contracting Governments concerned".

Section 9.4 of the ISPS Code contains following:

9.4 Such a plan shall be developed**,** taking into account the guidance given in part B of this Code and shall be written in the working language or languages of the ship. If the language or languages used is not English, French or Spanish, a translation into one of these languages shall be included. The plan shall address, at least, the following:

.1 measures designed to prevent weapons, dangerous substances and devices intended for use against persons, ships or ports and the carriage of which is not authorized from being taken on board the ship;

.2 identification of the restricted areas and measures for the prevention of unauthorized access to them;

.3 measures for the prevention of unauthorized access to the ship;

.4 procedures for responding to security threats or breaches of security, including provisions for maintaining critical operations of the ship or ship/port interface;

.5 procedures for responding to any security instructions Contracting Governments may give at security level 3;

.6 procedures for evacuation in case of security threats or breaches of security;

.7 duties of shipboard personnel assigned security responsibilities and of other shipboard personnel on security aspects;

.8 procedures for auditing the security activities;

.9 procedures for training, drills and exercises associated with the plan;

.10 procedures for interfacing with port facility security activities;

.11 procedures for the periodic review of the plan and for updating;

.12 procedures for reporting security incidents;

.13 identification of the ship security officer;

.14 identification of the company security officer including 24-hour contact details;

.15 procedures to ensure the inspection, testing, calibration, and maintenance of any security equipment provided on board;

.16 frequency for testing or calibration of any security equipment provided on board;

.17 identification of the locations where the ship security alert system activation points are provided; and

.18 procedures, instructions and guidance on the use of the ship security alert system, including the testing, activation, deactivation and resetting and to limit false alerts.

Following note was obtained from a vessel's SSP for your further knowledge:

IMPORTANT NOTES:

01)

The Ship Security Plan is not subject to detailed inspection (other than confirming its existence on the ship) by duly authorised officials of a Port State unless there are "clear grounds" to believe that the ship is not in compliance with the requirements of SOLAS or the ISPS Code. The only means to verify or rectify the non-compliance is to review the relevant requirements of the Ship Security Plan. In such a case, limited access to the plan relating to the non-compliance is exceptionally allowed, but only with the consent of the Flag State, or the Master. **Any such request or demand must be immediately be reported by the ship to the Company Security Officer for guidance and reference to the Flag State before any details are revealed to Non-Flag State officials**.

02)

English is the official working language in all departments

d) Continuous synopsis record

In the past, it was a common a practise to change the flag by shipowners to avoid legal consequences, specially by shipowners having substandard ships. If they happen to change the flag few times continuously, vessel may not be traceable at all.

Therefore, in accordance with the SOLAS chapter XI – 1/5.3, vessels are required to have a "Continuous Synopsis Record" onboard to maintain the traceability of the vessel. This applies to ships of 500 GT and above engage on international voyages. This is a record issued by the Administration. When the registration is changed, a new record will be issued by the new flag state.

CSR number one will be issued to a brand-new vessel. If the flag is changed, the new CSR issued by the new flag will be numbered as number 2 and so on. Each CSR issued by the new administration include identification of the former flag. Master shall maintain all the CSRs onboard along with records of amendments to CSR.

MISCELLANIOUS AREAS

1) The factors to be considered when scheduling and arranging work

- Ship's SMS defines the duties and responsibilities of each person onboard. The chief officer must make sure the duties are assigned according to the requirements of the SMS unless in an emergency.
- Make sure to comply with the work & rest hour requirements.
- Number of people required for a particular job.
- Prioritization of the jobs (important jobs to be finished first).
- Experience and competency of the staff to be utilised.
- Risks involve & methods of mitigating the risks.
- Consider about the age of the seafarers. According to MLC 2006, certain types of work cannot be delegated to people below 18 years of age.
- Prevailing weather condition.
- Availability of equipment. Sometimes you may have to borrow equipment or get support from the engine room. In that case, discuss with the 2nd engineer and find when such equipment will be available and accordingly need to plan your work.
- Time available and the time required to complete the work. If the vessel is expecting to berth within another 2 hrs there is no point of starting non urgent work which needs 4 hrs to complete.
- It is not advisable to do chipping work on the accommodation block in the morning as there will be staff who are sleeping after their duties.
- Under normal circumstances, the priority shall be given to training and drills. Therefore, time shall be saved to do training and drills.
- Master's orders and instructions.

2) BIMMS agreement

BIMMS stands for Bangladesh, India, Maldives, Myanmar and Sri Lanka. This is an agreement between these countries which facilitates non-compliance of international regulations (with reference to certification and training requirements) when sailing within these countries for ships registered under these flags.

The holders of the unlimited COCs and the near coastal voyage (NCV) COCs issued by the said Administrations are eligible to sail between these countries.

3) **MOU (Memorandum of Understanding) with regards to Port State Control (PSC) inspections and their objectives**

PSC inspections of foreign ships in national ports are encouraged by IMO to verify that the conditions of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules.

If the inspections of ships in a particular region can be closely co-ordinated (if the inspections are conducted by countries in the region with a mutual understanding), following can be ensured:

- Many ships can be inspected;
- Unnecessary inspection of the same ship can be avoided;
- Delays can be avoided;
- Monitoring of substandard ships will be easy;
- Sharing of details of ships inspections among the countries involved; and
- Easy access to the other PSC details around the world.

MOUs are used to co-ordinate this PSC inspections. The objectives of MOUs are to harmonize and co-ordinate of PSC activities and to develop practical recommendations which can be forwarded to IMO for further considerations.

Parties to the MOUs can detain vessels if they are not complying with the international requirements provided that the party who is carrying out the inspection has implemented those international requirements in that country. As an example, the Sri Lankan Administration cannot inspect vessels coming to Sri Lankan ports for the compliance of Ballast water management Convention since Sri Lanka is not a party to the said convention.

If the ship's flag state is not party to a convention, according to that flag state's regulations, their ships are not required to comply with the requirements of that convention, but, if a port state has implemented that convention, the port state can inspect the vessels coming into their port for the compliance of that convention. Therefore, the ship owners are required to take actions to comply with that convention through Recognized Organizations (RO). In short, this is internationally known as 'no more favourable treatments' (just because the flag state has not ratified, does not mean that the ship owners can run substandard ships. When a vessel is going to a foreign port, the ship has to comply with the regulations implemented in that port state).

As an example, if the vessel's flag state has not ratified MARPOL Annex – VI and if the vessel is expecting to visit ports which have ratified the said Annex, the vessel owner is required to take necessary certificates from the vessel's recognized organization and need to carry required documents onboard. Otherwise, she could be detained in those countries.

There are few MOUs existing at present in the various parts of the world. These MOU include:

- Paris MOU
- Mediterranean MOU
- Tokyo MOU
- Caribbean MOU
- Abuja MOU (West & Central Africa)
- Riyadh MOU (Gulf)
- Latin American MOU
- Black sea MOU

14) Ship's plans to be available onboard and in the company

The following plans and documents shall be kept available onboard and in the company. The DPA is responsible for maintaining these plans and the documents ashore.

- General arrangement plan;
- Capacity plan;
- Hydrostatic curves;
- Loading manual;
- Midship section plan;
- Scantling plan;
- Plans of separate decks if available;
- Shell expansion plan;
- Plans of transverse bulkheads;
- Plans of rudder and rudder stock; and
- Plans of cargo hatch covers if available.

15) Among other conventions, Sri Lanka is not a party to the following conventions, protocols and annexes of the conventions[222]

- SOLAS protocol 78 & 88;

[222] https://wwwcdn.imo.org/localresources/en/About/Conventions/StatusOfConventions/x-Status.xlsx (Last visited 19/07/2026)

- Load line protocol 88;
- SAR Convention 79;
- MARPOL Annex VI;
- Bunkers convention;
- Antifouling convention 2001; and
- Ballast water convention 2004.

16) Important Acts, Regulations and guidelines applicable to Sri Lankan ships and seafarers

- Merchant Shipping Act No. 52 of 1971
- Merchant Shipping (Amendment) Act No. 36 of 1988
- Merchant Shipping (Training, Certification and Watch Keeping) (STCW'78 as amended)- Gazette No.1987/19 (entered into force on 04/10/2016)
- Marine Pollution Prevention Act, No.35 of 2008
- Carriage of Goods by Sea Act No. 21 of 1982
- MSN issued by the DGMS

17) Certificates to be carried onboard according to Act number 52 of 1971

- Certificate of registry;
- Passenger ship safety certificate;
- Cargo ship safety construction certificate;
- Cargo ship safety equipment certificate;
- Cargo ship safety radiotelegraphy certificate or a cargo ship safety radiotelephony certificate; and
- International load line certificate or Sri Lankan load line certificate

  Note the following with regards to Load Line Certificate according to the above Act:

  Exemptions may be granted for the load line convention in the following circumstances:

  a) When trading between neighbouring ports in Ceylon and another ratified state or
  b) When trading between neighbouring ports in any ratified states or
  c) Ships of less than 80 t GT engage in coasting or
  d) Ships of novel kind or
  e) If a coasting vessel needs to undertake a single international voyage in exceptional circumstance.

An international load line exemption certificate to be issued in the case of (d) and (e) above. Vessels of 24 m or more in length not engage in international voyages to be issued with a Sri Lanka load line exemption certificate.

Master of the ship is required to put up a copy of the Load Line Certificate in some conspicuous place on board the ship, so as to be legible to all persons on board, so long as it remains in force.

18) Deck logbook entries

- The deck logbook shall contain sufficient navigational information for the purpose of reconstructing a voyage:
  - ✓ Ship's positions at regular intervals.
  - ✓ Course alterations and speed alterations.
  - ✓ Weather condition.
  - ✓ Precautions observed during severe weather conditions.
  - ✓ Behaviour of the vessel (rolling, pitching etc.).
  - ✓ Bridge watch level.
  - ✓ If lookouts posted.
  - ✓ Whether the vessel is on auto pilot or hand steering.
  - ✓ Engine room unmanned and maned times.
  - ✓ Change of con.
  - ✓ Testing of bridge equipment while arrival and departure.
  - ✓ Abnormal occurrences such as accidents, groundings, pollutions, salvage operations, observances of pollutions/dangers to navigation reporting made.
  - ✓ Times of POB, EOSP, first line ashore, all fast, FWE, anchor let gone, vessel brought up, singled up, vessel under way, commenced heaving up anchor, anchor aweigh, pilot away, BOSP etc.
  - ✓ Any other facts which are important to the vessel's safety, security and pollution prevention.

- Entries to be made by a Chief officer other than the navigational information (this may depends upon the SMS and the flag state regulations):
  - ✓ Daily cargo lashing inspections.
  - ✓ Maintenance work carried on deck.
  - ✓ Opening and closing of watertight doors while the vessel is at sea.
  - ✓ Daily freshwater ROB.
  - ✓ Departure and arrival draughts.
  - ✓ Details of drill conducted.

19) Dust explosions

A dust explosion occurs when combustible dust particles become suspended in the air and ignite within a confined space. When ignition occurs, the dust burns rapidly, creating a sudden increase in pressure known as deflagration. If pressure cannot escape quickly enough, the resulting overpressure can damage equipment, destroy facilities, and endanger workers[223].

The following elements shall be available to generate a dust explosion:

- Dust (combustible particulate solid);
- Particles must be suspended in the air at a sufficient concentration;
- Must be within a confined area;
- Source of ignition; and
- Air (Oxygen).

Dust explosions may occur with any type of cargo which generates dust sufficient enough to have correct concentration. Most of the dust explosions have taken place in processing plants where generate large concentrations of dust, but not much dust explosions have taken place on board ships. Onboard ships this may be avoided by means of:

- reducing the generation of dust by sprinkling water on the cargo if possible, or
- removing all possible sources of ignition or
- reducing dust formation by slow cargo operations or
- keeping the cargo compartments open, if possible, to avoid building up pressure.

20) Definitions of terms commonly used on tankers

a) Clingage

This is the cargo residue that attaches to the bulkheads of an oil cargo hold after the cargo is discharged.

b) Gas Free

This is an atmospheric condition in a tank when it is free from any concentration of inflammable, noxious or toxic gases and vapours.

[223] https://philadelphiasafetydevices.com/blog/dust-explosions-prevention-guide/ (Last visited 19/07/2026)

c) Gas freeing

This is the process of creating normal atmospheric conditions inside the tank wherein oxygen level is 21%.

d) Upper Flammable Limit or Upper Explosive Limit (UFL or UEL)

This is the concentration of a hydrocarbon gas in an air sample above which there is insufficient oxygen to support & propagate combustion. This varies with different types of oils but for crude oils generally it is taken as 10% by volume of the hydrocarbon gas in air.

e) Lower Flammable Limit or Lower Explosive Limit (LFL or LEL)

This is the concentration of a hydrocarbon gas in an air sample below which there is insufficient hydrocarbon to support and propagate combustion. For crude oils generally it is taken as 1% by volume of the hydrocarbon gas in air.

f) Flammable range (Explosive range)

This is the range of hydrocarbon gas concentrations in a sample of air between the lower and the upper flammable limits. Therefore, such air mixtures are capable of being ignited and or burning.

g) Flash point

This is the lowest temperature at which a liquid gives off sufficient gas to form a flammable gas mixture (gas and oxygen) near the surface of the liquid.

h) Ignition point

This is the lowest temperature that the surface layers of oil will be ignited and burning will be continued if a source of ignition is introduced. If the cargo and its empty space is in the flammable range, it will not be ignited as long as the temperature is below it's ignition point.

i) Bonding

Connecting of two or more steel structures to allow continues flow of electricity is known as bonding. This is different from earthing, because earthing means, connecting a steel structure and the earth to allow current to pass into earth.

j) Inerting

This is the process of filling a compartment with Inert Gas (IG) in order to bring down the oxygen content to 8% or less or for the purpose of increasing the pressure in a tank.

k) Purging

Inerting a tank which is already contains IG for the purpose of reducing the oxygen content in the tank or to create a positive pressure inside the tank or both.

l) Wedge Formula

A mathematical means to approximate small quantities of liquid and solid cargo and free water on board prior to loading and after discharging based on cargo compartment dimensions and vessel's trim. The wedge formula is to be used only when the liquid does not touch all bulk heads of the vessel's tanks.

m) Wedge Table

A pre-calculated table based on the wedge formula and displayed much like the vessel's usual ullage tables. These tables, however, are for small quantities (remaining on board) when the cargo or free water does not touch all bulkheads of the vessel tank.

n) Vessel Experience Factor (VEF)

The VEF is the historical difference in the ship and shore figures for a ship over a period of time. A VEF is used to assess the validity of quantities delivered to the ship that are derived from shore measurements.

Vessel capacity tables are often calculated from the vessel's building plans, rather than based on accurate physical tank calibration measurements. This means that there are usually differences between the quantity of a cargo measured in a calibrated shore tank or by a custody transfer meter, and the quantity determined by vessel tank measurements.

For any given vessel a simple ratio can be found between the quantity of liquid measured onboard the vessel and the corresponding measurement by a load or discharge facility. A historical compilation of this ratio, typically over 10 voyages, is known as the Vessel Experience Factor (VEF).

In simple situations the application of a VEF is the principle way a chief officer is able to assess if the bill of lading quantity is reliable. But in more complicated situations; such as in cases where shore based measurements are not available, or are known to be inadequate for custody transfer and subject to agreement of interested parties, bill of lading or out-turn quantities may be determined based on vessel received or delivered quantities adjusted by the VEF[224].

21) Free board notice

Some flag states require displaying a free board and the departure draughts at a conspicuous place onboard the vessel (at a place where all the staff members can see) before departure from a port and till arrival at the next port. The format of this notice also will be given from the relevant flag. Refer the below freeboard notice which is issued by MCA, UK[225].

[224] https://north-standard.com/insights-and-resources/resources/articles/vessel-experience-factor (Last visited 19/07/2026)

[225] Refer the MGN 579 (M), MCA, UK or the latest for further details

Draught of Water and Freeboard Notice

MSF 2004 / REV 0605

SHIP ______________________________ **PORT OF REGISTRY** ________________________ **GROSS TONNAGE** _______________

(1) Summer freeboard ______________________________ millimetres corresponding to a mean draught of ________________ millimetres

(2) Winter freeboard ______________________________ millimetres corresponding to a mean draught of ________________ millimetres

(3) Tropical freeboard ______________________________ millimetres corresponding to a mean draught of ________________ millimetres

(4) Winter North Atlantic freeboard ______________________ millimetres corresponding to a mean draught of ________________ millimetres

(5) Allowance for fresh water for all freeboards other than Timber freeboards ____ millimetres

(6) Timber Summer freeboard _________________________ millimetres corresponding to a mean draught of ________________ millimetres

(7) Timber Winter freeboard __________________________ millimetres corresponding to a mean draught of ________________ millimetres

(8) Timber Tropical freeboard _________________________ millimetres corresponding to a mean draught of ________________ millimetres

(9) Timber Winter North Atlantic freeboard __________________ millimetres corresponding to a mean draught of ________________ millimetres

(10) Allowance for fresh water for Timber freeboards ____ millimetres

NOTES:

1. The particulars to be given above of freeboards and allowances for fresh water to be taken from the load line certificate currently in force in respect of the ship.
2. All freeboards given on the load line certificate must be stated.
3. The mean draught to be given above is the mean of the draughts which would be shown on the scales of measurement on the stem and on the sternpost of the ship if it were so loaded that the upper edge of the load line on each side of the ship appropriate to the particular freeboard were on the surface of the water.
4. Where the draught is shown on the scales of measurement on the stem and on the stem post of the ship in feet the mean draught must be given in millimetres.

1	2	3	4	5	6	7	6	9
DATE	PLACE	ACTUAL DRAUGHT			MEAN FREEBOARD		SIGNATURE OF MASTER AND AN OFFICER	
		FORWARD	AFT	MEAN	ACTUAL	CORRECTED (See Note 3)	MASTER	AN OFFICER

PARTICULARS OF LOADING

Notes

1. The actual mean freeboard (Column 6) is the mean of the freeboards on each side of the ship at the time when the ship is loaded and ready to leave.
2. If the actual mean freeboard is less than the appropriate minimum saltwater freeboard as shown on the load line certificate there must be entered in Column 7 the corrected freeboard arrived at after making any allowances for density of water, rubbish to be discharged overboard and fuel, water and stores to be consumed on any stretch of river or inland water, being allowances duly entered in the ship's official log-book.
3. If the actual mean freeboard is greater than the appropriate salt water freeboard, Column 7 need not be filled in.

(FORMERLY FRE 13)

An executive agency of the Department for Transport

22) Pump cavitation[226]

Pump cavitation is the formation and implosion of vapor bubbles within a pump due to low pressure conditions. When these bubbles collapse, they create shockwaves that can damage internal components such as the impeller and casing. Cavitation in pump operations is one of the most common causes of premature equipment failure.

Early detection is key to preventing severe damage. Common warning signs include:

- Unusual noise (like gravel or marbles inside the pump)
- Increased vibration
- Reduced flow rate or pressure
- Drop in pump efficiency

23) Maritime Labour Convention (MLC) 2006

MLC is applicable to all ships except war ships, fishing vessels, traditional build ships and vessels navigating only in inland water irrespective of the ship's tonnage. Certification is compulsory only for ships of 500 GT or above and engaged in international voyages. Chief officers are also responsible for ensuring a vessel is complying with the requirements of MLC 2006. A chief officer shall ensure that:

- the work and rest hours regulations are complied with; it is recorded and a signed copy of it is handed over to seafarers.
- the shore leave is granted provided it is safe to do so.
- appropriate onboard training is provided before assigning new duties.
- the night work of seafarers under the age of 18 years is prohibited, except required for the purposes of training & must make sure that it does not affect their health. Refer the flag state regulations to identify the meaning of 'night work'.
- no work that may jeopardize their health and safety is given to seafarers who are below 18 years of age. Refer the flag state regulations to identify what are the duties that may 'jeopardize their health & safety'.
- the accommodation spaces are:
  - ✓ cleaned and in a good state;
  - ✓ sufficiently heated or air conditioned;
  - ✓ having proper bedding, mattress, tables, lamps etc.;
  - ✓ ventilated properly; and
  - ✓ sufficiently illuminated (natural or artificial).

[226] https://winstonengineering.com/cavitation-in-pumps-understanding-the-issue-and-solutions/ (Last visited 30/08/2026)

- sufficient laundry facilities are available.
- anti-mosquito facilities in place in case the vessel is visiting malaria infected regions.
- sanitary facilities are hygienic, accessible and comfortable.
- the cabins are provided with a bed, lamp and table.
- the recreational facilities are available for seafarers, which may include:
  - ✓ libraries facilities and means to watch movies;
  - ✓ facilities for social activities; and
  - ✓ gym to promote health and fitness etc.

- sufficient and quality food and water available.
- varied choices of meals, available respecting religious and cultural believes.
- the ship's galley is kept in hygienic condition.
- frequent inspections of ship's galley and provision rooms are carried out, and records kept.
- risk assessment methods are in place.
- sufficient personal protective equipment and other safety equipment readily available.
- the company's health and safety policies are in place onboard and to comply with safety procedures provided in the ship's SMS.
- on-board programmes for the prevention of occupational accidents, injuries are available.

Documents and certificates that need to be carried on board according to MLC 2006

- Copy of the MLC 2006.
- On board complaint procedures.
- Onboard complain records.
- Flag state regulations concerning repatriation procedures.
- Risk assessment procedures.
- Watch schedules.
- Financial security for death, long term disabilities and repatriation of seafarers. Copy of this document shall be posted at a prominent place onboard.
- If the vessel is taking seafarers from non-ratified countries, a document confirming that the recruiting agency in the non- ratified country is complying with the MLC 2006.
- If applicable, need to have CBA (Collective Bargaining Agreement) onboard.
- Seafarer employment agreement must be available with the seafarer.
- All ships above 500 GT & above, trading in international waters to have:
  - ✓ Maritime Labour Certificate (issued by Flag or RO, valid for 5 years and subjected to intermediate inspection)

- ✓ Declaration of Maritime Labour Compliance (DMLC) Part I (issued by Flag or a RO)
- ✓ Declaration of Maritime Labour Compliance (DMLC) Part II (prepared by shipowner)

24) STCW 1978 as amended 2010 requirements (in brief)

a) Work and rest hours

1. All persons who are assigned duty as officers in charge of a watch or as a rating forming part of a watch and those whose duties involve designated safety, prevention of pollution and security duties shall be provided with a rest period of not less than:
   .1 a minimum of 10 hours of rest in any 24-hour period; and
   .2 77 hours in any 7-day period.

2. The hours of rest may be divided into no more than two periods, one of which shall be at least 6 hours in length, and the intervals between consecutive periods of rest shall not exceed 14 hours.
3. Above rest hour periods need not be maintained in the case of an emergency or in other overriding operational conditions. Musters and emergency drills shall be conducted in a manner that minimizes the disturbance of rest periods and does not induce fatigue.
4. Watch schedules shall be posted where they are easily accessible.
5. When a seafarer is on call, such as when a machinery space is unattended, the seafarer shall have an adequate compensatory rest period if the normal period of rest is disturbed by call-outs to work.
6. Records of daily hours of rest of seafarers shall be maintained and an endorsed copy by the master or by a person authorized by the master shall be given to seafarers.
7. Above rest periods does not applicable in emergencies and as soon as practicable after the normal situation has been restored, the master shall ensure that any seafarers who have performed work in a scheduled rest period are provided with an adequate period of rest.
8. Administration may allow exceptions from the required hours of rest in paragraphs 1.2 and 2 above provided that the rest period is not less than 70 hours in any 7-day period.

   Exceptions from the weekly rest period provided for in paragraph 1.2 shall not be allowed for more than two consecutive weeks. The intervals between two periods of exceptions on board shall not be less than twice the duration of the exception.

The hours of rest provided for in paragraph 1.1 may be divided into no more than three periods, one of which shall be at least 6 hours in length, and neither of the other two periods shall be less than one hour in length. The intervals between consecutive periods of rest shall not exceed 14 hours. Exceptions shall not extend beyond two 24-hour periods in any 7-day period.

b) Medical standards

- Validity period of Medical certificates is 02 years.
- If the age is below 18 years, maximum period of validity is 01 year.
- If the period of validity of a medical certificate expires in the course of a voyage, then the medical certificate will continue to be valid until the next port of call where a recognized medical practitioner is available, provided that the period does not exceed 03 months.
- In urgent cases, seafarers can work without a valid medical certificate until the next port of call where a recognized medical practitioner is available, provided that:
  - ✓ Such time period does not exceed 03 months; and
  - ✓ The seafarers are having a recently expired Medical Certificate.

c) Alcohol limits

- Masters, officers and other seafarers, while performing bridge or engine room watch, designated safety, security and prevention of pollution duties should not consume alcohol that would result in a limit greater than;
  - ✓ 0.05% blood alcohol level (BAC) or
  - ✓ 0.25 mg/l alcohol in the breath.

25) Marine casualty investigations

The objective of this Code is to provide a common approach for States to adopt in the conduct of marine safety investigations into marine casualties and marine incidents. Marine safety investigations do not seek to apportion blame or determine liability. Instead, a marine safety investigation, as defined in this Code, is an investigation conducted with the objective of preventing marine casualties and marine incidents in the future[227]. Even though the Code is applicable for admirations or parties involved in casualty investigations, some important information for seafarers is provided below.

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[227] Casualty Investigation Code (2008 edition), IMO

Definitions

Serious injury means an injury which is sustained by a person, resulting in incapacitation where the person is unable to function normally for more than 72 hrs, commencing within seven days from the date when the injury was suffered.

Marine casualty means an event, or a sequence of events, that has resulted in any of the following which has occurred directly in connection with the operation of a ship:

- The death or, or serious injury to, a person;
- The loss of a person from a ship;
- The loss, presumed loss or abandonment of a ship;
- Material damage to a ship;
- The stranding or disabling of a ship, or the involvement of a ship in a collision;
- Material damage to marine infrastructure external to a ship, that could seriously endanger the safety of the ship, another ship or an individual; or
- Severe damage to the environment, or the potential for severe damage to the environment, brought about by the damage of a ship or ships.

But, does not include;

A deliberate act or omission, with the intent to cause harm to the safety of a ship, an individual or the environment.

Very serious marine casualty means a marine casualty involving the total loss of the ship or death or severe damage to the environment.

Marine incident means an event, or sequence of events, other than a marine casualty, which has occurred directly in connection with the operations of a ship that endangered, or, if not corrected, would endanger the safety of the ship, its occupants or any other person or the environment.

But, does not include;

A deliberate act or omission, with the intent to cause harm to the safety of a ship, an individual or the environment.

Marine safety investigation means an investigation or inquiry, into a marine casualty or marine incident, conducted with the objective of preventing such events in future.

Other important points of the Code

- The Code requires to conduct a marine safety investigation into every very serious marine casualty by the flag state or coastal state or other interested parties or combination of them.
- A marine safety investigation is required to be conducted by the flag state for marine casualties and marine incidents if it is important to prevent marine casualties and marine incidents in future.
- If any seafarers are required to provide evidence, shall be allowed to return to their ship or be repatriated at the earliest possible opportunity and their human rights shall be respected all the time.
- If any seafarers are required to provide evidence, they shall be informed and allowed access to legal advice, regarding:
  - ✓ Any potential risk that they may incriminate them in any proceedings subjected to the investigation; and
  - ✓ Any right not to self-incriminate or to remain silent.

- If a marine safety investigation is commenced, the master, owner and agent of the vessel should be informed as soon as practicable of:
  - ✓ the time and place of the investigation;
  - ✓ names and contact details of the marine safety investigation authorities;
  - ✓ the relevant details of the legislation under which the investigation is being conducted;
  - ✓ the rights and obligations of the parties' subject to the investigation; and
  - ✓ the rights and obligations of the state or states conducting the investigation.

- Such investigations shall not cause undue delays to a vessel.
- Such investigations shall not detain vessels unnecessarily.
- The investigators shall not remove original documents or equipment from the vessel unless they are extremely required for the investigation. They shall make copies of documents where practicable.
- The investigators may have access to;
  - ✓ records held by flag state, owners & classification societies;
  - ✓ all recorded data onboard including VDR; and
  - ✓ government surveyors, coast guard officers, VTS operators, pilots etc. to collect evidence.

26) Actions to be taken when an anchor is lost and how to refit another anchor

- Note down the position where the anchor was lost and report to the owners and port authority.

- Master must inform the class and the flag state asking for an exemption certificate. The class will issue a Condition of Class.
- During the period of validity of the exemption certificate take actions to re-fit the anchor.
- It is always recommended to re-fit the same anchor if it is possible to recover provided it is cost effective and the anchor is not damage.
- If the same anchor is impossible to recover, need to find a suitable second-hand anchor.
- The second-hand anchor should be suitable for the existing cable (because of the wear and tear of the cable) or else, better to replace the whole cable with a new anchor and cable.
- When buying a second-hand anchor, make sure it has a class certificate.
- Discuss with owners and arrange a barge for refitting the anchor.
- Discuss with the barge and see whether they prefer to have the anchor lost side alongside or the opposite side alongside. Accordingly, the master shall discus with the pilot/charterer/port agent and berth as requested by the barge.
- When about to fit the anchor, the chief officer shall discuss with the barge master about the operation and identify very clearly, whether he needs any support from the ship, who are responsible for what and carry out a risk assessment.
- If required arrange proper lighting and fenders.
- It is preferable to conduct the whole operation under the direct supervision of the chief officer.
- Appoint a reliable and experienced person (preferably, the bosun) to monitor the operation throughout.
- Once fitted, carryout a visual inspection and make sure, it is correctly fitted. Check whether the anchor houses properly and it comes out of the hawse pipe without any problem. Make sure the securing can be applied properly after the anchor is housed.

27) How to switch a paint manufacturer

A ship owner may switch the paint manufacturer as per his / her wish. But the ship owner has to send the specifications of the existing paint to the expected new manufacturer, so that he/she can provide a compatible paint type. These specifications are contained in the ship's paint manual

It is not the same when it comes to the dedicated sea water ballast tanks on ships of 500 GT and above and double-side skin spaces arranged in bulk carriers of 150 m in length and upward. In that case, copy of the Coating Technical File has to be forwarded to the expected new supplier. So that the new paint manufacturer shall provide paints having the same specifications.

28) Cyber risk management on board

Cyber risk management means the process of identifying, analysing, assessing and communicating a cyber-related risk and tolerating, terminating, transferring or treating it to an acceptable level by taking into consideration the costs and benefits of actions taken by stakeholders[228].

Cyber risk management should be an inherent part of a company's safety and security culture conducive to the safe and efficient operation of the ship and be implemented at various levels of the company, including senior management ashore and onboard personnel. Cyber risk management should[229]:

- identify the roles and responsibilities of users, key personnel, and management both ashore and on board
- identify the systems, assets, data, and capabilities that, if disrupted, could pose risks to the ship's operations and safety
- implement technical and procedural measures to protect against a cyber incident, timely detection of incidents and ensure continuity of operations
- a contingency plan which is regularly exercised.

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[228] Refer MSC-FAL.1/Circ.3/Rev.3 of IMO or the latest for further details

[229] BIMCO, Chamber of Shipping of America, Digital Containership Association, International Association of Dry Cargo Shipowners (INTERCARGO), InterManager, International Association of Independent Tanker Owners (INTERTANKO), International Chamber of Shipping (ICS), International Union of Marine Insurance (IUMI), Oil Companies International Marine Forum (OCIMF), Superyacht Builders Association (Sybass) and World Shipping Council (WSC), The Guidelines on Cyber Security Onboard Ships, Version 4, https://www.ics-shipping.org/wp-content/uploads/2021/02/2021-Cyber-Security-Guidelines.pdf (Last visited 04/08/2026)

Cyber risk management approach[230]

Administrations are required to ensure that cyber risks are appropriately addressed in safety management systems no later than the first annual verification of the company's Document of Compliance after 1 January 2021[231].

[230] Ibid

[231] Refer Resolution MSC.428(98) of IMO or the latest for further details

The master, chief officer, chief engineer and 2^{nd} engineer or the Cyber Safety Officer (if appointed by the company) should ensure that the cyber safety is assured onboard. The duty of the chief officer is to ensure that the company instructions are complied with along with the master. This involves lifelong learning as these risks may evolve with the time and technology.

Types of Cyber threats[232]

In general, there are two categories of cyber threats that may affect companies and ships:

- untargeted attacks, where a company or a ship's systems and data are one of many potential targets; and
- targeted attacks, where a company or a ship's systems and data are the intended target or one of multiple targets.

Untargeted attacks are likely to use tools and techniques available on the internet, which can be used to locate, discover and exploit widespread vulnerabilities that may also exist in a company and onboard a ship. Examples of some tools and techniques that may be used in these circumstances include:

- **Malware.** Malicious software, which is designed to access or damage a computer without the knowledge of the owner. There are various types of malware including trojans, ransomware, spyware, viruses, and worms. Ransomware encrypts data on systems until a ransom has been paid. Malware may also exploit known deficiencies and problems in outdated/unpatched business software. The term "exploit" usually refers to the use of a software or code, which is designed to take advantage of and manipulate a problem in another computer software or hardware. This problem can, for example, be a code bug, system vulnerability, improper design, hardware malfunction and/or error in protocol implementation. These vulnerabilities may be exploited remotely or triggered locally eg a piece of malicious code may often be executed by the user, sometimes via links distributed in email attachments or through malicious websites.
- **Water holing.** Establishing a fake website or compromising a genuine website to exploit unsuspecting visitors.
- **Scanning.** Searching large portions of the internet at random for vulnerabilities that could be exploited.

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[232] BIMCO, Chamber of Shipping of America, Digital Containership Association, International Association of Dry Cargo Shipowners (INTERCARGO), InterManager, International Association of Independent Tanker Owners (INTERTANKO), International Chamber of Shipping (ICS), International Union of Marine Insurance (IUMI), Oil Companies International Marine Forum (OCIMF), Superyacht Builders Association (Sybass) and World Shipping Council (WSC), The Guidelines on Cyber Security Onboard Ships, Version 4, https://www.ics-shipping.org/wp-content/uploads/2021/02/2021-Cyber-Security-Guidelines.pdf (Last visited 04/08/2026)

- **Typosquatting.** Also called URL hijacking or fake URL. Relies on mistakes such as typos made by internet users when inputting a website address into a web browser. Should a user accidentally enter an incorrect website address, they may be led to an alternative and often malicious website.

Targeted attacks may be more sophisticated and use tools and techniques specifically created for targeting a certain company or ship. Examples of tools and techniques, which may be used in these circumstances, include:

- **Social engineering.** A non-technical technique used by potential cyber attackers to manipulate insider individuals into breaking security procedures, normally, but not exclusively, through interaction via social media.
- **Brute force.** An attack trying many passwords with the hope of eventually guessing correctly. The attacker systematically checks all possible passwords until the correct one is found.
- **Credential stuffing.** Using previously compromised credentials or specific commonly used passwords to attempt unauthorized access to a system or application.
- **Denial of service (DoS)** prevents legitimate and authorised users from accessing information, usually by flooding a network with data. A distributed denial of service (DDoS) attack takes control of multiple computers and/or servers to implement a DoS attack.
- **Phishing.** Sending emails to a large number of potential targets asking for particular pieces of sensitive or confidential information. The email may also contain a malicious attachment or request that a person visits a fake website using a hyperlink included in the email.
- **Spear-phishing.** Like phishing but the individuals are targeted with personal emails, often containing malicious software or links that automatically download malicious software. In some instances, SAT-C messages have been used to establish a sense of familiarity with a malicious sender's email address.
- **Subverting the supply chain.** Attacking a company or ship by compromising equipment, software or supporting services being delivered to the company or ship.

The above examples are not exhaustive. Other cyber-attack methods are evolving such as impersonating a legitimate shore-based employee in a shipping company to obtain valuable information, which can be used for a further attack. The potential number and sophistication of tools and techniques used in cyber-attacks continue to evolve and are limited only by the ingenuity of those organisations and individuals developing them.

Chief officer's duties in cyber risk management onboard

- Familiar with the instructions provided in the ship's SMS with regards to cyber risk management;
- With the aid of recognized publications and websites keep up dating yourself with regards to the latest information on cyber risks at sea as this evolves with the time and technology;
- In accordance with the SMS ensure that no access is allowed to unauthorized persons to;
  - ✓ cargo calculations software;
  - ✓ software operated cargo operating systems;
  - ✓ software operated ballast water operating systems;
  - ✓ software operated planned maintenance systems; and
  - ✓ company's network systems.

- Comply with the SMS requirements when third parties (ship's service providers and ship's staff both) require using their own external devices (such as hard drives, pen drives etc.) with the ship's IT devices;
- Any new software being downloaded should be verified and scanned; ideally only preapproved software should be allowed to be installed on devices. This will minimise the chances of malware, such as Trojans, entering the system[233];
- Update the software systems onboard to newer versions in consultation with the company and the master;
- Assess the navigation risks along with the master and take necessary actions with the aid of the company;
- Ensure sufficient contingency/backup plans are available with regards to navigational safety, cargo safety and onboard operational safety;
- Train crew on cyber risks and contingencies in accordance with the SMS requirements. Staff training greatly reduces the success of phishing and waterhole attacks[234];
- Regularly run anti-malware scans[235];
- Report cyber risk related incidents to the company through the master; and
- Implement a strong cyber safety culture onboard along with the master.

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[233] Department for Transport, UK, Cyber Security Code of Practice for Ships, July 2023, https://assets.publishing.service.gov.uk/media/64c929c0d8b1a71bd8b05e80/code-of-practice-cyber-security-for-ships.pdf (Last visited 05/08/2026)

[234] Ibid

[235] Ibd

29) Fatigue & management of fatigue

As managers onboard ships, chief officers are required to have a good idea about fatigue and fatigue management. Therefore, following summery is taken from MSC.1/Circ.1598 on "Guidance on fatigue", to give you a basic understanding on the subject.

Fatigue means is a condition of physical and/or mental impairment due to;

- inadequate sleep,
- extended wakefulness,
- work/rest requirements out of synchronized with circadian rhythms (biological clock of the body) and
- physical, mental or emotional exertion that can impair alertness and the ability to safely operate a ship or perform safety-related duties.

Fatigue is a problem for all 24-hour-a-day transportation modes and industries, including the maritime industry. Nature of shipping may require;

- the seafarers to work long and irregular hours;
- to work extended hours/contracts periods onboard with varying environmental conditions;
- the seafarers to stay and work at the same place; and
- to work without clear separation between work and recreation

A person may encounter fatigue due to various reasons which includes;

- lack of sleep;
- poor quality of sleep and rest;
- Work/sleep does not match with human circadian rhythm (refer next slide);
- staying awake for long periods;
- stress; and
- excessive workload (prolonged mental and/or physical exertion).

This a very dangerous phenomena specially in the transport sector. Because a fatigued person may encounter one or couple of the below mentioned problems which may lead to catastrophic situations onboard.

- Inability to concentrate
- Diminished decision-making ability
- Poor memory
- Slowing of cognitive processes
- Involuntary need to sleep
- Loss of control of bodily movements

- Health Issues
- Mood change
- Change of attitude

Causes of fatigue can be categorized as:

- seafarer-specific factors;
- management factors (ashore and aboard ship);
- ship-specific factors;
- environmental factors; and
- operational factors.

How to identify when fatigued

A fatigued person may show one or couple of the symptoms listed below.

- Neglecting important areas when decision making
- Slow or no response even in emergencies
- Lapses of attention
- Poor judgement of distance, speed, time, etc.
- Difficulty in concentrating
- Inability to stay awake
- Difficulty with hand-eye coordination skills
- Speech difficulties
- Increased frequency of dropping objects
- Digestion problems
- Anti-social behaviour
- Mood changes
- Ignores normal checks and/or procedures
- Increasing omissions, mistakes

Master's and Chief Officer's duties in mitigating and managing fatigue

Apart from the company responsibilities, the senior officers also have a role to play in mitigating and managing fatigue. These may include:

- Compliance with minimum hours of rest and/or maximum hours of work;
- Proper resting of new joiners;

- Manage HEAVY and LONG working hours;
- Nutritious food & drinking water is provided;
- Provided appropriate meal choices for night shift workers;
- Maintain interactions with shore and ship with regards to mitigating fatigue;
- Ensure suitable people are selected depending upon the type of work to be performed;
- Improving shipboard conditions & proper scheduling of work;
- Avoiding potentially hazardous tasks during the circadian lows;
- Making awareness of fatigue and conduct fatigue related training; and
- Report the impacts on fatigue caused due to the nature of ship design and operation.

Training on fatigue and fatigue management

It is also better to give proper training on fatigue and how to manage fatigue to officers and crews. This will enhance the safety onboard. Training may include;

- Fatigue, its causes and potential consequences;
- Circadian rhythms and body clock;
- Importance of proper sleep;
- Fatigue countermeasures;
- Basic information on sleep disorders;
- Understanding of the rules and regulations;
- How to identify fatigue;
- How to mitigate fatigue; and
- Importance and responsibility of reporting.

How to maintain fitness for duty

Training shall also include how to maintain fitness by;

- taking strategic naps (the most effective is about 20 minutes);
- taking advantage of scheduled breaks;
- monitoring and effectively manage sleep;
- monitoring fitness for duty including medical fitness;
- reporting any fatigue impairment in themselves and in others;
- recording and reporting actual hours of work and rest;
- eating regular, well-balanced meals;
- exercising regularly; and
- limiting the use of medications (if possible).

“You can never cross the ocean until you have courage to lose sight of the shore”

– Christopher Columbus

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