

CARGO HANDLING & STOWAGE



2nd Mate written notes
Question wise

By : Anupam Singh Rajput

 : SMART MARINER (Please subscribe)

IF YOU HAVE ANY SUGGESTION FOR

ME, PLEASE EMAIL IT TO:

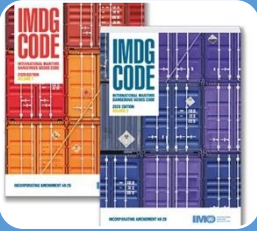
anupamsinghrajput8084@gmail.com

For more notes visit marineredition.com



Q NO 3

- CRUDE / PETROLEUM PRODUCT (INCLUDING INERTING/ COW PROCEDURES)



Q NO 5

- IMDG CODE INCLUDING IMDG CONTAINERS, MFAG, EmS



Q NO 6

- BULK CARGOES: GRAIN/ HIGH DENSITY/COAL CARGOES



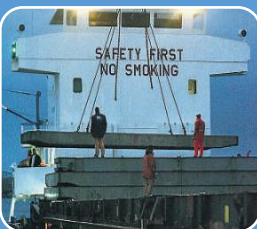
Q NO 7

- CODE FOR SAFE PRACTICES (TIMBER / IMSBC / BLU / SECURING)



Q NO 8

- CONTAINER/ Ro-Ro CARGOES, PCC, PTC,



Q NO 10

- DAMAGE TO CARGO SPACES – INSPECTION & REPORTING / CARGO GEAR INSPECTION

3. CRUDE/PETROLEUM PRODUCTS (INCLUDING INERTING/COW PROCEDURES)

- P-211,212 (1) Sketch and describe flammability range diagram. (8 times)
- P-212,213 (2) Sketch, label & describe the inert gas system used on crude oil tanker (11 times)
- (3) Describe the construction & working principle with a neat sketch for following:
- P-213 to 216 (a) PV valve (5 times) (b) PV Breaker (7 times) (c) Wet type deck seal unit (5 times)
- P-216,217 (4) Explain the purpose, precaution, advantage & disadvantage of COW on a tanker ship (5 times)
- P-217 to 220 (5) Explain the following instrument: (a) Explosimeter (4 times)
- (b) Tank scope (6 times) (c) Oxygen analyzer (5 times) (d) Multi-gas detector (3 times)
- P-220,221 (6) Wrt an oil tanker (a) Ring main system (b) Direct line system
- P-222 (7) Prepare a simple sketch of pipelines on an oil tanker
- P-222,223 (8) Explain static charge on a tanker. What precautions can be taken on-board to safeguard against it
- P-223 (9) Give the various points of ship shore safety checklist used on oil tanker
- P-224 (10) Explain (a) Purging (b) Gas freeing.

5. IMDG code INCLUDING IMDG containers, MFAA, EMS

- P-225,228 (1) What is the purpose of IMDG code? How are various classes of dangerous goods are segregated. (12 times)
- P-225,229 (2) State the various classes of dangerous goods as per IMDG code (9 times)
- P-229 (3) What is IMDG code? List the information available from the IMDG code.
- P-229,230 (4) Wrt IMDG code, explain the following (a) MFAA (15 times) (b) EMS (15 times)
- (c) UN no. (8 times) (d) stowage (5 times) (e) DG Manifest (4 times) (f) Subsidiary risk
- P-230 (5) Wrt carriage of dangerous cargo, explain (a) segregation table
- (b) Packing (c) Marking (d) Labelling (e) Placarding
- P-235 (6) What precautions have to be observed while loading/discharging explosives (8 times)
- P-235,236 (7) (a) List the precautions to be observed during loading of IMDG cargo
- (b) List the precautions to be observed when carrying dangerous goods
- P-237 (8) Describe shipper's responsibilities for shipping dangerous goods as per IMDG code.
- P-237,238 (9) Differentiate between following: (a) Stowage & segregation
- (b) Index and dangerous cargo list (c) UN number & class
- P-238 (10) A container on deck ---- collapsed. What actions are required to be taken on-board with respect to safety, health and pollution prevention

6. BULK CARGOES (GRAIN/HIGH DENSITY/COAL CARGOES)

- P-240 (1) Write short notes on DDA (Document of Authorization) as per grain code and the conditions which must be fulfilled to load bulk grain without DDA? (8 times)
- P-240, 242 (2) Write short notes on (a) strapping & lashing (b) saucering (c) Bundling.
- P-242 (3) Define Angle of repose & draw its neat labelled sketch. What is the importance of Angle of repose.
- P-243 (4) Describe the preparation of hold for loading bulk grain (8 times)
- P-243, 241 (5-a) What are the hazards associated with the carriage of **solid bulk cargo**?
- P-245 (b) what are the precautions to be taken while carrying solid bulk cargo?
- P-245 (6-a) What are the hazards associated with the carriage of **coal cargoes**?
- P-246 (b) What are the precautions to be taken while carrying coal cargoes?
- P-246, 247 (7) What are the hazards associated with the loading & carriage of **grain cargo**?
- P-247 (8-a) What are the hazards associated with the loading & carriage of **high density cargo**?
- P-247 (b) What are the precaution to be taken while loading & carrying high density cargo?
- P-248 (9-a) What are the hazards associated with the loading & carriage of **concentrates**?
- P-248 (b) What are the precautions to be taken while loading & carrying concentrates?
- P-248, 249 (10-a) What are the hazards associated with the loading & carriage of **sulphur**?
- P-249 (b) what are the precautions to be taken while loading & carriage of sulphur?

7. CODE FOR SAFE PRACTICES (TIMBER/IMSBC/BLU/SECURING)

- P-250 (1) Briefly describe the contents and use of cargo securing manual (5 times)
- P-251, 254 (2) As per the code of safe working practice for ship carrying timber deck cargo, what are the recommendation for stowage, lashing & securing of Timber deck cargoes? Explain with suitable sketch (11 times)
- P-254 (3-a) What is timber deck cargo?
- P-254 (b) What are the hazards of loading & carriage of timber deck cargo? (8 times)
- P-255 (c) What preparation are required prior loading timber deck cargo?
- P-255 (d) What are the stability criteria for loading timber cargo?
- P-255 (e) What checks are required for loaded passage carrying timber deck cargoes?
- P-256 (4-a) What is the purpose of code of safe practice for cargo stowage and securing?
- P-256 (b) What are the principle of safe stowage and securing as per above code?
- P-257 (5) As per BLU code, prepare a ship-shore safety checklist for loading in bulk carrier. (6 times)
- P-258 (6) Explain liquefaction and TML. How should a can test may be done?
- P-259, 241 (7) Wrt IMSBC code, define (a) FLOW moisture point (b) Flow state

- P-260 (8) a) How does IMSBC divides various group of cargoes?
b) What all things are required to be checked before accepting & loading a cargo?
- P-263 (9) Differentiate b/w following:- (a) cargo sweat and ship sweat
20 (b) Stowage factor and load density (c) SWL and proof load
- P-261 (10) Discuss how the IMSBC code and BW code assist the mariner.

8. CONTAINER/RO-RO CARGOES

- P-262,263 (1) Sketch and describe Bay plan of a container ship.
- P-264 (2) w.r.t container marking, describe CSC plate.
- P-264,265 (3) W.r.t container marking, describe (i) container number (ii) Stack weight (iii) Tare weight
- P-266 (4) With the suitable sketch, show the marking on a container including information on a CSC plate.
- P-266,267 (5) What are the advantages and disadvantages of containerization.
- P-268,269 (6) Describe the various types of container based on size, material of construction & usage
- P-269 to 271 (7) Sketch and label the various lashing material used in securing containers on a container ship.
- P-271,272 (8) Sketch and describe securing and lashing arrangement of containers.
- P-272 (9) Explain all the factors in detail which affect the stowage of containers on deck.
- P-273 (10) Describe the different types of sling used for cargo handling.
- P-274 (11) Describe the procedure for closing and securing of bow doors on a Ro-Ro vessel.
- P-274,275 (12) How will you prepare the car decks for the loading of trailer & vehicles.
- P-275,276 (13) Describe main hazard on a RO-RO vessel and give reasons for the same
- P-276 (14) On a Ro-Ro vessel, what are all precautions must be taken while loading cars?
- P-277 (15) List the precautions to be taken for safe stowage & securing of vehicles on Ro-Ro ship.

10. DAMAGE TO CARGO SPACE-INSPECTION & REPORTING/ CARGO GEAR INSPECTION

- P-278 (1) Write a short note on dock safety regulation
- P-279 (2) W.r.t dock safety regulation, define (i) Authorized Person (ii) competent person
(iii) Responsible Person.
- P-279,280 (3) List all checks you will do prior putting a cargo gear for use for lifting heavy lifts.
- P-281 (4) Explain the need for periodical inspection and load testing of cargo gear. How frequently should ~~such~~ such inspections & tests be conducted.
- P-281 (5) As per dock labour act, define (i) lifting appliances
(ii) dangerous cargo.

- P-282 (6) Write contents and endorsement of chain register.
- P-283 (7) Explain how & why stevedore damage report shall be made.
- P-284 (8) How will you ensure the water/weather tightness of hatch cover.
- P-285 (9) Explain the causes of corrosion in cargo and ballast tank.
- P-286, 287 } (10) What is the purpose of enhanced survey programme and when ships are required to adopt this survey?

CRUDE / PETROLEUM PRODUCT ***(INCLUDING INERTING/ COW*** ***PROCEDURES)***



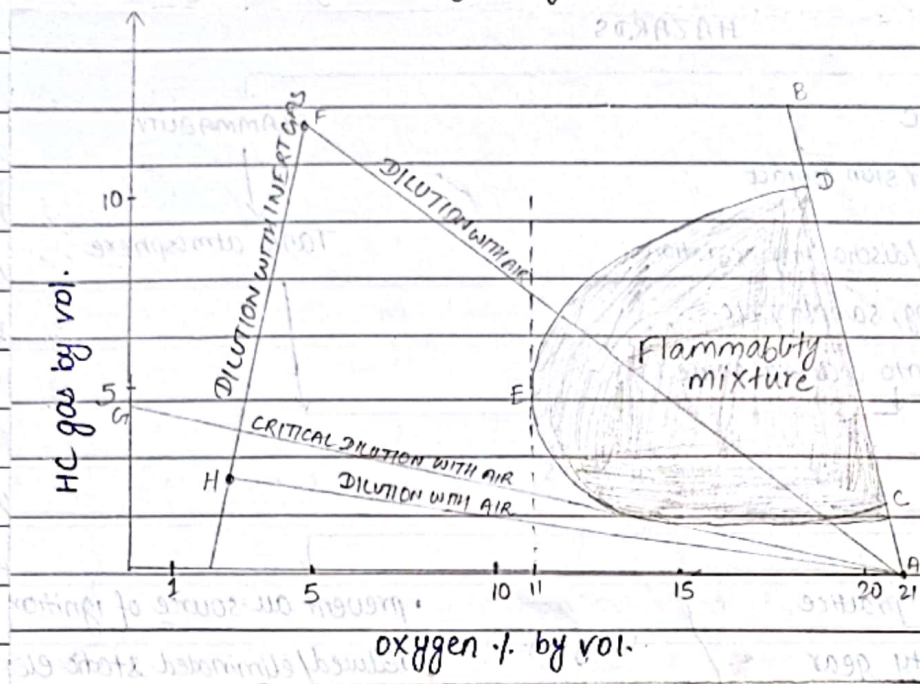
YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

3. CRUDE/PETROLEUM PRODUCT (INCLUDING INERTING/COW PROCEDURES)

Q.(1) Sketch & describe flammability range diagram (8 times)

Ans:-



• Flammability diagram explains to us how a gas or mixture of two gases will behave and catches fire when diluted with other gas or air.

• The flammability diagram is the key element for planning a safe operation on-board ship.

• For example, let's say we get lower flammability limit 1% (point C) & upper flammability limit 20% (point D) from MSDS of a crude oil.

• For understanding, let's take a point F as a condition in our tank. At point F, HC gas is approximately 11% & oxygen is approx 2%.

• Now at this point, if we do dilution with air, it will follow the path AF i.e. HC gas component keep on decreasing & the oxygen content keep on increasing gradually (bcz oxygen is present in the air)

At particular point, this line will come in contact with flammability mixture curve & there will be a high chances of explosion.

• So, we will use inert gas to lower the HC gas component & little bit of oxygen content till the point H.

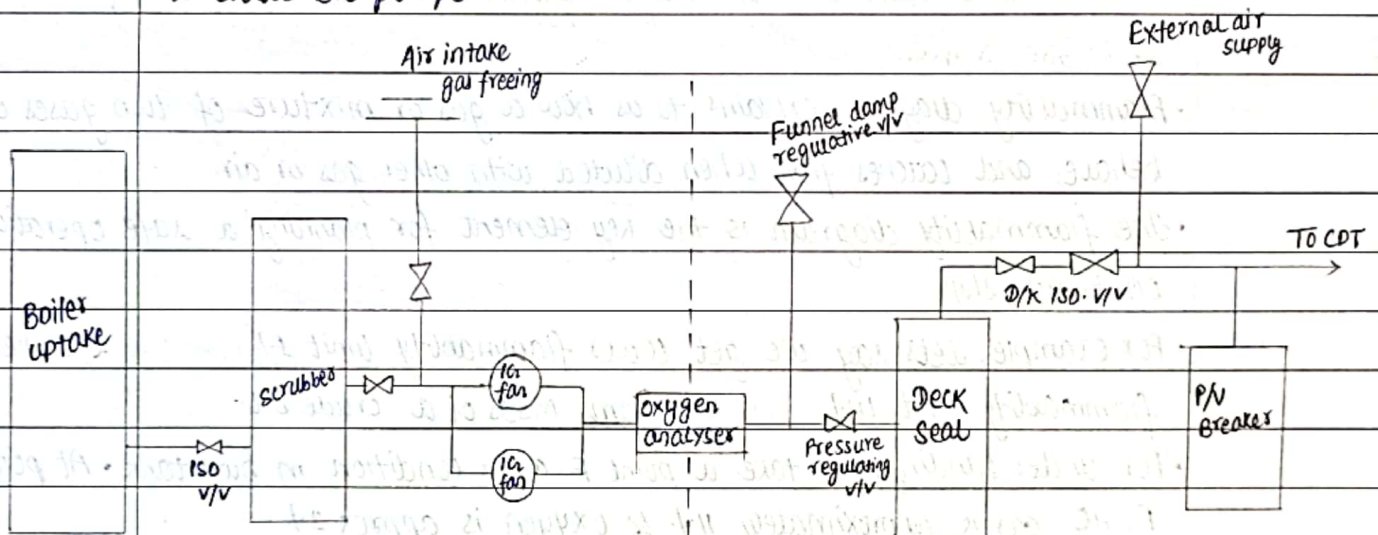
After dilution with IG, we can dilute with air, it will follow the path AH & it will be much safer as it is far away from flammability curve & there will be very less chances of explosion.

- If we lower the HC gas component till point G & then we dilute with air, it will follow the path AG which is very close to the flammability mixture & there will be risk of explosion.

Q. (2) Sketch, label and describe Inert gas system used on crude oil tanker. (11 times)

Ans:- The inert gas system are used to spread the inert gas over the cargo hydrocarbon mixture which increase the lower explosion limit LEL (at which vapour can ignite) & decrease the higher explosion limit HEL (at which vapour explodes).

- Inert gas is produced from exhaust gas of boiler (flue gas).
- The cost of production is almost free as inert gas is mainly used during discharging & boiler is anyway running during discharging to provide power to crude oil pumps.



* Production plant

* distribution plant

Working:

- Inert gas source is taken from exhaust uptake of boiler or main engine as it contains flue gas in it.
- Scrubbing tower: Flue gas enters the scrub tower from the bottom and passes through a series of water spray and baffle plates to cool, clean and moist the gas. The gas become clear of soot.
- Demister: Normally made of polypropylene, it is used to absorb moisture and water from treated flue gas.

• Gas blower: After that, flue gases are supplied to tank with the help of IGI blower.

• IGI pressure regulating valve: It is attached after ^{IGI} blower discharge which re-circulates the excess gas back to the scrubbing tower.

• Deck seal: The deck seal stop the gases to return back to the blower. Normally wet type deck seals are used.

• Mechanical NRV: It is an additional non-return mechanical device which prevents the back flow of HC vapours and liquid from the cargo tank in case of tank overflow.

• Deck isolating vlv: It fully isolates the engine room system with the deck system.

• PV Breaker: The pv breaker helps in controlling the over and under pressurization of cargo tanks. The pv breaker vent is fitted with a flame trap to avoid the fire flame to get in.

• Cargo tank isolating valves: Each tank has a seperate isolating valve which controls the flow of inert gas inside that particular tank.

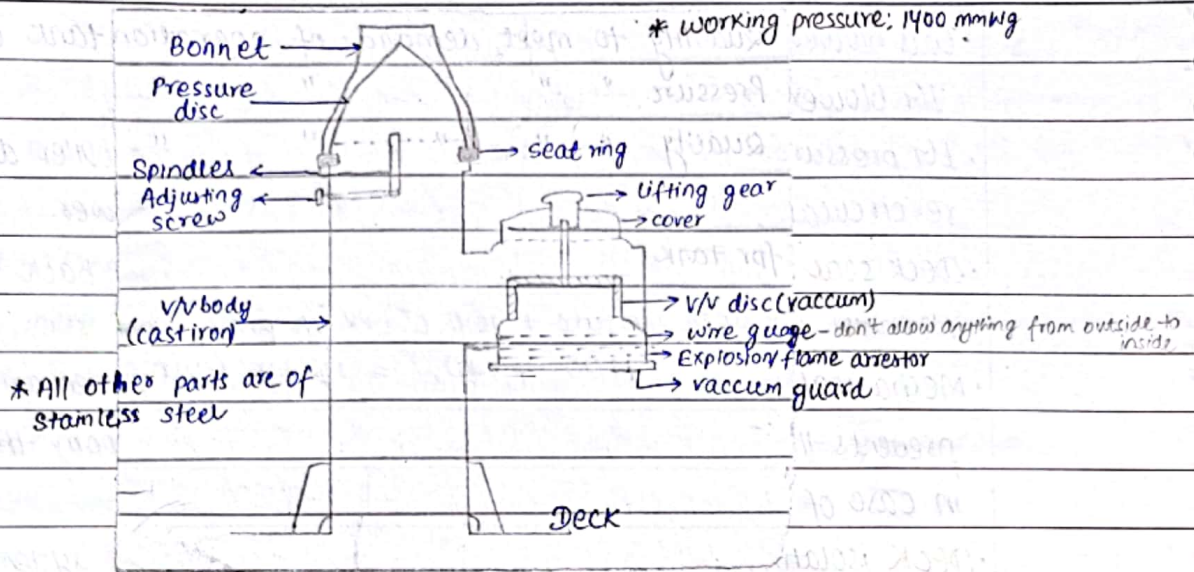
The various alarms in the Inert gas plant are as follows:-

- Low pressure in scrubber line supply.
- High water level in scrubber.
- High temperature of flue gas
- 6 • low water level in deck seal.
- LOW O₂ content (1%)
- High O₂ content (5%)

(3) Describe the construction and working principle with a neat sketch for the following:

(a) PV valves (5 times)

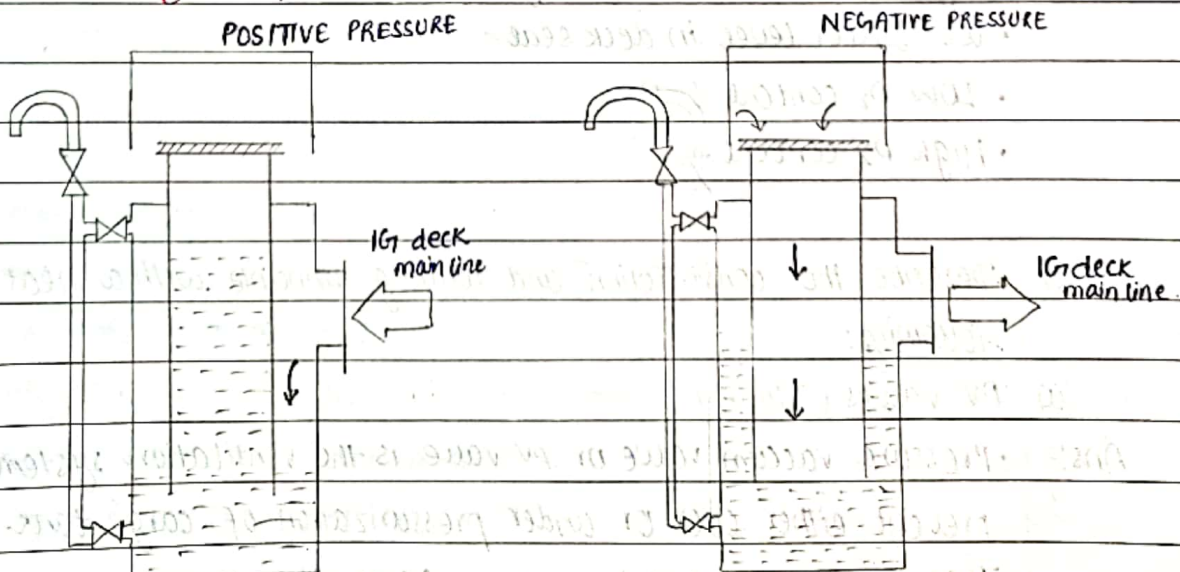
- Ans:-
- 1 • Pressure vacuum valve or PV valve is the ventilation system which will prevent either over or under pressurization of cargo tank.
 - They are set at certain pressure, hence the tank pressure of about 1400 mmHg will lift the main valve and release excess pressure.



- The vapour passes through the gauge flame trap.
- In case of drop in tank pressure in compare with that of outside, atmosphere will open the vacuum disc to equalise the pressure.
- PV valve can relieve moderate change in pressure due to change in temperature and vapour quantity but rapid rise in pressure due to an explosion would not be relieved.
- It is not designed for venting, tank should be vented through mast risers or high velocity vent valve.

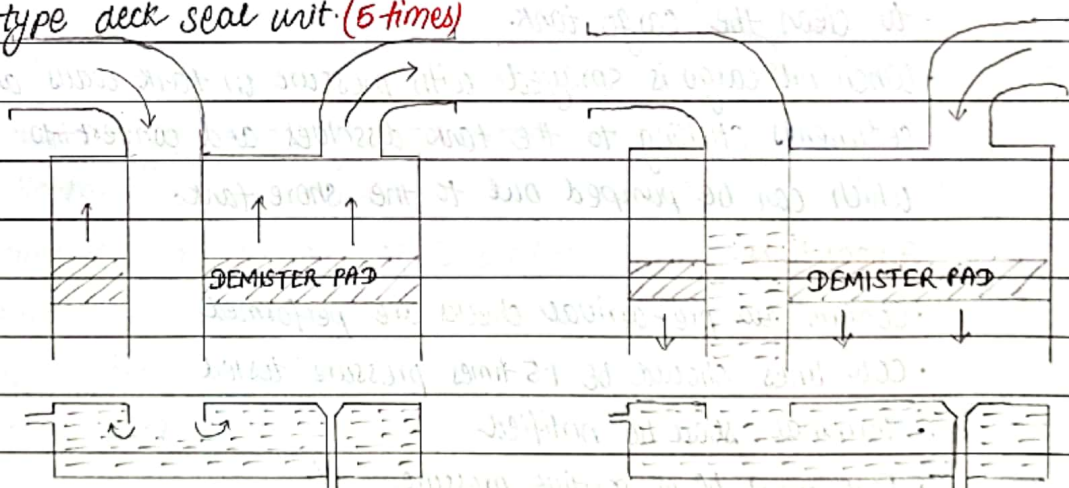
• PV valve operates at a pressure of 1400 mmHg & at a vacuum of -250 mmHg.
Disadvantage:- It may not be free due to rust & may not get operated.

(b) PV Breaker (7-times)



- The PV breaker is fitted to a branch line of inert gas deck main line.
- The purpose of PV breaker is to safeguard against over pressurisation as well as under pressurisation of cargo tanks.
- 3 • The PV breaker is the final backup for any of the pressure vacuum valves.
- It consist of two concentric tubes
- In case of excess **backpressure**, the liquid rises in the **inner** pipe & if the pressure is beyond the capacity of breaker, liquid will **push out** to let the pressure inside to get out
- In case of excess **vacuum**, the liquid rises in the **outer** pipe & if the pressure is beyond the capacity of breaker, the liquid will be **drawn** into the COT & atmospheric air will be inhaled in tank.
- 3 • After installation on-board, PV breaker should be kept filled with sea water.
- Total liquid level in the PV breaker during filling does not exceed the set limit.
- In cold sea water, 20% of the water is replaced by glycol or any other antifreeze additive
- 10 3 • **PV breakers** operated at a pressure of ¹⁸⁰⁰2500 mmHg & at a vacuum of **-700 mmwg**

(c) Wet type deck seal unit. (5 times)



gas flow towards cargo tank

back pressure in cargo tank

- It consist of a chamber semi-filled with water.
- There are two pipes :- one for inlet & other for outlet of inert gas.
- Two small pipe is one for inlet & other for outlet of sealing water.
- There is a demister pad to absorb water from inert gas.

Working:

- This is the simplest type of water seal

- When the inert gas plant is operating, the inert gas is delivered through the water from the submerged inert gas inlet pipe.
- But, when the tank pressure exceeds, the water is pressed up in the inlet line and thus prevent backflow.

Limitation

- The water droplets may be carried over with inert gas, although it does not hamper the quality of inert gas, but could increase corrosion.
- Hence, demister is fitted in gas outlet to reduce any carry over.

Also see dry & semi-dry type

(4) Explain the purpose (4 times), precaution (5 times), advantages & disadvantages (5 times) of crude oil washing on a tanker ship.

Ans:- **Purpose:**

- Previously oil tanks was cleaned by water but this method of cleaning increases marine pollution and require bigger slop tanks to store cleaning water.
- To overcome this problem, where the oil cargo of the tank itself is used to clean the cargo tank.
- When oil cargo is sprayed with pressure on tank walls and surfaces, the sediments sticking to the tank dissolves and convert into useful cargo which can be pumped out to the shore tank.

Precaution:

Preos

- Confirm all pre-arrival checks are performed
- COW lines should be 1.5 times pressure tested.
- Terminal shall be notified
- Tank must be in positive pressure.

6

- The oxygen content inside the tank must be less than 8% by vol.
- Oxygen analyzer, fixed & portable to be checked & calibrated for proper functioning.

Dunnig

- Deck seal water level is to be checked.
- Inert gas pressure to be monitored closely.

5

- A responsible person to be always present on deck.
- All deck lines & valves must be frequently checked for any leakages.
- Tank sounding to be monitored.

ROB - remaining onboard

Advantages of COW

- Reduced sea pollution as less (oil-contaminated water) is discharged to sea.
- Reduced manual cleaning.
- More time for maintenance at sea.
- Reduced sludge accumulation.
- Increased cargo out-turn.
- Less ROB quantity, so higher freight can be earned by loading more cargo at next port.
- Decreased rust caused by water washing.
- No manual de-sludging required.

Disadvantages of COW

- Need for additional equipment for COW.
- The additional maintenance require for COW machine.
- Specialized man power required.
- Increased stay in the discharge port.
- Increased work load.
- Safety & pollution risk during COW operation as line pressure is 10 bar.

(5) Explain the uses of following gas measuring instrument and how do they contribute towards safety of ship & human lives on-board a tanker

(a) Explosimeter (4 times)

Ans:- Explosimeter is a device that is used to determine the content of hydrocarbon inside the cargo tank.

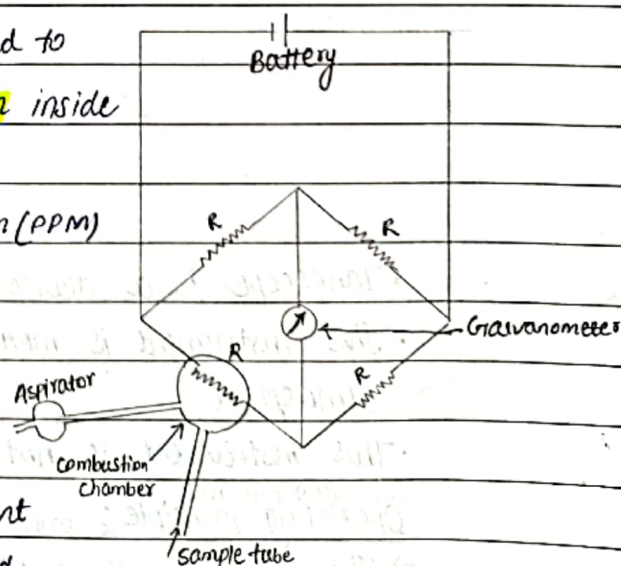
• The scale used are in parts per million (PPM)

• Explosimeter works on the principle of Wheatstone bridge.

• The wheatstone is supplied with a battery and there is no flow of current when the bridge resistance is balanced.

• One of the four resistance in the wheatstone bridge is a hot filament.

• This resistance is enclosed in a combustion chamber wherein a sample is drawn with the help of flexible tube and aspirators.



- The combustion of the sample take place in the chamber in the presence of hot filament.
- This combustion of sample causes increase in temperature which cause change in resistance and imbalance in the wheatstone bridge.
- Due to this imbalance, current flows through the meter and calibrated to indicate the value in percentage of L.E.L.

zero calibration & span adjustment (2 times)

Full calibration requires atleast two steps: a zero calibration & span adjustment

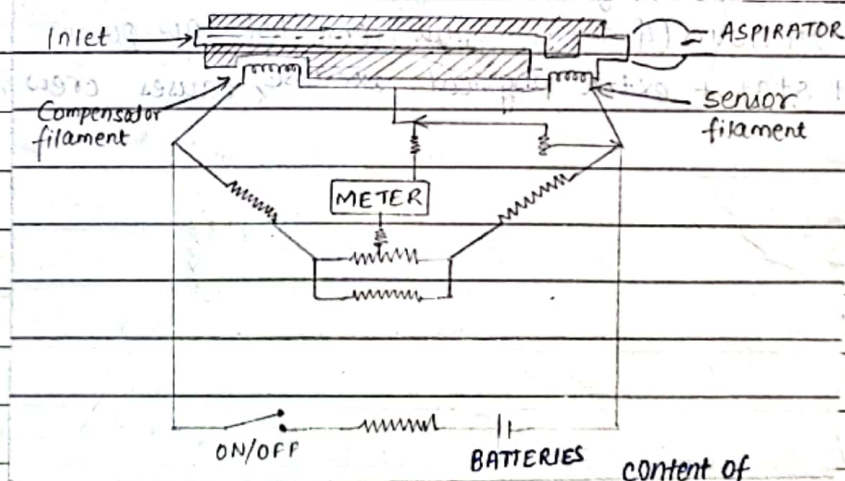
Zero calibration requires removing any trace of the target gas from the sensor, so that it will show zero reading when no gas is present.

Span adjustment requires applying a specific known concentration of the particular gas. If the value indicated will have some error, we can correct it.

Note:- While doing any calibration, we need to check any zero error and then check for span error and correct it if found.

Explosimeter will show incorrect reading when oxygen is less or inert gas is present.

(b) Tank scope (6 times)



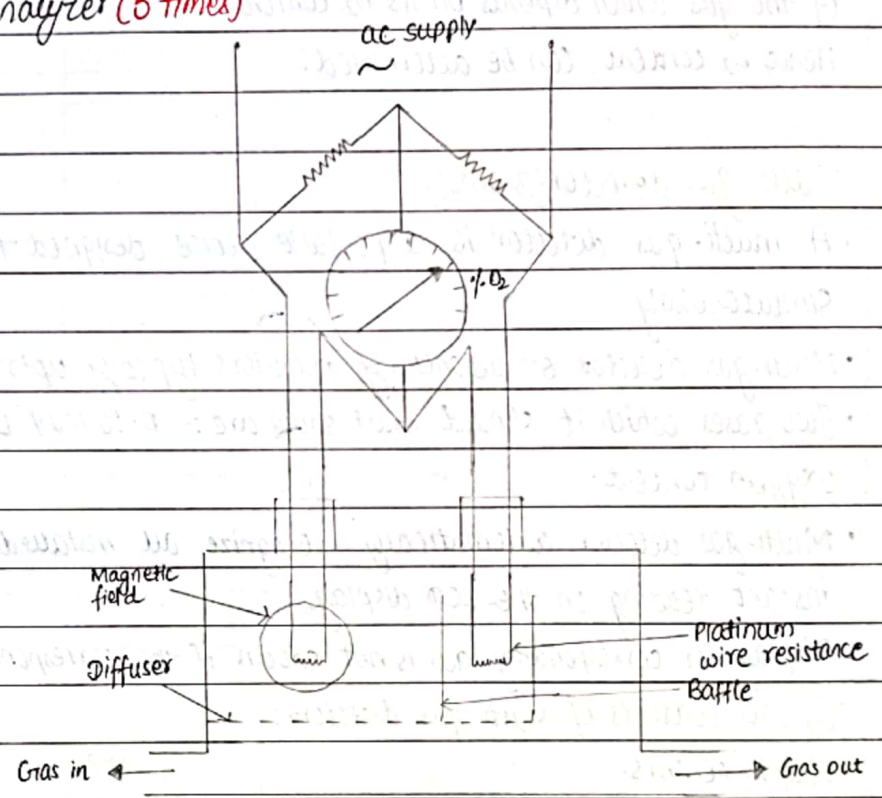
- Tankscope is a device used to measure the **hydrocarbon** gas in a cot.
- This instrument is meant for measuring the hydrocarbon vapour in **inerted** atmosphere
- This instrument is not as sensitive as explosimeter.

Operating principle

- 1) It also works on the principle of wheatstone bridge.
- 2) It consist of two filament:- one is sensor filament & other is compensator filament
- 3) The **sensor filament** is one arm of wheatstone bridge which is usually a non-catalytic hot filament
- 4) The **compensator filament** is another arm of wheatstone bridge which is kept permanently in air.

- 5) The initial zeroing, balances the bridge & establish the correct voltage across the filament, thus ensuring the correct operating temperature.
- 6) The sample is drawn with the help of aspirator.
- 7) The presence of HC gas changes the resistance of the sensor filament & this is shown by a deflection on the bridge meter.
- 8) The meter gives a direct reading of % volume hydrocarbons.

(C) Oxygen analyzer (5 times)



- Oxygen analyzer is a device used to measure the O₂ content of the atmosphere within the tank.
- Samples of the atmosphere are drawn by means of a rubber aspirator bulb and passed over a sensor.
- The sensor is most important part of the oxygen analyzer & can be of various type :- Paramagnetic sensor.
Electrolytic sensor
Chemical absorption liquid
- The main property of oxygen which helps in its detection is Para-magnetism. This means that oxygen get attracted towards magnetic field. So, here we discuss the set up used for measuring oxygen content using this property.

- The magnetic properties of oxygen is used to deflect a light metal body suspended in a magnetic field.
- When a sample air is drawn inside, the suspended body experience a force proportional to the magnetism of gas.
- An equal and opposing force is produced by an electric current passing through a coil, would round the suspended body.
- This equalising current will be directly proportional to the magnetic force of the gas which depends on its O_2 content.
Hence O_2 content can be determined.

(d) Multi-gas detector (3 times)

- A multi-gas detector is a portable device designed to detect multiple gases simultaneously.
- Multi-gas detector simultaneously monitors typically upto four gases.
- Two gases which it should must show are :- 0 to 100% LEL Hydrocarbons & Oxygen content.

- 5
- Multi-gas detector automatically recognize all installed sensor and display instant reading on the LCD display.
 - Display for corresponding gas is not shown if the corresponding sensor is not working.

Typical features of Multi-gas detectors:

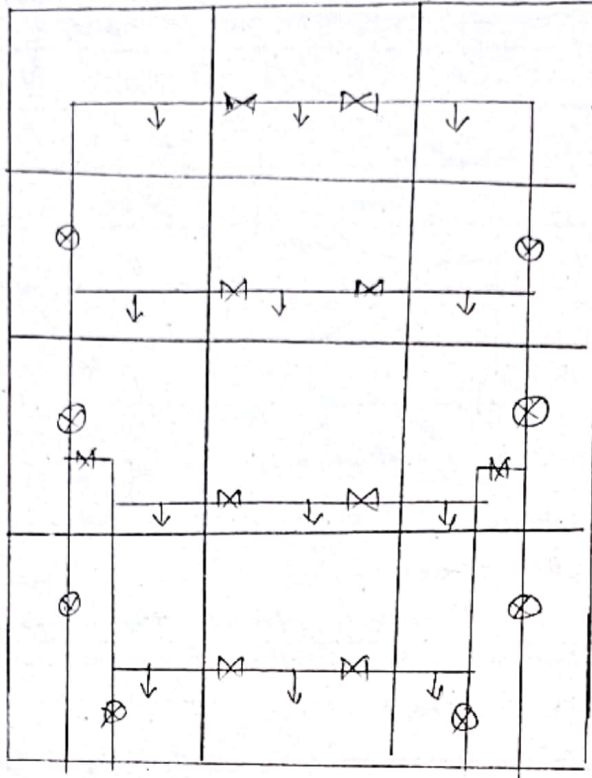
- Plug in sensors.
- Audible & visual alarms.
- Easy one button calibration.
- High reading memory.

(6) (a) with respect to an oil tanker explain Ring main system (2 times)

- Ans:-
- Ring main system is a type of cargo piping system with more pipelines and increased number of valves.
 - It is ideal for product carrier where different grade of cargoes are being carried.

Advantages

- Any pump can be lined up to discharge any tank. Thus different grade of cargo can be loaded.

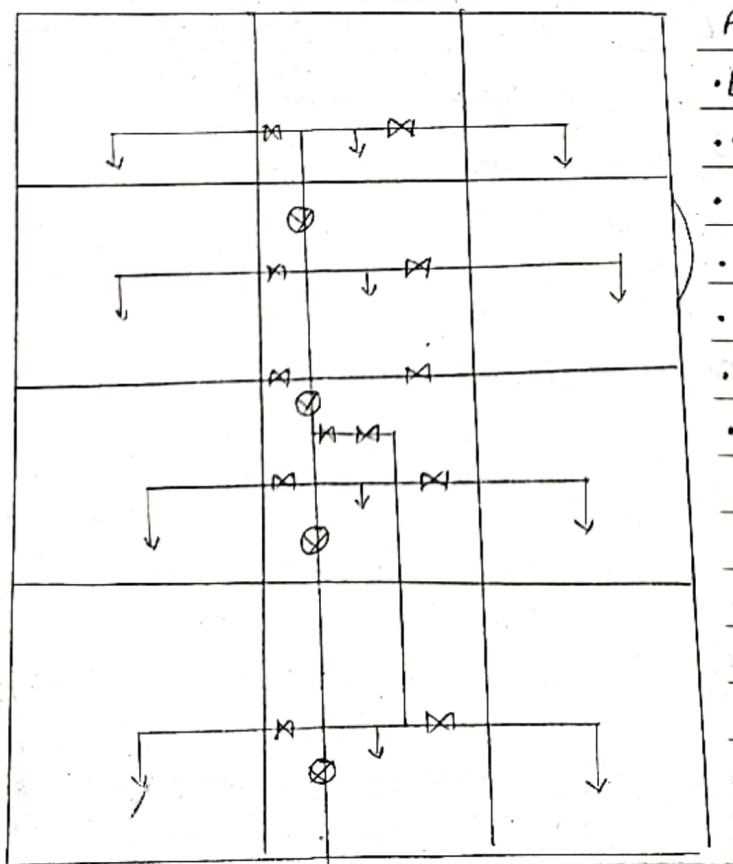


Disadvantage:

- because of complicated pipeness & valves layout, better training is required
- It is expensive to build due to extra length of piping required.
- low pumping rates are achieved.
- Large number of valves.

(b) Direct line system.

- Direct line system is a simplest type of pipeness system which uses fewer valves than other.
- It is ideal for crude oil tanker.



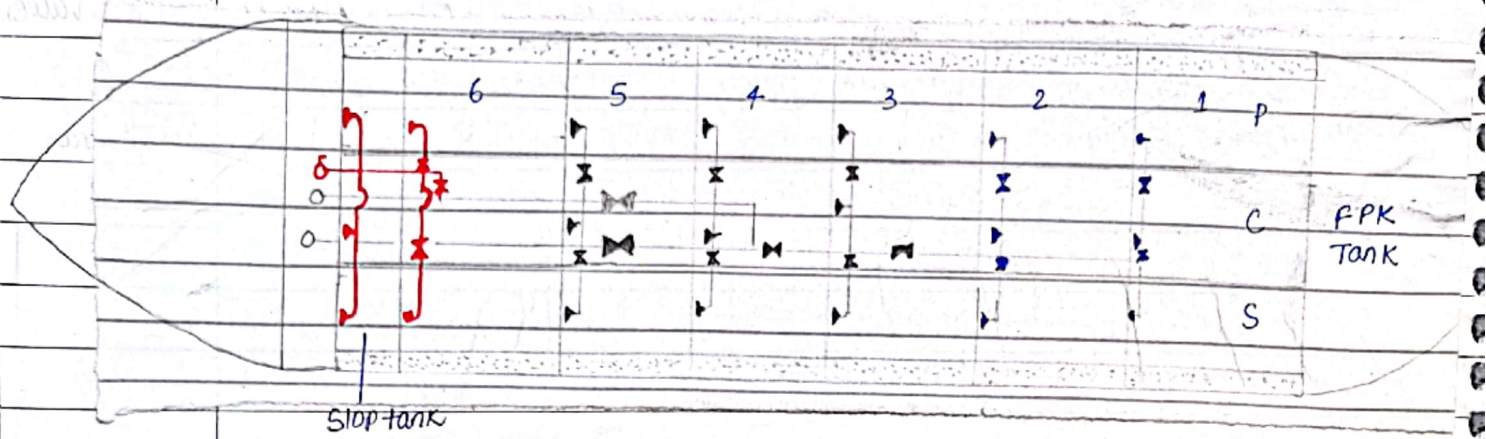
Advantage:

- Easy to operate, so less training is required
- It is cheaper than the others.
- Less loss of pressure due to pipeline friction.
- Quick loading & discharging
- Short pipe line
- Less bend
- Leak is minimized

Disadvantage:

- In case of leaking, control of leakage is difficult.
- The system is inflexible, so it is difficult to plan for a multi-port discharge.

(7) Prepare a simple sketch of pipelines on an oil tanker (2 times)



(8) Explain static charge on a tanker. what precautions can be taken on-board to safeguard against it. (3 times)

Ans:-

- Static charge is produced on movement between dissimilar material through physical contact
- Static electricity present fire and explosion hazard during loading & discharging operation and during other tanker operation such as tank cleaning, dipping, ullaging and sampling.
- These operation can give rise to the static accumulation with sufficient energy to ignite flammable gas/air mixtures.
- There is, of course no risk of ignition unless a flammable gas/air mixture is present.
- There are three basic stage to a static hazard:
 - charge separation
 - charge accumulation.
 - electrostatic discharge.

All three stages are important for electrostatic ignition of flammable atmosphere.

Precautions taken on-board to safeguard against it:-

- The bonding to be done on metallic components of equipment used for dipping, ullaging and sampling.
- Load at a restricted rate for the first 30 minutes to avoid splash filling.
- All metallic object such as spanner should be removed from the cargo area.

- Banning the use of all **metallic** component for dipping, ullaging and sampling during loading and for 30 minutes after completion of loading.
- Banning the use of all **non-metallic** container of **more than 1 litre** capacity during loading and for 30 minutes after completion of loading.
- **Non-metallic** container of **less than 1 litre** capacity may be used for sampling in tanks at **any time**.
- To prevent charging, container should not be rubbed dry prior sampling.

(9) Give the various points (atleast 15 points) of the ship shore safety checklist used on oil tanker. (3times)

Ans:-

1. There is a safe access between the ship and the shore.
2. The ship is securely moored.
3. The agreed ship/shore communication system is operative.
4. Emergency towing off pennants are correctly rigged and positioned.
5. The ship's fire hoses & fire fighting equipment are positioned and ready for immediate use.
6. The terminal fire fighting system is positioned and ready for immediate use.
7. The ship's cargo and bunker hoses, pipelines and manifold are in good condition.
8. The terminal's cargo and bunker hoses or arms are in good condition.
9. The cargo transfer system is completely isolated and drained to allow safe removal of blank flanges prior to connection.
10. Scuppers and save-alls on-board are effectively plugged and drip trays are in position and empty.
11. Temporarily removed scupper plugs will be constantly monitored.
12. Shore spill containment and sumps are correctly managed.
13. The ship's unused cargo and bunker manifold connections are properly secured with blank flanges fully bolted.
14. The terminal unused cargo and bunker connection are properly secured with blank flanges fully bolted.
15. All cargo, ballast, bunker tank lids are closed.
16. The ship's fire plan are located externally.
17. Fixed IG system & oxygen content recorder are working.
18. All cargo tank atmosphere are at positive pressure with oxygen content of 8% or less by volume.

(10) Explain (a) Purging

Ans:- Purging is done for the intention of gas freeing for man entry to reduce hydrocarbon gas & oxygen content, so that when diluted with fresh air, the condition within the tank is out from the flammability curve & critical dilution line.

There are two methods of purging, they are:-

(1) Dis

-placement method:- 1) depends on the fact that the inert gas is slightly lighter than hydrocarbon gas, so that while enters at the top of the tank, the heavier hydrocarbon gas escapes from ^{bottom-through} suitable piping.

2) When using this method, it is important that the inert gas has a very low velocity to enable a stable horizontal interface to be developed between the incoming & escaping gas 3) Displacement generally allow several tanks to be inerted or purged simultaneously.

(2) Dilution method:- 1) takes place when incoming inert gas mixes with the original tank atmosphere to form a homogeneous mixture throughout the tank, so that, as the process continue the concentration of original gas decreases progressively

2) It is important that the inert gas has sufficient entry velocity to penetrate to the bottom of the tank 3) To ensure this, number of tanks must be fixed that can be inerted simultaneously.

(b) Gas freeing.

• After using inert gas to lower the HC content & when condition inside the tank is out from the flammability mixture curve, then the cargo tank is diluted with fresh air.

• We can supply fresh air using lbr system in fresh air mode or,

• Hydraulic, pneumatic or sea water driven blower fans may be used to supply fresh air in cot.

• The material used in construction of these fans must be spark free.

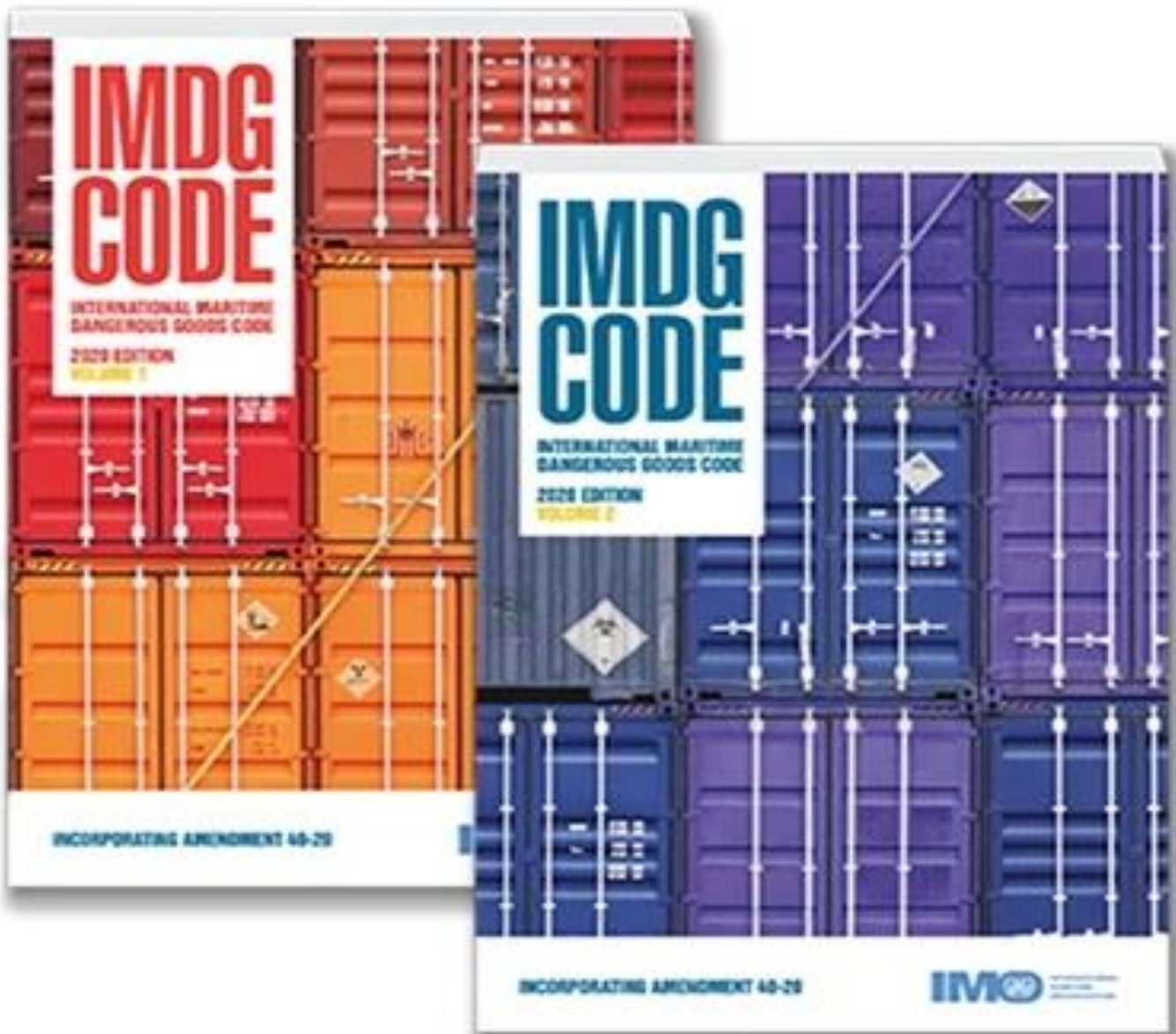
• vented gas must not be allowed to enter the accommodation or other tank.

• It takes about 25-30 replacement of atmosphere to bring down the concentration of CH gas in air from 50% to below LFL.

• Tank lids must not be opened till the ventilation starts.

So, it is the process of introduction of fresh air into the tank in order to bring up oxygen level to 21% and at the same time reducing content of other toxic gases to acceptable minimum level.

IMDG CODE INCLUDING IMDG CONTAINERS, MFAG, EmS



YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

(5) IMDG code INCLUDING IMDa container, MFAA, EMS.

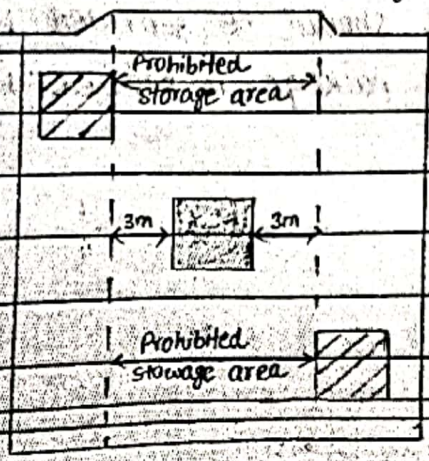
Q.no ① What is the purpose of IMDa code. How are various classes of dangerous goods segregated? (12 times) (OR)
 Describe the use of segregation table as per IMDG. List the various segregation term used in IMDa code.
 W.r.t IMDa, explain the following with sketches (a) Away from (4 times)
 (b) Separated from (c) Separated by a complete compartment or hold

Ans:- Purpose:
 • The IMDa code was developed as an international maritime code for transportation of goods in packaged form, in order to enhance the safe carriage of dangerous goods to prevent pollution to the environment.
 • Since the dangerous goods of different classes are likely to react among themselves & hence they require to stow at certain separation/segregation.
 • Hence, IMDa sets out the certain requirements for each individual substances or materials regarding their packing, stowage etc.
 • The purpose of IMDa code is also to bring worldwide uniformity in the requirements of packing and stowing of dangerous goods.

The method of stowage & segregation as described in the IMDa code are as follows:-

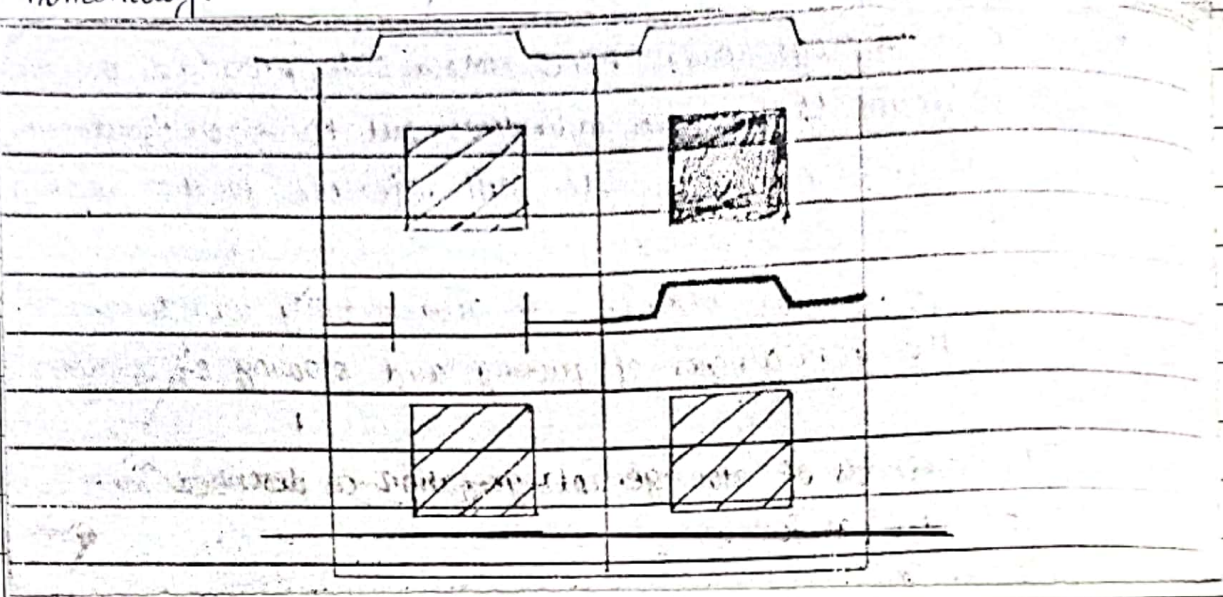
(a) Away from (5 times)

Effective segregation is required (so that incompatible goods cannot interact dangerously in the event of an accident), but may be carried in the same compartment or deck providing a minimum horizontal separation of 3m projected vertically



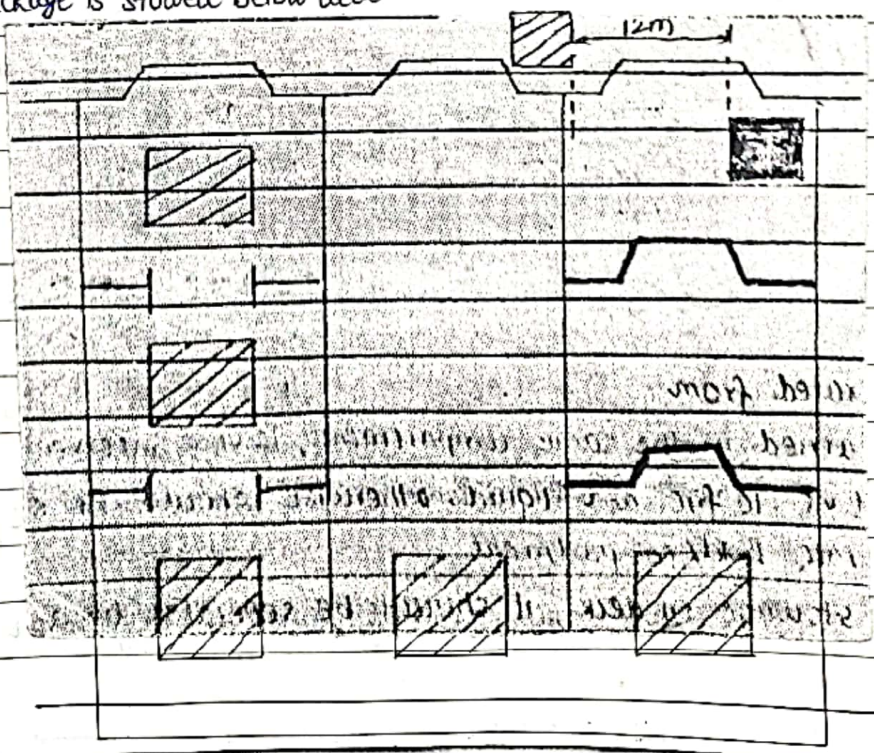
(b) Separated from

- can be carried in the same compartment, if the intervening deck is resistant to fire and liquid, otherwise should be carried in separate hold/compartment.
- for stowage on deck, it should be separated by distance of atleast 6m horizontally.



(c) Separated by a complete compartment or hold from

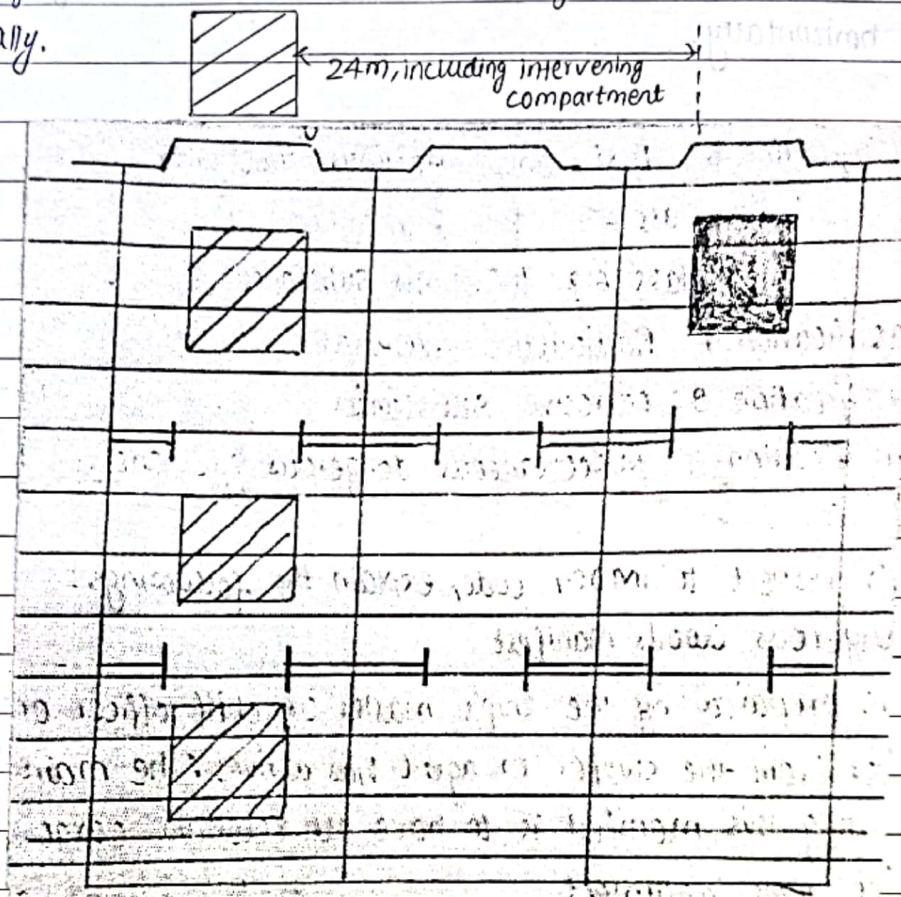
- There must be either vertical or horizontal separation by a complete compartment/hold, and the intervening deck or bulkhead should be resistant to fire and liquid.
- for stowage on deck, it should be separated by a distance of 12m horizontally, even if one package is stowed below deck.



add one

(d) separated longitudinally by an intervening complete compartment or hold from:

- A vertical separation does not meet this requirement
- It should be separated horizontally by a minimum distance of 24m, including a complete compartment, even if one package is stored under decks.
- For stowage on deck, it should be separated by a minimum distance of 24m horizontally.



Q.No@: State the various classes of dangerous goods as per IMDG code (9 times)

Ans:- The IMDG code is classified into nine categories and further into their sub categories to plan the carriage requirement for different types of dangerous cargo.

- Classification 1: Explosives:- This classification have 6 sub-divisions as per the amount of risk they pose.
- Classification 2: Gases:- This classification have 3 sub-categories.
Class 2.1 : flammable gases
Class 2.2 : non-flammable & non-toxic gases
Class 2.3 : toxic gases.
- Classification 3: Flammable liquids:- This classification has no sub-division.

- Classification 4: Flammable solids - This classification has 3 sub-categories
 - Class 4.1: Flammable solid, self reactive substances
 - Class 4.2: Substances liable to spontaneous combustion.
 - Class 4.3: Substances which emits flammable gases when in contact with water.
- Classification 5: Oxidising substance and organic peroxides.
 - Class 5.1: Oxidising substance
 - Class 5.2: organic peroxide.
- Classification 6: Toxic and infectious substance.
 - Class 6.1: Toxic substance
 - Class 6.2: Infectious substance.
- Classification 7: Radioactive material
- Classification 8: Corrosive substances
- Classification 9: Miscellaneous dangerous goods.

Not so imp

Q. ⑧

What is IMDG code? List the information available from the IMDG code.

Ans:-

- The International maritime dangerous goods code (IMDG code) is an internationally agreed regulation developed by the IMO and sets provision for the safe transport of dangerous goods by sea.
- The goal of the IMDG code is to enhance the safe transport of dangerous goods by sea and protect the marine environment.
- The code is composed by 7 parts.
- The code is presented in two books, volume 1 and volume 2.
 - Volume-1**
 - Part 1: General provision, definitions and trainings
 - Part 2: Classification
 - Part 4: Packing and tank provision.
 - Part 5: Consignment procedure
 - Part 6: Construction and testing of packing intermediate bulk container, large packing portable tank, and road tank vehicle
 - Part 7: Provision concerning transport operation.
 - Volume-2**
 - Part 3: Dangerous good lists and limited quantity exception.

Q.4 With respect to IMDG code. Explain the following

(a) MFAG - Medical First Aid Guide (15 times)

- Ans:-
- MFAG is provided as a supplement in the IMDG code which contains information on medical first aid to be provided in the incidents caused by dangerous goods listed in IMDG code.
 - The advice given in the MFAG is for the substance, materials and goods covered in the IMDG code.
 - It is intended to provide the advice within the limits of facilities available at sea.
 - For the convenience of user, this guide is divided into three step approach procedure:
 - Step 1: Emergency action and diagnosis.
 - Step 2: This table give brief instruction for special circumstances.
 - Step 3: Appendices. It provide a list of medicine/drugs.
 - After looking up the MFAG table No, see the table in the MFAG. It will give the signs, symptoms, treatment and other advice as per the effect of good under that table.
 - It suggest treatments in case of skin contact, eye contact, inhalation and ingestion. The procedure for the treatment are also mentioned.

(b) EMS (15 times)

- EMS means Emergency Response Procedure for ships carrying dangerous goods (Ems guide)
- EMS guide is provided as a supplement to IMDG code which provide guidance on dealing with fire and spillages on-board ship caused by dangerous good listed in IMDG code.
- EMS codes are assigned to each UN number in column 15 of dangerous cargo list in IMDG code.
- EMS code is a two part codes, first is for fire starting with letter 'F' and second is for spillage starting with letter 'S'.
- Fire schedule codes are from F-A to F-J

- Spillage schedule codes are from S-A to S-Z
- Ems tables are published in supplement to IMDG code.
- This guide is intended to assist shipowner, ship operators or other parties concerned in developing emergency response procedure for ship & also to integrate it with ship contingency plan.
- In any case of fire or spillage on-board in which dangerous goods are involved, the emergency response procedure should be as per the Ems guide.

(c) UN NO. (8 times)

- Ans:-
- The united nations committee of experts on transportation of dangerous goods has compiled a report which deals with its classification, labeling & transportation document required.
 - It has assigned a number for every material and this no. is called **UN number**.
 - UN number helps overcome language barriers when identifying dangerous goods.
 - In IMDG code, there is a numeric index with list of goods according to their UN number.

(d) Stowage (5 times)

segregation is in column 16 E

- Stowage means proper placement of dangerous goods on-board a ship to ensure safety and environment protection during transport.
- Stowage requirements are different for different type of ship & cargo they carry.
- Stowage requirement is assigned through "stowage" categories in (column 16A of Dangerous good list) in **chapter 3.2** of IMDG code.
- For explosives stowage categories are 01 to 05
- For dangerous goods other than explosives, stowage categories are A to E.

(e) Dangerous Goods Manifest (4 times)

- It is prepared by the ship's master or chief officer once the shipping paper from the shipper or agent has arrived.
- The main purpose of creating this manifest is to have all relevant cargo-related information in a single document.

- A prepared dangerous good manifest include:
 - information as found on shipping paper
 - Pinpoint location of dangerous goods to ensure quick emergency response.
 - Emergency action plan for the same.
 - Segregation plan for dangerous good loaded on ship.
- It is kept on the vessel's bridge, having a copy in cargo control room for easy access.
- The contents of Dangerous Cargo manifest include:
 - Name, call sign & IMO number of the vessel.
 - Flag Name
 - Technical name of the dangerous goods
 - Complete description and classification of dangerous goods.
 - Total number of such packages being carried.
 - Location of such cargo as per cargo stowage plan of the ship.
 - Responsive action in case of emergency
 - An emergency response contact number
 - Gross weight for each type of packaging.
 - Port of loading & discharging.

(f) Subsidiary risk

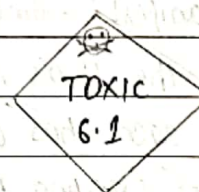
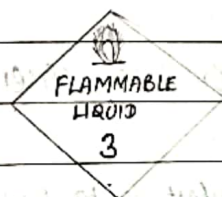
- It is an additional risk or secondary dangerous property of the dangerous goods apart from its primary dangerous property.
- It should be labelled additionally as a secondary label showing the hazards.
- Class number should not be present on subsidiary risk label.

Example:- Like, Ethanol has only one risk i.e. flammability.

But, Methanol has two risks, Main risk = flammability

& **Subsidiary risk** = toxicity.

- The cargo having subsidiary risk will show two label.



- This column also identify the dangerous good as a marine pollutant or severe marine pollutant.
 - P = marine pollutant
 - PP = severe marine pollutant.

Q.5) With respect to carriage of dangerous cargo, explain (6 times)

(a) Segregation Table. (3 times)

- Ans:-
- The general provisions for segregation between various classes of dangerous goods are shown in the **segregation table**
 - The number and symbols in the table have the following meanings:
 - 1 - Away from
 - 2 - Separated from
 - 3 - Separated by complete compartment or hold from
 - 4 - Separated longitudinally by an intervening complete compartment or hold from.
 - X - refer column 16 of Dangerous good list.
 - * - see 7.2.7.1.4
- You must be trained to use this table.

(b) Packing

Ans:-

1. Dangerous goods to be packed in good quality packings (free from corrosion, rust, contamination or other damages)
2. Strong enough to withstand shocks / stresses experienced while loading & normal transport taking into account all modes by which they may be transported.
3. Packagings should be such that the contents of package do not get altered due to vibrations, changes in temp, pressure or humidity
4. Provisions apply to new, reused, reconditioned, remanufactured, packings.
5. No dangerous material should adhere to out side of the packings.
6. Packings should be of approved design
7. Where necessary they should be provided with inner coating. The inside must not get deteriorated due to contact with dangerous goods (nor should it initiate a reaction with the dangerous goods)
8. When packagings are filled with liquid, ullage space must be left to allow for expansion of the liquid.
9. Cushioning material / Absorbent material used should be adequate for the required purpose
10. Pkgs containing DG which emit gases should be hermetically sealed (vent may be fitted if reqd)
11. Inner pkgs (which have carried DG in past should be treated as if it still contains that DG unless cleaned)
12. Leakproofness test for pkgs intended for liquids

* Packing group

- It is column 5 of dangerous good list
- This column contains the packing group number I, II and III where assigned to the substance

Packing group I : Substances presenting high danger

Packing group II : Substances presenting medium danger

Packing group III : Substances presenting low danger.

(c) **Marking (6 times)**

Ans:-

The marking and labelling of the dangerous goods is carried out in accordance with their properties.

The details are enumerated below:-

1. Proper shipping name and corresponding UN no shall be displayed prominently on each package.
2. All package markings shall be
 - i) readily visible and legible.
 - ii) Information identifiable on packages to survive at least three months immersion in sea. In deciding the suitability of marking methods the durability of the packaging material and the surface of the package should be taken into consideration.
 - iii) Markings are to be displayed on a background of contrasting colour on the external surface of the package.
 - iv) Markings are not to be located with other package marking that could substantially reduce their effectiveness
3. Salvage markings should be additionally marked with the word 'Salvage'.
4. IBC > 450L and large packaging shall be marked on two opposite sides.
5. Special consideration is to be given to packaging containing radioactive materials. These shall be marked legibly and durably on the outside of the packaging with an identification of consignor & consignee or both.
6. Packagings containing marine pollutant should be durably marked with the environmental hazard displaying prominently adjacent to the dg goods label or where reqd or considered appropriate
7. Packages containing exempted quantities of DG should display the same
8. Packages containing limited quantities of DG goods should display the same

(d) **Labelling (6 times)**

Ans:-

- IMDG code states that all packages and drums carrying dangerous goods must be labelled.
- Each label are to be divided into two parts, the bottom half and the top half.
- The top half is for the symbol of the class of dangerous goods.
- The bottom half is for the text, class or division number.
- The minimum dimension of label should be 10 cm x 10 cm.
- Labels are to be placed on package in such a way that it can easily be seen.
- The quality of label should be such that it do not deteriorate & remain unaltered during the complete transport period and atleast three month in the sea.
- If that dangerous goods poses any subsidiary risk, it is also necessary to use secondary risk label.
- Primary & subsidiary risk label are to be located next to each other
- Labels shall be fixed on a contrasting colour.
- On a irregular shape or small size package, label may be attached by a tag or by any other suitable means.

(c) **Placarding**

Ans:-

1. Enlarged labels (placards) and marks to be affixed on the exterior surface of CTU and be clearly visible
 2. Survive three months of immersion in sea
 3. Remove all placards, labels, marks and signs from the CTU once the task is completed
 4. Placards must give clear indication of primary and secondary risks
 5. Placards shall be affixed one on each side and one on each end
 6. Size of placard shall be at least 250mm x 250mm with a line of same colour as the symbol
- Containers carrying dangerous goods must display at least one placard on each side and one on each end of the unit (this is to say, on its four sides).
- Rail wagons must be placarded on at least both sides.
 - Freight containers, semi-trailers and portable tanks must be placarded on all four sides.
 - Road vehicles must display appropriate placards on both sides as well as the rear.

Q. ⑥ What precautions have to be observed while loading/discharging explosives (8-times)

- Ans:-
- Explosives must be stowed on a magazine which is of wood or in a wooden compartment.
 - No smoking sign & other relevant symbols should be in place.
 - No electric cables should be passed through the deck area.
 - Bunkering to be stopped.
 - Radar to be switched off.
 - Wireless transmission should be stopped.
 - Explosives are unstable when wet and should be stowed in a cool, dry place.
 - Must be stowed away from hot bulkhead or deck.
 - Must be stowed away from living quarters.
 - Ventilation system should be working efficiently.
 - Ventilation fan near the space must be flameproof or disconnected.
 - Electrical fittings should be disconnected in compartment near explosives.
 - No hot work should be carried out.
 - Mast must be fitted with an efficient lightning conductor as lightning causes a grave danger.
 - Comply with local port regulation.

Q. ⑦@ List the precautions to be observed during loading of IMDG cargo. (2-times)

- Ans:-
- All the documents related to "dangerous goods" should be in order including container packing certificate, dangerous good manifest etc.
 - All cargo operation should be supervised by responsible officer.
 - No unauthorized person should be allowed near to hazardous cargoes.
 - The compartment or deck area should be dry and clear & suitable for ^{the} stowage of cargo.
 - Where cargo handling equipment is to be used, it should be inspected prior use.
 - Dangerous goods should not be handled under adverse weather condition.
 - All packaging, labeling and segregation of the goods are carried out as per the IMDG code.
 - Suitable "emergency equipment" should be kept ready for use in case of any emergency.

- Safe access to the packages must be available in order to protect or move away from immediate hazards
- Must be stowed away from hot bulkheads or deck
- Cargoes which required special ventilation should be stowed near to ventilation system
- The Port authority should be informed of all movements of dangerous goods.
- Suitable security should be given to special cargoes like explosives.
- Correct signal i.e. a flag should be displayed during the period of loading & discharging.
- Some package may require daylight movement, some get affected by rain & hence appropriate loading schedule to be planned.

(b) List the precautions to be observed when carrying dangerous goods.

- Ans:-
- All the documents related to "dangerous goods" should be in order including container packing certificate, dangerous good manifest etc.
 - Dangerous cargo with prohibited UN number shall not be accepted for loading unless under special circumstances permission is obtained from the company.
 - The condition of dangerous cargo container must be checked prior loading, and damaged or leaking container shall be rejected.
 - Before loading the dangerous cargo, the shippers declaration should be given to MASTER which contain:
 - Technical name of the dangerous goods
 - UN number
 - Class according to the IMDG code
 - Container number & weight.
 - All Dangerous good container must be checked for proper packaging, labeling & placarding as per the IMDG code
 - From referring to IMDG code with help of technical name, also identify the EMS and MFAG numbers.
 - Find out the action to be taken in ^{case of} various emergencies.
 - It must be ensured that all DA containers are loaded in the planned stow position.
 - Carry out drills & instruct the crew members regarding action to be taken in an emergency & use of emergency equipment.
 - Check Lashing frequently especially if bad weather is expected.

Q.⑧ Describe shipper's responsibilities for shipping dangerous goods as per IMDG code.

- Ans:- The shipper must:
- Classify and declare dangerous goods in compliance with the IMDG code.
 - Package the goods in compliance with the IMDG code.
 - Label the packages with the proper shipping name, UN number, hazard label, and marine pollutant level (when appropriate).
 - Ensure that incompatible goods should not to be stowed in the same transport unit.
 - Issue a stowage certificate when dangerous goods are stowed in a container.
 - Packaging should be sturdy and is in good condition.
 - Packaging should be such that the contents should not be affected if may come into contact with something else.
 - Packaging should be able to withstand the normal risks that are involved in handling and in transportation by sea.
 - Write some content from Q.No. 5 (P-233)

Q.⑨ Differentiate between following

(a) Stowage and segregation.

Ans:- Stowage: see P-231, Q.No.4(d)

Segregation

- Segregation is the process of separating two or more substances which are mutually incompatible & stowage together may result in accident in case of leakage or spill.
- Segregation is obtained by maintaining certain distances between incompatible dangerous goods or by separating from one or more steel bulkheads or deck.
- Segregation requirement can be obtained from segregation table.
- There are four terms of segregation.
 - AWAY from
 - Separated from
 - separated by a complete compartment or hold from
 - separated longitudinally by an intervening complete compartment or hold from.

(b) Index & dangerous cargo list.

- In **index**, substances, materials and articles have been listed in the alphabetical order of their names.
- We can also get UN number & the class of the dangerous goods from the index.
- Certain marine pollutant are identified only in the index.
- In **dangerous cargo list**, the details regarding the transport provision are provided in Chapter 3.2 against the UN number.
- The dangerous cargo list is divided into 18 columns.
- Column 1 is UN no.
- Column 2 is Proper shipping name (PSN)
- Column 3 is Class or division
- Column 4 is Subsidiary hazard
- Column 5 is packing group & followed by
- Column 15 is Ems
- Column 16a is Stowage and Handling
- Column 16b is Segregation
- Column 17 is Properties & observation
- Column 18 is UN no.

(c) UN number & class

Ans:- UN number: See Page 231, Q. NO 4(c)

Class : See Page 228, 229, Q no 2

Q. 10) A container loaded on deck containing SEP 17 + MARCH 22 collapsed. What actions are required to be taken on-board with respect to safety, health and pollution preventions.

Ans:- * Action required to be taken w.r.t safety :- As in Q. 7(a) & 7(b), P- 235, 236

* Action required to be taken w.r.t health :- write about MFAA, P- 230

* Action required to be taken w.r.t pollution prevention :- write about Ems, P- 230, 231

BULK CARGOES: GRAIN/ HIGH DENSITY/COAL CARGOES



YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

6. BULK CARGOES (GRAIN/HIGH DENSITY/ COAL CARGOES)

Q.1) Write short notes on DOA (Document of Authorization) as per Grain code and the conditions which must be fulfilled to load bulk grain without DOA? (8-times)

- Ans:-
- As per SOLAS regulation VI/9.1 (Requirements for cargo ship carrying grain), a cargo ship carrying grain must hold a Document of Authorization as required by the International Grain code.
 - The Document of Authorization certifies that a ship is capable of loading grain in accordance with the requirements of the International Grain code.
 - The DOA shall be issued either by the administration or an organisation recognised by the IGC code or by the contracting government on behalf of the administration.
 - It shall be accepted as a evidence that the ship is capable of complying the requirements of these regulation.
 - The ship without a Document of Authorisation (DOA) must not load grain until the master satisfies the flag state administration or organisation, that the ship comply with the requirements of the International grain code.

The ship not having a DOA & still want to load grain cargo may be permitted to load bulk grain but then it needs to fulfill certain criteria's which is as follows:-

- The total weight of the bulk grain shall not exceed $\frac{1}{3}$ rd of the deadweight of ship.
- All filled compartment shall be fitted with centreline division extending for the full length of such compartment.
- All hatch covers of filled compartment shall be closed and secured in place.
- All grain surface in partly filled compartment shall be trimmed and secured in accordance with grain code.
- The metacentric height (GM) after the free surface effect (FSE) correction shall be 0.3m or more throughout the voyage.
- The master should satisfy the flag state administration or the contracting government of the port of loading that the ship in its proposed loading condition will comply with the requirement of IGC.

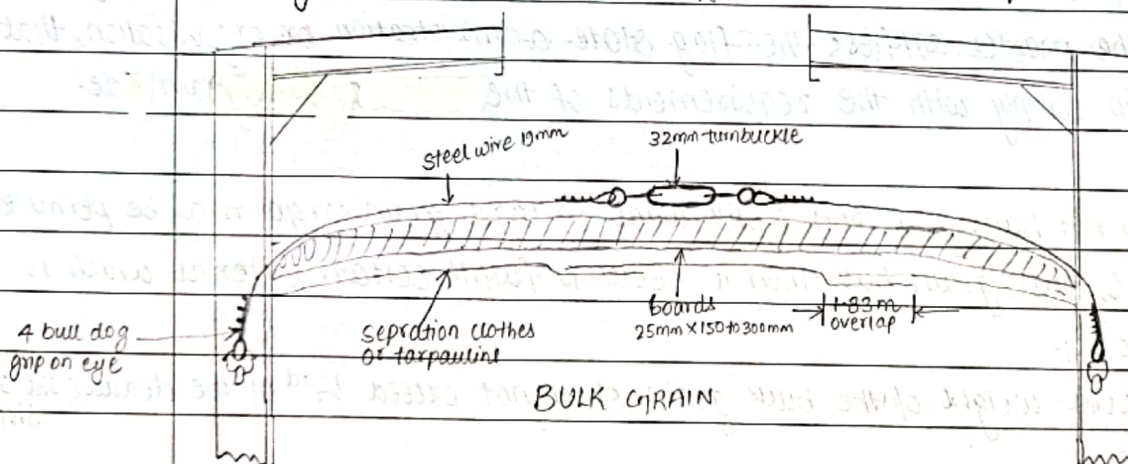
Write short notes on

a) Strapping and lashing (4-times) (OR) Explain securing arrangement for a partly filled compartment when carrying grain in bulk with diagram (2-times)

Ans: * In order to eliminate heeling moment in **partly filled compartment**, strapping or lashing is used.

Securing shall be as follows:

- Surface of grain should be levelled but slightly crowned
- Surface of grain should be covered with "separation cloth" or tarpaulins, whose joints overlaps atleast 1.83m.
- Two solid floors of 25mm x 150mm to 300mm lumber to be laid athwartship - first tier and fore & aft - 2nd tier.
- Lashed with steel wire rope or chain, which is set tightly by means of a turnbuckle
- Lashing should be positively attached to the framing.
- Lashing should not be placed ^{not} more than 2.4m apart.



b) Saucering (2-times)

* In order to reduce heeling moment in a **filled, trimmed compartment**, a saucer is used in the way of hatch opening.

* The depth of the saucer ~~are~~, measured from the bottom of the saucer to the deck line, shall be as follows:

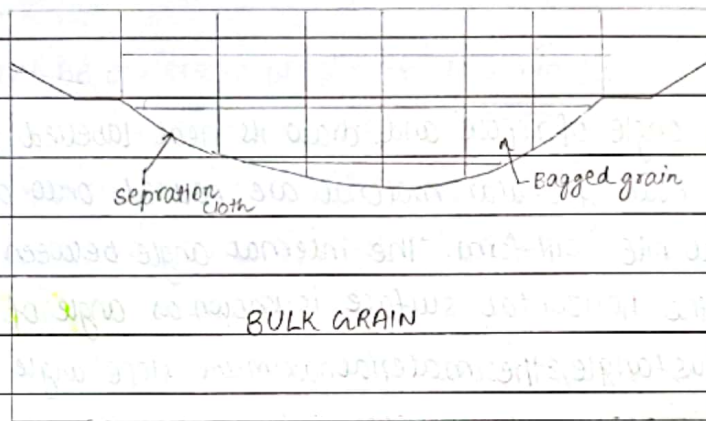
→ ship with moulded breadth of upto 9.1m, saucer will not less than 1.2m.

→ ship with moulded breadth of 18.3m or more, saucer will not less than 1.8m

→ ship with moulded breadth between 9.1m and 18.3m, the saucer shall be calculated by interpolation.

Securing shall be as follows:

- The top (mouth) of the saucer is formed by the underdeck structure in the way of the hatchway i.e. hatch side girders or coamings.
- The saucer and hatchway above is completely filled with bagged grain or other suitable cargo.
- The bagged grain or other suitable cargo are laid down on the separation cloth and stowed tightly against adjacent structures and the hatch beams.



C) Bundling (5 times)

saucer
will be
there in
bundling but
filling will change

- * Alternative to filling the saucer with bagged grain or other suitable cargo in **filled, trimmed compartment**, a bundle of bulk grain may be used.
- * The depth of the saucer, measured from the bottom of the saucer to the deck line, shall be as follows:
same as in saucer.

Securing shall be as follows:-

separating

- The top (mouth) of the saucer is made with separation cloth or tarpaulins & with suitable means of securing.

lashing

- Athwartship lashing to be placed not more than 2.4m apart, inside the saucer formed in the bulk grain.

dunnage

- Dunnage of not less than 24mm x 150 to 300 mm to be placed fore and aft over these lashing to prevent the cutting or chaffing of the separation cloth.

filling

- The saucer is then filled with bulk grain & made level with bottom of the beams

dunnage

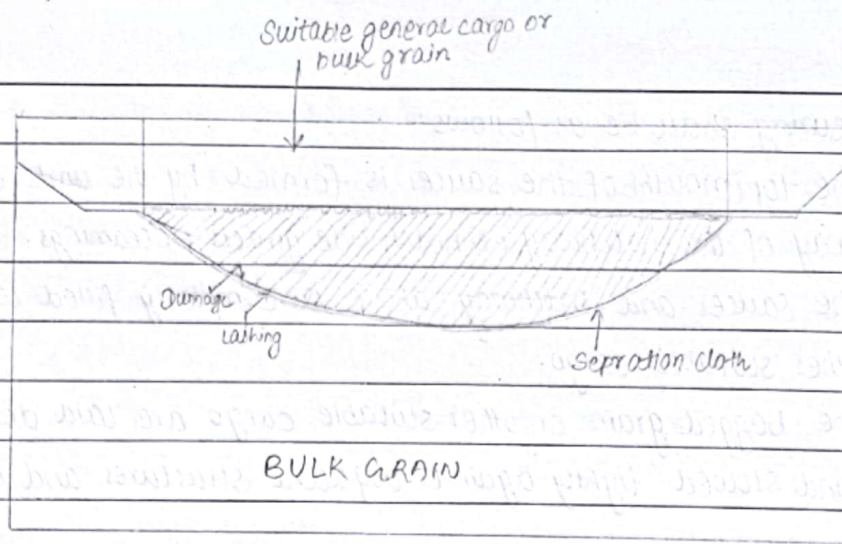
- Again dunnage to be laid on top, before saucer is secured by lashing.

lashing

- Then, saucer is secured at the top.

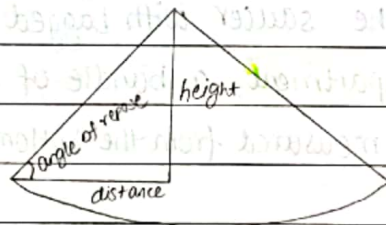
filled

- Suitable general cargo or bulk grain may be placed between the beams on the top of the saucer.



Q.3) a) Define angle of repose and draw its neat labelled sketch. (4 times)

- Ans:-
- When bulk granular material are poured onto a horizontal surface, a conical pile will form. The internal angle between the surface of the pile and the horizontal surface is known as **angle of repose**.
 - Angle of repose means the maximum slope angle of granular material.
 - At this angle, the material on the slope face is on the verge (फ़ौर) of sliding.
 - The angle of repose can range from 0° to 90° .



• The equation for calculating the angle of repose is:

$$\tan^{-1}(h/d)$$

where, h = height

d = distance.

- The bulk cargoes having an angle of repose less than 30° like grain should be carried in accordance with the requirement as they pose high risk of shifting causing vessel to get unstable.

b) What is the importance of angle of repose? (1 times)

- Ans:-
- Because low angle of repose indicate that bulk cargo is prone to shifting at sea.
 - The IMO "code of safe practices for bulk cargoes" recommends level trimming and complete filling of hold for cargoes with a smaller angle of repose.

Q.4) Describe the preparation of hold for loading bulk grain (8 times)

- Ans:-
- Cargo holds must be thoroughly clean, swept, washed down by fresh water and free from insects.
 - Hold should be completely dry and there should be no trace of previous cargo in frames, beams, girder and other structure.
 - There should not be any loose rust or paint scale anywhere in the cargo hold including bulkheads, upper and lower hopper space, underneath of hatch cover and tank top.
 - There should not be any traces of live or dead insects and weevils.
 - Any sign of insect infestation must be dealt by spraying appropriate insecticides.
 - Bilges must be thoroughly clean, free from previous cargo, dry and odour free.
 - Bilge well suction should be operation at all times.
 - Bilge covers should be cleaned of any cargo residue and enough drain holes.
 - Bilge cover should be grain tight not water tight.
 - Bilge cover should be wrapped with a burlap cover.
 - The hold drainage system should be clear and free from blockage.
 - The hatch covers should be check for their watertight integrity.
 - Australian ladders & its platforms and stanchions, ballast/air pipes holding brackets etc should be inspected for damage and security.
 - Hold ventilation system should be operated to check fan condition.
 - The fire/smoke detection system should be tested and seen to function correctly.
 - Check the water integrity of all inspection manholes, bootie hatches, entrance ladders & not vents.

Q.5.a) what are the **hazards** associated with the carriage of **solid bulk cargoes**? (3times)

Ans:- Mainly hazards of carrying solid bulk cargo depends on specific type of cargo but here are few major and common hazards of carrying solid bulk cargoes on-board ship:-

@ Cargo shift:- It is the most common hazards in bulk carrier & even cause vessel to capsize. This problem is greater in ships carrying grain cargoes. Grain settles by 2% of its volume. Because of this, grain cargoes are loaded in accordance with International grain code & special precautions are required to followed.

⑥ **Cargo falling from height:** This hazard is mainly associated with high density cargo like iron ore, steel scraps etc. During loading, if dropped from the grab or conveyor belt from more height, it may damage the tank top. The personnel involved in the cargo operation should wear protective clothing at all time.

⑦ **Cargo dust:** It is the most common hazards in bulk carriers. Many bulk cargoes are dusty by nature. It can have disastrous effects on health if inhaled. It cause sneezing and irritation to the eyes. The personnel involved in cargo operation or anyone sweeping cargo with brush should wear a suitable respirator or a protective face mask.

⑧ **Cargo liquefaction:** If the moisture content of cargo exceeds the Transportable moisture limit, cargo liquefaction can occur. Liquefaction develop a flow state within the cargo, which cause cargo to slide or shift in one direction thus creating a free surface effect and reduce the GM, thereby reducing the stability of ship.

⑨ **Structural damage:** While loading & making a cargo plan, for heavy cargoes like iron ore, nickel ore, bauxite etc chief officer must ensure that load density of the tank top should never exceed. If cargo is loaded more than the load density of tank top, it may rupture the tank top which cause water ingress from adjacent double bottom tank. While loading heavy cargoes, the distribution of weight is also taken care of. Poor distribution and inadequate trimming of certain cargo can result in excessive bending & sheer forces.

Few other are:-

① **Corrosion:** - coal & sulphur.

② **Fire:** - coal, sulphur, cotton etc

Write points like self heating, spontaneous combustion

③ **Contamination:** - Preparation of cargo hold is critical element in bulk carrier. especially when you have to load grain cargo. A lack of proper preparation of cargo hold prior loading will lead to contamination of cargo (due to ingress of water) & huge claim will be borne by ship owner.

adjacent or tank hatch cover rubber packing, bilge, cargo sweat, TML

(5.b) What are the **precautions** to be taken while carrying **solid bulk cargoes** (2-times)

Ans:-

- Same as in (5.a)
- The hazards have their respective precautions written along with them in 5.a
- In case of coal cargoes, since it is liable to spontaneous heating, the code recommends that hatches should be closed immediately after completion of loading in each cargo hold.
- The ventilation should be carried out as specified in IMSBC code.

Q.6.a) What are the **hazards** associated with loading & carriage of **coal cargoes** (6-times)

Ans:-

Coal are categorised according to the hazards associated with it. Whenever coal is shipped, the history of the previous shipment must be known, so as to be aware of hazards of the particular type of coal.

- Methane emission: Most of the coal emits methane which is highly explosive. A naked flame or a little spark is sufficient to ignite it. Methane is lighter than air and so it flows towards the top empty part of the cargo compartments, including a hatch top and may even flow into an adjacent compartment. If the methane level become unacceptable, surface ventilation should be carried out as recommended by the IMSBC code.
- Spontaneous heating/combustion: Some coals are liable to spontaneous heating due to the presence of moisture that causes exothermic reaction (a reaction that results in production of heat) of coal at ambient temperature. If the heat is not reduced, the temperature rises and coal may ignite.
- Corrosion: Some type of coal react with water to produce acid that can cause a excessive corrosion of the ship's structure known as cargo corrosion. As a result of the chemical reaction during the process of the forming acid and then corrosion, colourless and odourless gases such as hydrogen are produced.
- Cargo liquefaction: It is a process where the moisture in the cargo migrates to the surface due to the vibration of the ship resulting in the development of a flow state

Same as in Q. no 5(a)

(6.b) What **precautions** are to be taken while carrying **coal cargoes** (6 times)

Ans:-

1. Prior to loading, the shipper or agent should provide relevant documents to the MASTER, which includes information regarding the characteristics of the cargo and the recommended safe handling procedure for loading and transport of the cargo.
2. Bilge wells suction should be operational at all times.
3. Bilge covers should be cleaned of any cargo residue and enough drain holes.
4. Bilge cover should be wrapped with a burlap cover.
5. No naked light or smoking must be allowed in or near a coal carrying compartment.
6. Only intrinsically safe torches and other equipment may be used in or near coal compartment.
7. Electrical cables, cargo hold lights or any other electrical instrument within the cargo hold should be checked for any insulation damage which may generate the spark.
8. The firefighting equipment should be available for immediate use at all times when loading and during the passage.
9. Vessel fitted with fixed CO₂ system should blow through the lines using compressed air prior to commencement of loading to ensure that all cargo holds are well covered by the CO₂ system.
10. The smoke detection equipment must be continuously operated and monitored regularly.
11. Extra monitoring should be implemented when coal is loaded in holds adjacent to hot area like heated fuel tank, engine room bulkheads etc
12. A pH value of the bilge water should be continuously monitored and if a higher pH value is recorded it indicates the likelihood of increased corrosion. In such cases bilge should be kept dry by pumping out any accumulated water.
13. Prior to loading, the temperature of this cargo shall be monitored.
14. This cargo shall only be accepted for loading when the temperature of the cargo is not higher than 55°C.
15. The hatches should be closed immediately after completion of loading in each cargo hold.
16. The cargo therefore should not receive thorough ventilation, but surface ventilation must be provided to quickly remove any evolved gas and keep the cargo cool.
17. The ventilation should be carried out as specified in IMSBC code.

Q.7) What are the **hazards** associated with the loading & carriage of **grain cargo** (6 times)

Ans:-

The major hazards associated with carrying grain cargo are as follows:

- **Setting and shifting:** A compartment may be full when the cargo is loaded but due to ship's vibration and other movements, the grain settles by about 2% of its volume leaving a space at the top of the cargo. This space allowed grain to move side-by-side during rolling and pitching of the vessel. As the cargo shift the vessel lists to one side. The shifting of the grain is the greatest hazard involved in the carriage of grain.
- Since, grain has a low angle of repose (15–18° depending on the type of grain), which means if ship rolls more than 15–18°, the cargo will shift very easily. This shifting of cargo will cause the vessel to list and if the rolling continues it will cause a greater shift of cargo which in turn will capsize the vessel. Thus the healing moment should be kept as small as possible. This is done by:-
 - (i) Having maximum number of holds filled with grain
 - (ii) Restraining or securing the grain surface to prevent shifting.

- **Heat by fuel oil tank:** Master and Officer will monitor the tank top temperature above the fuel oil DB tank as this can affect the integrity of the grain cargo. Fuel oil temperature can be monitored on fuel oil transfer pump.
- **Spontaneous combustion:** Some grade of grain cargo are carried in a damp condition and may cause a spontaneous combustion to occur. The centre of this cargo will have very little ventilation to allow for cooling effect, the natural heat generated can build up to such a degree that combustion take place.
- **Depletion of oxygen or evolution of toxic vapours:** Sea transportation of grain cargoes of an organic nature may result in severe oxygen depletion and formation of carbon dioxide. This will be a severe hazards as it may flow to an adjacent compartment and thus monitoring of adjacent compartment at frequent interval is required.
- **Contamination:** Preparation of cargo for next intended voyage is a critical element in bulk carrier especially when you have to load grain cargo. A lack of proper preparation of cargo hold prior loading will need to contamination of cargo and huge claim will be borne by the ship owner.
- **Rotting due to ingress of water:** The water is a big hazard for grain cargo. Any water ingress from the adjacent DB tank, bilge etc cause rotting of the grain cargo. Hence extra precautions is required and the water tightness of adjacent DB tank manhole, hatch cover water integrity should be checked, the bilge suction line should be properly secured etc. (make some more points by your own)

Q(8-a) What are the **hazards** associated with the loading & carriage of **high density cargo?** (2 times)

- Ans:-
- Since iron ores are heavy cargo which occupy a small area for a large weight. They have a lowest stowage factor. So, one of the major hazards associated with loading of iron ore is damaging the tank top. So while loading such cargo or making a cargo plan for the same, the chief officer must insure that load density of tank top should never exceed.
 - Poor distribution and inadequate trimming of this cargo can result in excessive bending and sheer force which can cause structural damage. Trimming of these cargoes is generally required to spread their weight across the entire tanktop.
 - When high-density cargo such as iron ore loaded on a bulk carrier, it will increase the vessel's GM to make it a stiff ship.
 - **Cargo falling from height:**
 - **Cargo dust:**
 - **Cargo liquefaction:**
- same as in Q 5(a) Page-244

(8-b) What are the **precautions** to be taken while loading & carrying **high density cargo?** (6 times)

- Ans:-
- Same as in 8(a)
 - The hazards have their respective precautions written along with them.
- * see the underlined part

Q.(9-a) What are the **hazards** associated with the loading & carriage of **concentrates**? (5 times)

Ans:-

- **Cargo falling from height:** same as in Q 5(a) Page-244
- **Cargo dust:**
- **Cargo liquefaction:**
- **Spontaneous combustion:**
- **Depletion of oxygen or evolution of toxic vapours:** same as in Q 7 Page -247

(9-b) What **precautions** are to be taken while loading & carrying **concentrates**? (5 times)

Ans:-

1. Bilge wells suction should be operational at all times.
2. Bilge covers should be cleaned of any cargo residue and enough drain holes.
3. Bilge cover should be wrapped with a burlap cover.
4. Precaution for cargo falling from height
5. Precaution for cargo dust
6. Precaution for cargo liquefaction +
 - The moisture content of the cargo shall be kept less than its TML during voyage
 - The cargo shall not be handled during precipitation.
7. Precaution for spontaneous combustion +
 - The ventilation should be carried out as specified in IMSBC code.
8. Sea transportation of concentrates causes **oxygen depletion** and formation of carbon dioxide. This will be a severe hazards as it may flow to an adjacent compartment and thus monitoring of adjacent compartment at frequent interval is required.
9. All non-working hatches of the cargo spaces into which the cargo is loaded or to be loaded shall be closed.
10. Cargo shall be trimmed properly
11. Distribution of weight must be even.

Q.(10-a) What are the **hazards** associated with the loading & carriage of **sulphur**? (2 times)

Ans:-

- This cargo is a non-combustible or a has a low fire risk. When this cargo is involved in the fire, a toxic, very irritation, harmful and suffocating gas is evolved which is very dangerous for personnel cleaning the hold or involved in loading/discharging operation.
- This cargo and a liability of dust explosion. A cloud of sulphur dust can cause explosion as they easily ignited by sparks generated by friction or static electricity.
- Sulphur is highly flammable and will readily ignite when in contact with flame. Metal chains or slings should not be used to load sulphur in order to avoid possibility of ignition by spark.
- There are circumstances during the passage or after discharge whereby bulk sulphur can emit a small quantity of hydrogen sulphide gas. This gas is dangerous to personnel and therefore ensure that cargo space is well vented wherever possible.
- Sulphur is not soluble in water and when in contact with oil there is a danger of fire.
- **Corrosion:** Same as in (6.a)- coal. Sulphur dust, sulphur in water can be very corrosive. The reaction between sulphur, water and steel can be minimised by physical barriers such as lime washing. A general recommendation is that 60 KG of lime is used in 200 L of water and solution should be spread to all surface that are going to be in contact with sulphur. Sulphur cargoes can have large moisture content and it is therefore important that bilge suctions are functioning properly, soundings regularly taken and bilge should be pumped out as required.

• After the cargo has been discharged, freshwater should be used to clean the hold & flush through the bilge system. Seawater should not be used for cleaning as the presence of sodium chloride will increase the reaction between sulphur and steel.

(10.6) What are the **precautions** need to be taken while loading & carrying **sulphur** cargo? (2-times)

Ans:-

- Sulphur has certain properties; corrosion and the emission of certain gases. A copy of the Material Safety Data Sheet (MSDS) should be requested from the shipper prior to loading the cargo.
- Bulk sulphur (whether formed solid, crushed lump or coarse grained) can be highly corrosive when in contact with water, and so the hold paint coating needs to be in a good condition.
- It is usual to limewash the holds to protect the steel structures. There are proprietary products, such as hold block, designed for preparing holds for carrying sulphur.
- The holds should not be washed with seawater, but should be thoroughly cleaned and washed with freshwater.
- The hold tank top should be rust-free.
- The holds are usually required to be cleaned to a grain standard, with no previous cargo residues, and no rust scale or flaking paint.
- Holds should be cleaned thoroughly & all inflammable materials like rags, pieces of wood, etc to be removed.
- No loose metal object to be left in the hold.
- Bilges to be tested & covered with limber boards. Any chinks should be caulked, to prevent dust from founding its way into the bilges.
- Co₂ system to be tried out.
- "No Smoking" signs put up & strictly enforced.
- "No Naked Lights" permitted on the deck or in the holds.
- Fire hoses to be rigged, fire main charged & other fire fighting apparatus kept in a constant state of readiness.
- Flashlights. Walkie-talkies etc. to be intrinsically

Note:

1. The safety precautions associated with the carriage of sulphur as set out in the IMBSC Code, including personal protective equipment and the extinguishing of lighting inside holds.
2. A strict 'no smoking policy' should be in force on deck during carriage.

CODE FOR SAFE PRACTICES **(TIMBER / IMSBC / BLU /** **SECURING)**



YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

7. CODE FOR SAFE PRACTICES (TIMBER/IMSBC/BW/SECURING)

Q.1) Briefly describe the contents and use of the cargo securing manual (5 times)

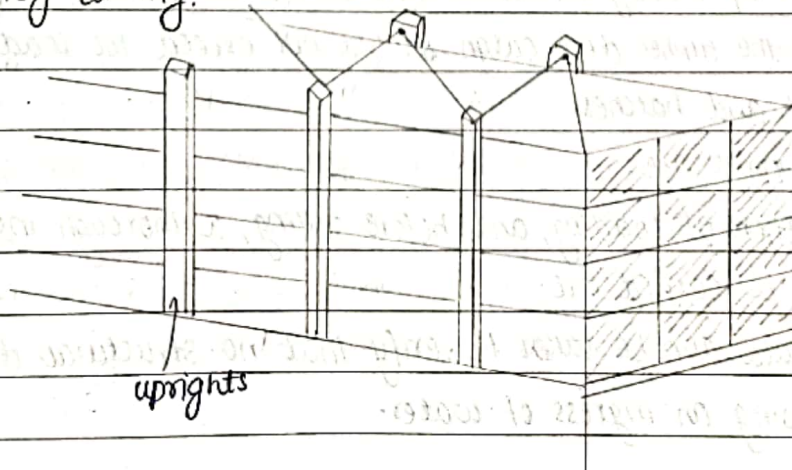
- Ans:-
- A cargo securing manual prescribes how cargo on-board a ship should be stowed and secured.
 - All ocean-going vessel that is engaged in transport of cargo except oil tanker & bulk carrier which carried solid bulk cargoes, should have a cargo securing manual on-board.
 - A cargo securing manual gives the detail of all cargo-securing equipment on-board the vessel, whether fixed or portable.
 - It specifies their location and how they should be used to secure the different types of cargo.
 - It specifies the strength of the cargo securing equipment to withstand any adverse weather.
 - The instruction for maintenance of the cargo securing equipment should be available in this manual.
 - Cargo securing manuals specifies the allowable load capacity of the equipment that is known as its MSL (maximum securing load)
 - It also specifies the appropriate cargo securing points.
 - A cargo ship may be carrying different size of container. The cargo securing manual should show the stowage position for different size, the maximum allowable stack, their sequence of stowage etc.
 - The cargo securing manual of container vessel should have a cargo safe Access Plan (CSAP)
 - It ^{is a plan that} provide safe access to the steredores or crew of the ship to the containers for their stowage and securing.
 - A cargo securing manual should be prepared in the working language of the crew of the vessel as per the guidelines by the SOLAS.
 - If it is prepared in a local language, a translation in English, French or Spanish must be prepared and made available on the ship.

* Lashing

- Every lashing should pass over the timber deck cargo and be shackled to suitable & adequate eyeplates, and efficiently attached to the deck stringer plate.
- All lashing and components used for securing should have a breaking strength of not less than 13.6T.
- Every lashing should be provided with a tightening device or system so placed that it can safely and efficiently operate when required.
- Every lashing should be provided with a quick release arrangement.
- Every lashing should be provided with a system to permit the length of the lashing to be adjusted.
- Upon completion of lashing, the tightening device or system should be left with not less than half the threaded length of screw.
- The spacing of lashing should be such that two lashing at each end are positioned as close as practicable to the extreme end of the timber deck cargo.
- The three types of lashing equipment with different strength and elongation characteristics are mostly used for securing timber deck cargoes:
 - chain lashing
 - wire lashing; and
 - fabricated web lashing.
- The maximum spacing of the lashing should be as per the height of timber deck cargo i.e. for a height of 4m or below, spacing should be 3m
for a height above 4m, spacing should be 1.5m.

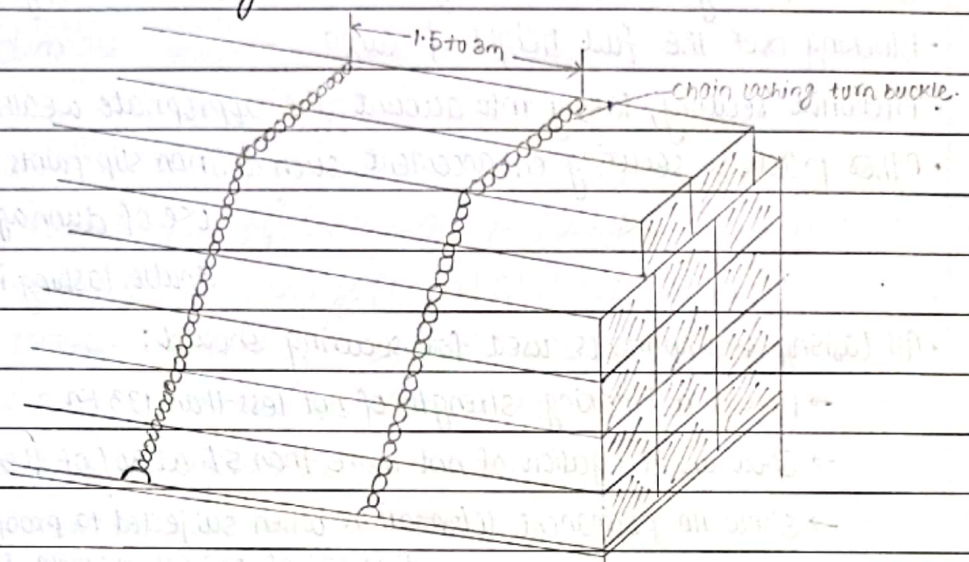
Three types of lashings are:-

(i) Hog lashing.



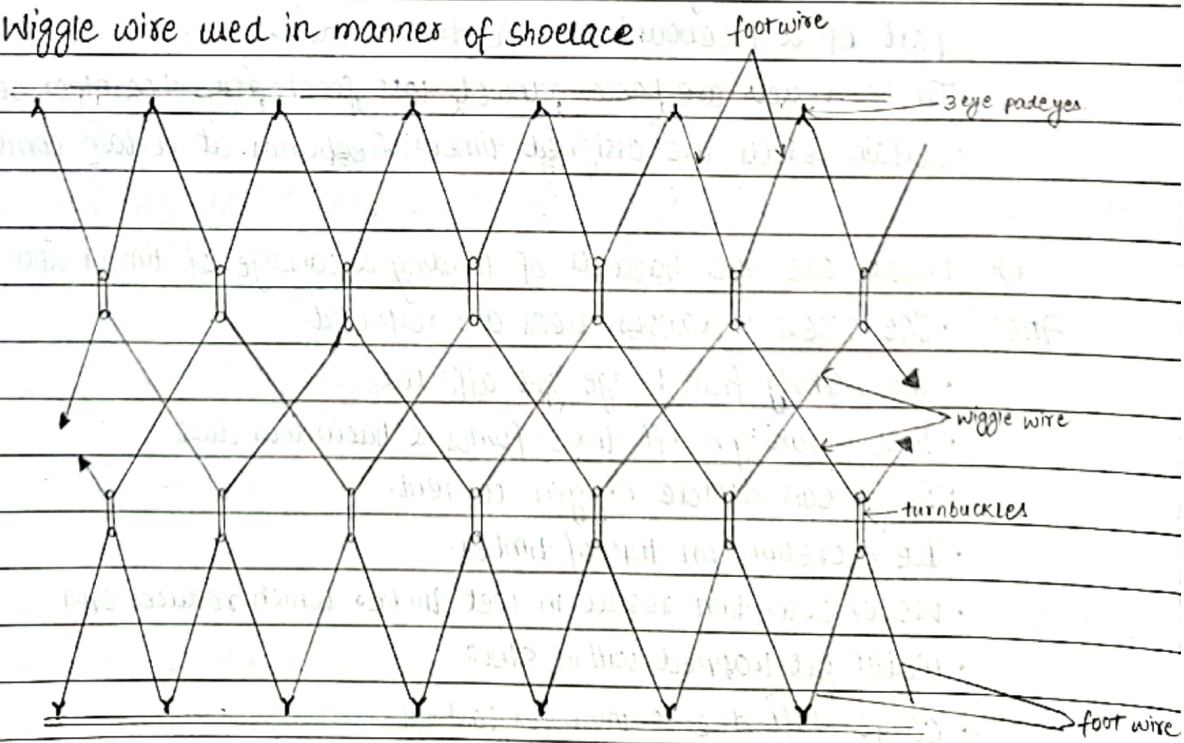
- Used over intermediate tiers
- May be set hand tight as the weight of upper ties will further tighten them.

(ii) Chain & wire lashing



- Secure & shackled to suitable and adequate eyeplates on the deck stringer plate.
- Wire lashing may be looped over the uppermost tier.
- Turn buckles are fitted in each lashing.

(iii) Wiggle wire used in manner of shoelace



- Passed continuously through a series of snatch blocks held in place by foot wire.
- Turn buckles may be set up between the blocks to keep the lashing tight.

* Securing

One or more of the following methods may be used to secure timber deck cargo:

- different types of lashing arrangements
- Bottom blocking of the base tier in combination with lashing arrangement.
- Blocking over the full height of cargo.
- Frictional securing, taking into account the appropriate weather and voyage criteria.
- Other practical securing enhancement, such as: non slip paints on hatch cover
use of dunnage in gaps
double lashing in exposed areas.
- All lashing & components used for securing should:
 - possess a breaking strength of not less than 133 kN
 - show an elongation of not more than 5% at 80% of their BS (breaking strength)
 - show no permanent deformation when subjected to proof loads of not less than 10% of original breaking strength.

Q. (3-a) What is timber deck cargo?

- Ans:-
- Timber deck cargo is denoted as a cargo of timber carried on an uncovered part of a freeboard or superstructure deck
 - Timber vessels are hence allowed less freeboard than other vessels.
 - Certain vessels are assigned timber freeboards at certain condition

b) What are the hazards of loading & carriage of timber deck cargo? (8 times)

- Ans:-
- The access to various areas are restricted.
 - The visibility from bridge get affected.
 - Timber can give off toxic fumes & hazardous dust.
 - Timber can deplete oxygen content.
 - Ice accretion on top of timber.
 - Water absorption result in wet timber which reduces G.M.
 - Water get trapped within stow
 - cargo shift due to improper lashing.
 - Deck may rupture if loaded more than load density of deck.
 - Injury to personnel while handling.
 - Insect/snakes/other reptiles are carried with timber.

(c) What preparation are required prior loading timber deck cargo? (4 times)

- Ans:-
- A pre-stowage plan should be made after considering all the available information, to allow the maximum utilization of the available space.
 - The cargo spaces and related equipment should be examined to check for any damages.
 - Weld additional securing point, if required.
 - Outboard end of lashing is secured to eye plates prior loading.
 - Protect ventilators, air pipes, sounding pipes, winches and similar appliances.
 - When necessary, lay dunnage (3x12m) at 1m apart.
 - Hatch covers, water-tight doors etc. within the area should be secured.
 - The bilge suction should be clean, & properly maintained to prevent the admission of debris in bilge piping system.
 - The MASTER should ensure the ballast valves are properly monitored & opening/closing of valves are properly logged to prevent accidental readmission of water into these tanks.

(d) What are the stability criteria for loading timber cargo? (2 times)

- Ans:-
- The area under the righting lever curve (GZ curve) should not be less than 0.08 metre-radian
 - The maximum value of the righting level (GZ) should be at least 0.25m
 - The metacentric height (G_M) should not be less than 0.10m after correction for free surface effects of liquids in tank, absorption of water by deck cargo and/or ice accretion on the exposed surface.
 - The metacentric height (G_M) should not exceed 3% of the breadth of the ship in order to prevent excessive acceleration during rolling which cause large racking stress and stress on cargo lashing which may result in cargo shift or loss.

(e) What checks are required on a loaded passage carrying timber deck cargoes?

- Ans:-
- The ship's heeling angle and rolling period should be checked.
 - Wedges, wastes, hammer and portable pump are to be stored in easily accessible place.
 - Check the wire used in lashing is ^{well} lubricated, if not then apply some grease.
 - Examine slip hooks.

Securing

Q.(A-a) What is the purpose of code of safe practice for cargo stowage & securing? (2-times)

Ans:- The purpose of the CSS code is to provide an international standard to promote the safe stowage and securing of cargoes by:

- specifying the requirements that shipowners and ship operators need to ensure that the ship is suitable for its intended purpose.
- providing advice to ensure that the ship is equipped with proper cargo securing
- providing general advice concerning the proper stowage and securing of cargoes to minimize the risks to the ship and personnel.
- providing specific advice on those cargoes which are known to create difficulties and hazards with regard to their stowage and securing.
- advice the actions to be taken in case of heavy sea conditions.
- advice the actions to be taken in case of cargo shifting.

b) What are the principle of safe stowage & securing as per above code- (2-times)

Ans:- The principles of safe stowage & securing as per the CSS code are as follows:

- All cargoes should be stowed and secured in such a way that the ship and persons on-board are not put at risk.
- The safe stowage and securing of cargoes depends on proper planning, execution & monitoring.
- Personnel commissioned for task of cargo stowage and securing should be properly qualified and experienced.
- Personnel planning and supervising the cargo stowage and securing should have practical knowledge of application and content of cargo securing manual.
- Improper stowage and securing of cargo will be dangerous for securing of other cargoes and as well as for ships itself.
- Decision taken for measures of stowage and securing of cargo should be based on most severe weather condition expected during voyage.
- In ship-handling decisions, master should take into account the type, stowage position of the cargo and the securing arrangements.



Bulk carrier

Q.5 AS per BLU code, prepare a ship-shore safety checklist for loading in bulk carrier. (6 times)

Ans:- (1) The following ship's data are to be filled:

Ship's Name: M.V. VISHVA VITAY Date: 05-07-2022

Port: AQABA, JORDAN Terminal: Q-3

Loading Unloading

Available depth of water in berth: 19m

Minimum air draft: 17m

Arrival draft: DF/DA - 5.5/7.1

Calculated departure draft: DF/DA - 12.35/12.50

Air draft : 13.6

Air draft: 9.2

- (2) Is the depth of water at the berth, and the air draught adequate for the cargo operation?
- (3) Are mooring arrangements adequate for all local effects of tide, current, weather, traffic and craft alongside?
- (4) In emergency, is the ship able to leave the berth at any time?
- (5) Is there a safe access between the ship and the shore?
- (6) Is the agreed ship/shore communication system is operative?
- (7) Are the contact person during cargo operation positively identified?
- (8) Are adequate crew on-board, and adequate staff in the terminal is there for emergency?
- (9) Have any bunkering operation been advised and agreed?
- (10) Have any repair job while alongside been agreed?
- (11) Has a procedure for reporting and recording damage from cargo operation been agreed?
- (12) Is the atmosphere safe in holds and enclosed space, to which access may be required?
- (13) Has a loading/unloading plan been calculated for all stages of loading/deballasting or unloading/ballasting?
- (14) Has the need for trimming of cargo in the hold been discussed?
- (15) Do both ship and terminal understand and accept that if the ballast programme goes out of step with cargo operation, it will be necessary to suspend the cargo operation until the ballast operation has caught up?
- (16) Have the procedure to adjust the final trim of the loading ship been decided & agreed?
- (17) Has the terminal been advised of the time required for the ship to prepare for sea, on completion of cargo work?
- (18) Is the illumination on and around vessel and jetty sufficient?

Q.6) Explain liquefaction and TML. How should a can test may be done? (3-times)

Ans:- Liquefaction:

- It is a process where the moisture in the cargo migrates to the surface due to the vibration of the ship resulting in the development of flow state
- If the moisture content of the cargo exceeds the Transportable moisture limit, cargo liquefaction may occur.
- Liquefaction develop a flow state state within the cargo which cause cargo to slide or shift in one direction thus creating a free surface effect and reduce the GM, thereby reducing the stability of the ship.

Transportable moisture limit.

- TML is the maximum moisture content of the cargo that is considered safe for transportation in ship.
- Cargo having moisture content above TML are liable to liquefy.
- It is around 90% of the FMP (flow moisture point) and is determined using the flow table as described in IMSBC code.

The can test can be done in few small steps & when performed correctly, it can help determine if a cargo might unsafe.

steps are as follows:-

- Take a rigid cylindrical can - (0.5 to 1L capacity)
- Half fill with a sample of the material.
- Bring it down sharply from a height of about 0.2m.
- Repeat 25 times at 1-2 sec. intervals
- Take good qualities pictures and videos.
- Examine the surface for moisture & fluid condition
- If moisture or fluid condition appears, DO NOT LOAD and SEEK ADVICE

Q.7) With respect to IMSBC code, define (a) Flow moisture point (2-times)

- Ans:-
- Flow moisture point mean the percentage of moisture content or the portion of the water (total wet mass) at which a flow state develops in a sample of material under the prescribed method of test.
 - Point at which a sample of cargo begin to lose shear strength.
 - cargoes with moisture content beyond FMP may be liable to liquefy.

(b) Flow state.

• A state occurring when a mass of granular material having the moisture content above the TML, & due to some external forces such as vibration, ship's motion etc, it loses its internal shear strength and behaves as a liquid.

Q. (8. a) How does IMSBC divide various groups of cargoes? (2-times)

Ans:- The IMSBC code categorises cargoes into three groups:

Group A : cargoes which may liquefy if shipped at a moisture content above TML.
Example:- mineral concentrate like zinc, nickel ore, coal etc.

Group B : cargoes which pose a chemical hazard which may give rise to a dangerous situation on ship.
Example: Coaly direct reduced iron (DRI), ammonium nitrate etc.

Group C : cargoes which are neither liable to liquefy (Group A) nor possess a chemical hazard (Group B). Cargoes in this group can still be hazardous.
Example:- iron ore, cement etc.

b) What all things are required to be checked before accepting and loading a cargo? (2 times)

Ans:-

- The Bulk cargo shipping name as listed in IMSBC code.

- The cargo group (A and B, A/B or C)

- The total quantity of the cargo to be loaded.

- The stowage factor.

- The need for trimming & trimming procedures

- Angle of repose

- Certificate with moisture content of cargo & its TML

- Toxic or flammable gases which may be generated by cargo (if applicable)

- Flammability, toxicity, corrosiveness and property of oxygen depletion by the cargo (if applicable)

- Self heating properties of cargo (if applicable)

- Properties on emission of flammable gases when in contact with water (if applicable)

- Radioactive properties (if applicable)

- Any other information required by national authorities.

Q.2) Differentiate between following:- (a) Cargo sweat & ship sweat

Ans:- Cargo sweat: Some cargoes such as hides, ores etc. give off large quantities of water vapour causes relative humidity to increase makes air relatively more moist which causes sweat to form on the steel part of the hold, that would further drip into cargo and damage it.

Ship sweat: When sea temperature is much lower than the temperature above it, the underwater parts of the hold is cooled by contact with sea which cause sweat to form on the steel part of the hold, that would further drip into cargo and damage it.

(b) Stowage factor & load density.

Ans:- Stowage factor: It is the ratio of weight to stowage space required under normal condition.

- This is a NET amount of space a unit weight of a cargo will occupy.
- It indicates the number of cubic meter of space occupied by a given type of cargo in a cargo ship's hold.
- Stowage factor varies with shape & size of cargo.
- Stowage factor expressed in cubic metres per tonnes ($m^3/tonne$) or cubic feet per ton (ft^3/ton)

Load density: It is the maximum weight that can be safely loaded on a unit area

- The height to which cargo can be stowed on tanktop depend on the load density of that tanktop.
- Load density is expressed in mt/m^2

(c) SWL and proof load.

Ans:- SWL: It is defined as the maximum safe load that the lifting equipment can lift, move, lower down to ground with any problem of breaking

- In simple terms, safe working load of any lifting equipment is the maximum weight of load it can carry safely.

Proof load: When a component of a lifting gear is to be tested, we cannot test it to its breaking strength as this would destroy the component.

- We have to apply the load on it, more than the safe working load

sufficient to assure that when it is loaded up to its SWL, it will safely bear this load.

- This load that we apply more than the SWL & less than the breaking strength is called the proof load.

Not so md

Q. 10) Discuss how the IMSBC code & BW code assist the mariner.

Ans:- IMSBC code

- The primary aim of IMSBC code (International maritime solid bulk cargoes code) is to facilitate the safe stowage and shipment of solid bulk cargoes by providing information on the dangers associated with the shipment of certain type of bulk cargoes.
- It provides the procedure to be followed and the appropriate precautions to be taken in the loading, trimming, carriage and discharge of solid bulk cargoes, when transported by sea.

BW code

- The primary aim of BW code (Code of Practice for safe loading and unloading of Bulk carrier) is to assist person responsible for safe loading and unloading of bulk carriers to carry out their functions.
- It promotes the safety of bulk carrier.
- It has been developed by IMO to minimize losses of bulk carrier.
- The recommendation in this provide guidance to shipowners, masters, shippers, charters, terminal operator for the safe handling, loading and unloading of solid bulk cargoes.

CONTAINER/ Ro-Ro CARGOES



YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

8. CONTAINER/RO-RO CARGOES

Q.1) Sketch and describe bay plan of a container ship - (8 times) (OR)

Explain Bay-Row-Tier method of identifying containers on a container vessel (2 times) (OR)

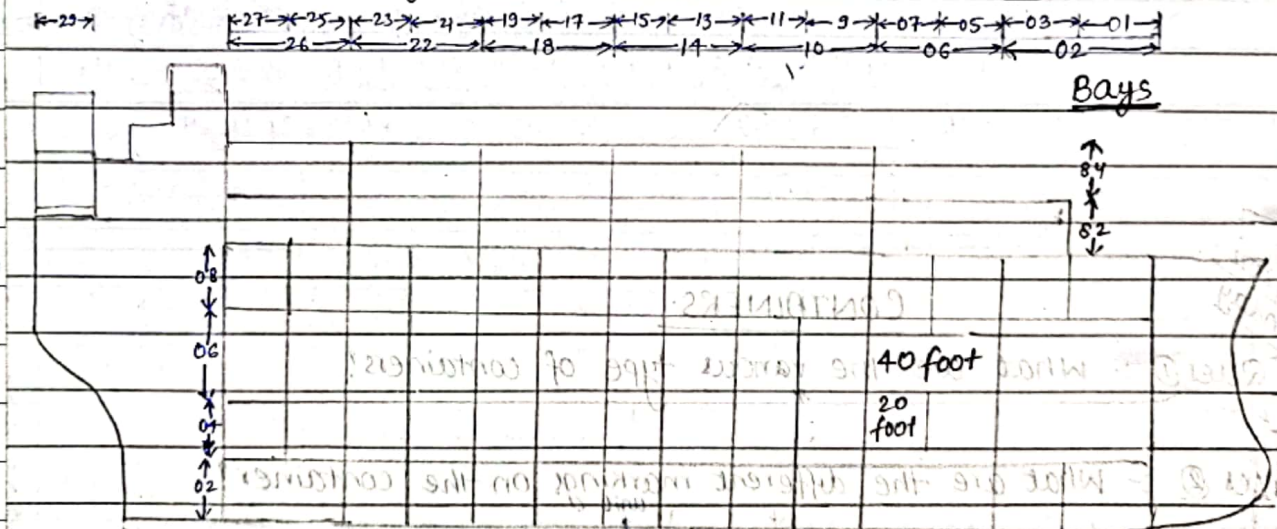
Describe how location of a particular container is designated on a container ship by suitable sketch (2 times) (OR)

With the help of sketch, explain the principle of Bay-Row-Tiers coordinates on-board a container vessel in helping to identify the location of container (2 times)

Ans:- The Bay plan:

- It is a numbering system that gives a cross-sectional view of the arrangements of containers on a vessel above and below the deck.
- It consists of 6 digits.
- The first two digits indicate the bay, the middle two indicate the row and the last two indicate the tier.
- The Bay plan will help to determine the correct stowage position of containers as per the prepared cargo plan.

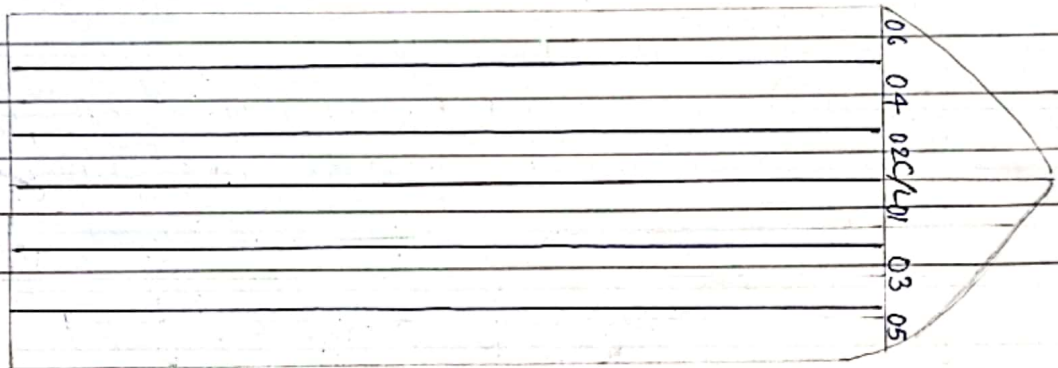
BAYS



- A container vessel is split into slots called bays.
- Bays are marked from forward to aft (w.r.t length of the vessel).
- It starts from Bay 01 from the bow and can continue till Bay 40 till the stern depending on the size of the vessel.
- Odd bays are for 20 footer containers & even bays are for 40 footer containers.
- Entries of timings of commencement of loading or discharging operation are made in cargo record book along with the bay number.

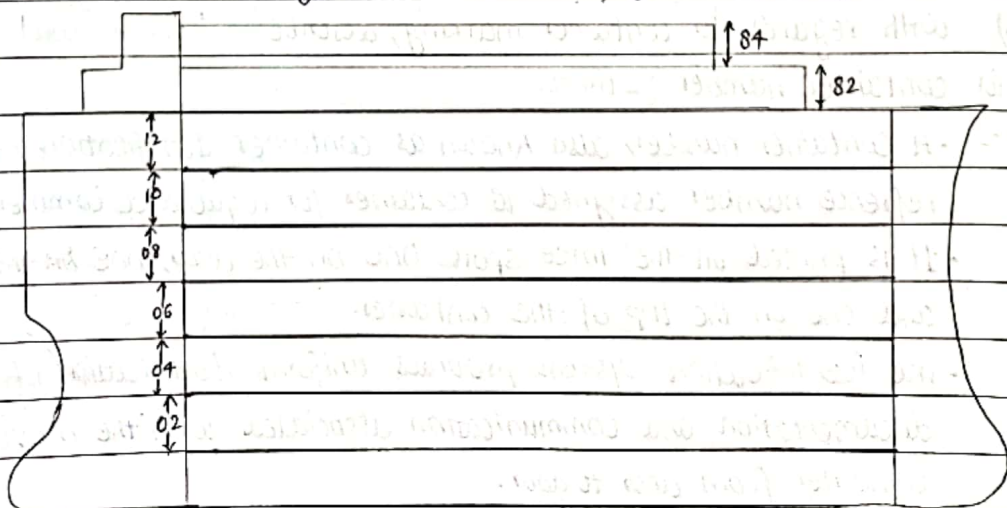
ROWS:

- The **row** is the position where the container is placed w.r.t breadth of the vessel
- Rows are marked from port to starboard (w.r.t. breadth of the vessel)
- If the container is placed on the centerline of the ship, it is given as Row 00.
- Rows are even numbered \leftarrow from centerline to port side. like 02, 04, 06, 08 and so on
- Rows are odd numbered from centerline to stbd side like 01, 03, 05, 07 and so on.



Tiers:

- **Tiers** denotes at which level the container is placed - basically how high the container is stacked on-board.
- The container tiers are marked vertically from bottom to top (w.r.t height of the vessel)
- They are numbered with even number
- It starts from bottom like 02, 04, 06, 08 & so on.
- In case of the deck cargo, it starts from 82 & goes like 82, 84, 86 & so on.



Q.2) Explain the information provided on the CSC plate of a container. (PR)

Write short notes on CSC plate of a container (3 times) (PR),
w.r.t container marking, describe CSC plate (6 times)

- Ans:-
- CSC - The international convention for safe containers.
The convention requires that any container used for international transport must be fitted with a valid safety approval plate (CSC plate)
 - The CSC plate is fitted in all the shipping containers from the time of manufacture.
 - It is typically riveted to the outside of the left door.
 - This rectangular plate with a minimum measurement of 200x100mm should be made of non-corrosive and fire proof material.
 - Every CSC plate must contain a certain level of information in either English or French.
 - A CSC plate contains information which include
 - word "CSC SAFETY APPROVAL"
 - classification company approval code
 - month & year of manufacture of the container
 - manufacturer's container identification number.
 - Gross weight of the container
 - stacking load value
 - racking test load value
 - & next date for inspection of the container.

} in both KGS & LBS
} in newtons

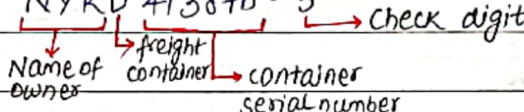
Q.3) With regards to container marking, describe

(i) container number. (2 times)

- Ans:-
- A container number, also known as container identification number, is a reference number assigned to containers for legal and commercial purpose.
 - It is printed on the three spots, one on the door, one on the side wall and one on the top of the container.
 - The identification system provides uniform identification of containers for documentation and communication associated with the movement of container from door to door.

- The identification system structure consist of
 - The owner prefix: Three capital letter of latin alphabet to indicate the owner of the container.
 - Equipment category finder: One capital letter of latin alphabet.
 - U for all freight containers
 - J for detachable freight containers
 - Z for trailers and chasis
 - Serial number: Six arabic numerals, chosen by owner.
 - Check digit: One arabic numeral, used to verify the entire identification sequence is accurate or not.

Example:- NYKU 413870 - 5



(ii) Stack weight (2-times)

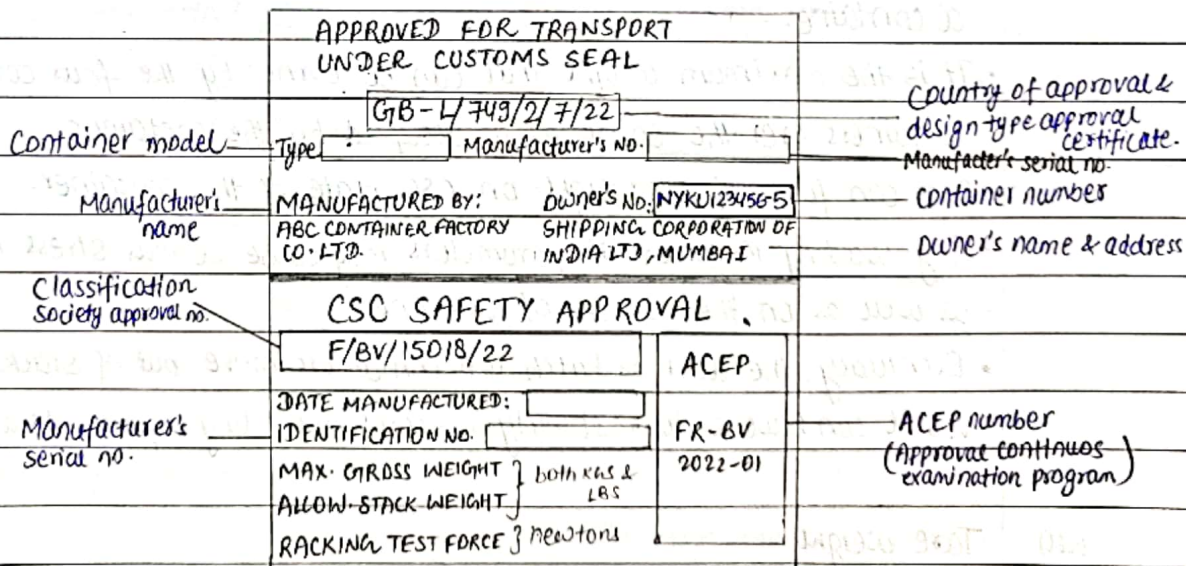
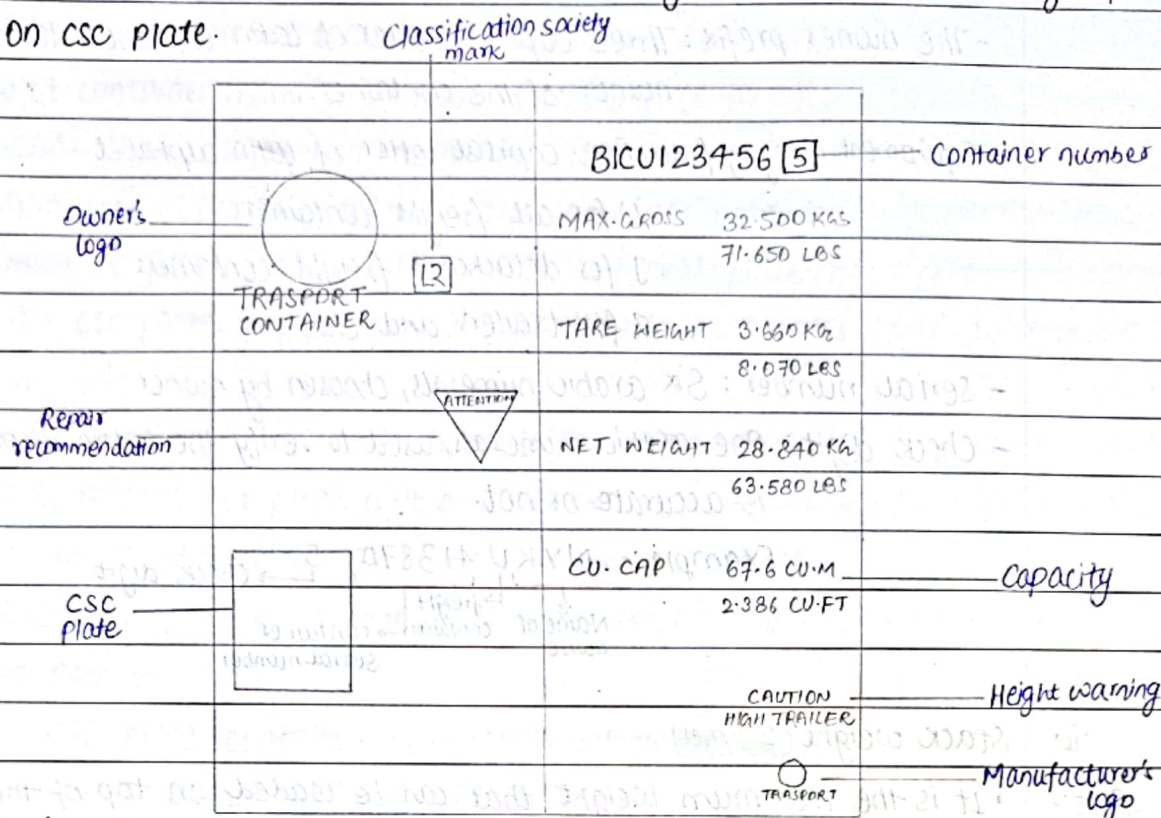
- Ans:-
- It is the maximum weight that can be loaded on top of the containers.
 - As its name suggests, it is a maximum weight that can be stacked upon a container.
 - It is the maximum weight that can be borne by the four corners of the containers over the entire area occupied by the container.
 - One can find stack weight on CSC plate of the container.
 - Any loading in excess of parameters may cause serious stress on the twistlocks as well as on the corners of container.
 - Eventually, the deck & hatch top containers move out of stack & fall overboard.
 - Vessel can have serious stability concerns depending upon extent of shift.

(iii) Tare weight

- Ans:-
- It is the weight of an empty container.
 - One can find tare weight printed on the doors of container.
 - Using this information, the weight of the internal goods can be determined by subtracting it from the container's gross weight.

Q.4) With the suitable sketch, show the marking on a container including information on CSC plate.

Ans:-



Q.5) What are the advantages & disadvantages of containerization?

Ans:-

*Advantages are as follows:-

- 1) Almost any type of cargo is carried in containers all over the world using road, railway & ships.
- 2) Door to door ship

- 3) No wastage during cargo operation
- 4) Prevention of theft and pilferage as container is sealed
- 5) Less insurance premium for shippers due to less chances of damage & theft.
- 6) less time in port for loading/discharging result in cost saving.
- 7) Can load/disch. in rain
- 8) less delays in custom formalities
- 9) cargo hold cleaning not required after disch.
- 10) segregation of cargo is easy-
- 11) special stowage for reefer container
- 12) Port premises remain clean
- 13) No warehouses are required as containers are all weather unit and stowed/stacked right next to vessel alongside
- 14) Greater quantity of cargo handled per year.

* Disadvantage of containerisation

- 1) Initial cost of investment is very high to set up container terminal, heavy machineries, gantries, straddle carriers, trucks, stackers, fork lifts etc.
- 2) Highly professional staff to work in shifts 24 X 7
- 3) Special workshop to be maintained
- 4) Container company has to have highly sophisticated computer programming to plan and load containers
- 5) certain containers need to be washed
- 6) Container vessel have to deliver cargo in time, freight rates are high
- 7) Custom authorities to be very efficient for speedy stuffing & destuffing of unit
- 8) Lashing/securing of containers is most challenging job & persons get injured.
- 9) Extreme weather condition may cause containers to break lashing and resulting in loss of containers at sea.
- 10) Shifting of containers can cause serious stability concerns.
- 11) As container vessels are becoming bigger, more feeder vessel will need to build to serve smaller ports or shallow water ports.

Q.6) Describe the various types of container based on size, material of construction and usage (4-times) (or)

Sketch & describe following types of containers: (i) General purpose } 2-times.
(ii) Tank (iii) Open-top & flat rack container.

Ans:- There are 8 most common types of containers which are as follows:-

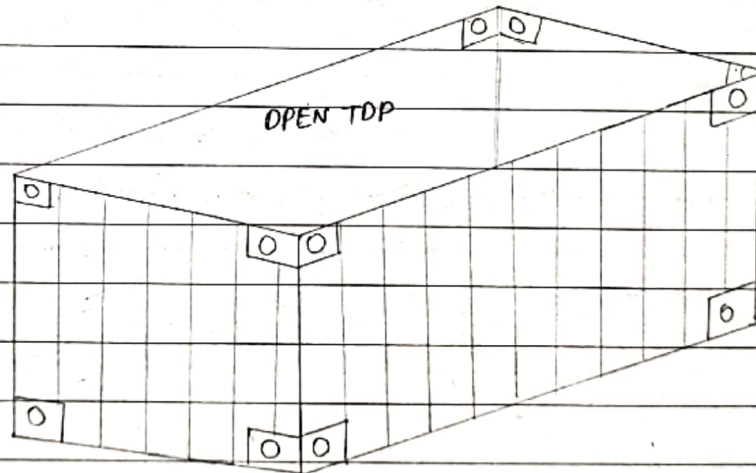
(i) General purpose container: It is most commonly used shipping container used for various types of cargoes. They come in various dimensions like 10ft, 20ft and 40ft. They are very strong, water-tight and durable.

(ii) Flat rack container: • It is a simple storage shipping container whose sides can be folded so as to make flat rack for shipping of wide variety of goods.

• The cargo can be loaded either from sides or from top.

(iii) Open top container: • It has a convertible top that can be completely remove to make an open top so that materials of any height can be shipped.

• This enables over sized cargo like timber, scrap metal etc. to be loaded from top.

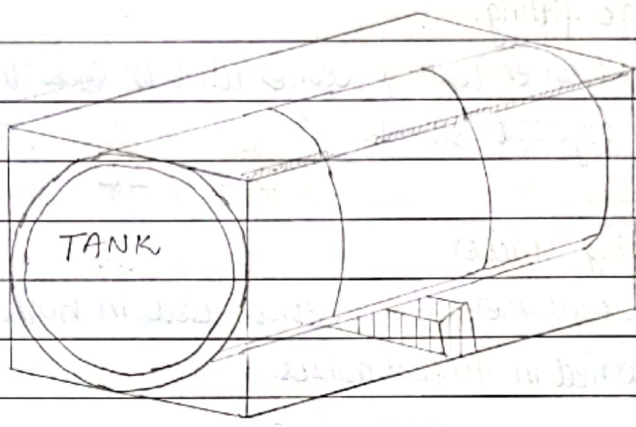


(iv) Open side storage container: • It has doors in side which can be completely open to make an open sides, thus providing a much wider room for loading of cargo inside it.

(v) Reefer container: • These are temperature regulated shipping container which have refrigeration system provided in it.

• It is used for shipment of perishable substance like fruits, vegetables over long distance.

- (vi) Tanks: • These have tanks which are most commonly used for transportation of liquid materials.
- It is build to the ISO standard, making it suitable for different modes of transportation.
 - They are mostly made of strong steels or other anti-corrosive material which provide long life & protection.



- (vii) Half height container: • These are half the height of full sized containers made mostly of steel.
- They are especially used goods like coal, stones etc. which requires easy loading and unloading.
- (viii) Special purpose container: • These containers are custom made for special purpose
- They are mostly used for high profile services like shipment of weapons and arsoms.
 - Their construction & materials composition depends that special purpose for which they are custom made, but in most cases, security remains the top priority.

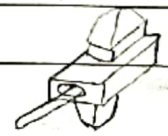
Securing & lashing

Q.7) Sketch and label the various lashing material used in securing containers on a container ship. (11 times)

Ans:-

(i) Twistlock

- It is a mechanical locking device mounted on the socket provided on deck.
- The container is loaded over the twist lock & then handle is moved to the locked position manually.



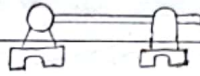
(ii) stacking cone.

- It is container lashing device that fit perfectly into the holes at the corner of container.
- It is placed on corners to perfectly align the stacks of containers and prevent them from falling/sliding.



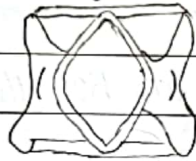
(iii) Bridge fitting.

- It is container lashing device used to ~~link~~ link the top of the two containers in two adjacent stacks.



(iv) Hanging stacker.

- It is a container lashing device used in holds where 20 foot containers are carried in 40-foot guides.



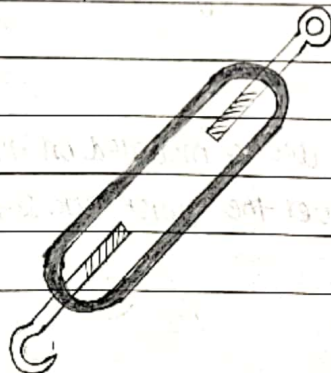
(v) Lashing rod

- It is a device used in combination with turnbuckles.
- The swivel head is made to fit into end of the container corner.
- The other end is attached to the appropriate turnbuckle.
- It is used to provide support to container stacks.



(vi) Turn buckle & bottle screw

- It is device for adjusting the tension or length of rods or other lashing device.
- It normally consist of two threaded eyebolts, one screwed into each end of a small metal frame, one with left hand thread & other with right hand thread.



(vii) Bull dog grip:

• It is used to connect wire to make a securing loop to secure the container with deck eye.



(viii) Load equalising device

• It is used to balance the load between two paired lashings.

Q. 8) Sketch and describe securing and lashing arrangement of container. (4 times) (OR)

How will you lash containers on deck. Explain with diagram (8 times) (OR)

Describe how the containers are loaded, secured and lashed (1 time)

Ans:- * **Lashing**

• Containers are lashed with the help of bottle screw, lashing rods, twist-locks, container stacker etc.

• In earlier container ships:

→ Cell guides were installed in the hold, hatch covers were fitted with lashing points and deck had container post to facilitate loading of containers on deck.

→ Twist locks, lashing rods, stacking cones or bridge fittings were used for lashing purpose.

• Modern container ships uses:

→ Twist locks is most popular method and containers can be stacked upto 4 tiers high.

→ Lashing bridge: solid steel structure running athwartship and placed between each 40 foot bay running across the length of the ship.

→ upto 3rd tiers, containers can be lashed using turnbuckles and lashing rods.

* **Securing Under deck**

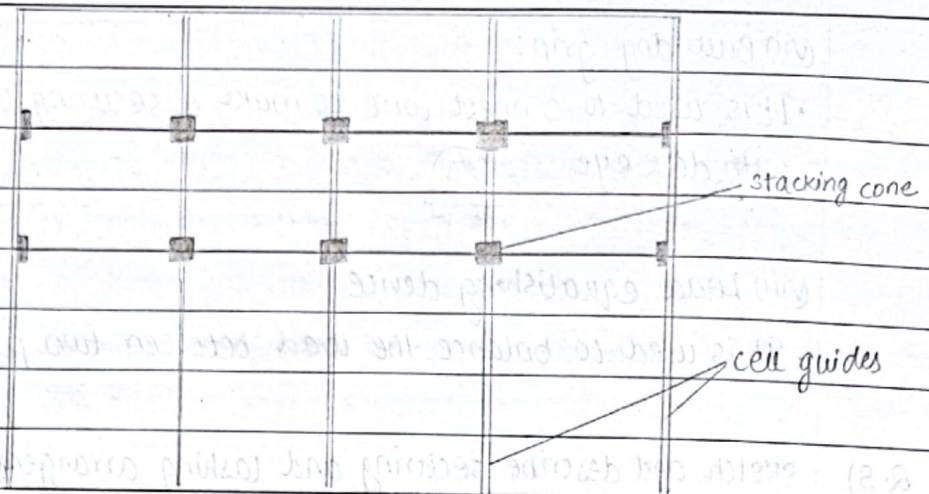
• Container ships are provided with cell guides, rails as securing means for hold ^{charges}

• The containers are loaded along the cell guide & it get fixed by cell guide itself.

• Since the containers are not connected vertically, the lateral stress is transmitted by each individual container to the cell guides. & containers are not usually able to shift.

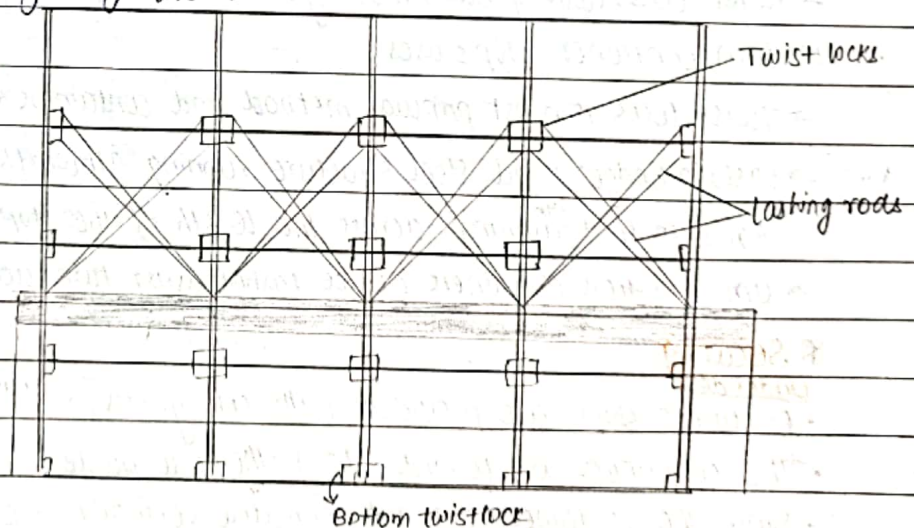
• 20 foot containers are generally joined through stacking cones to obtain tight stow

• A levelling pad is installed between the cell guide & bottom to prevent the inclination of loaded container.



Securing on-deck

- Containers on deck may be secured by twistlock alone, when stack is not more than two container high.
- The bottom corner of each container are locked to deck or hatchcover with the help of twistlock.
- Twistlock resist the horizontal movement of a deck stow.
- When stow are more than 2-3 container high, lashing rods are used in addition. Lashing rods provides extra racking strength.
- Lashing rods are used in combination with turnbuckles and it is always kept tight by adjusting the twistlocks.



Q.9) Explain all the factors in details which affect the stowage of containers on deck (1-time)

Ans:-	<ul style="list-style-type: none"> • Size of container • Type of container • Stack weight of container • Lashing of container. • Reefer container • IMDG container 	<ul style="list-style-type: none"> • Load density • GM • Bridge visibility • Stress of ship. • Port rotation (next port arrival) upon ratharge
-------	--	---

→ explain in detail by your own.

Q.10) Describe the different type of slings used for cargo handling. (2 times)

Ans:- (i) Endless sling.

- Splicing the ends of a piece of wire rope or fibre rope makes an endless swing.
- The endless sling is mostly used as choker hitch.
- When the endless sling is used as choker, personnel pass the sling around the cargo forming a loop on the top of the cargo.
- The other end is passed through this loop, pulled tight and attached to the cargo hook.



Choker hitch

(ii) Combination slings

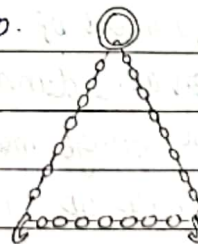
Combination sling



- When two or four slings are combine to form a basket or choker sling, it is said as a combination sling.
- Combination sling can lift any type of load.
- Several single slings are passed under large crates or boxes to form a basket sling.

(iii) Chain slings.

- These slings are used mainly for handling steel pipes, rails, beams and angles.
- Cargo handler should use dunnage to prevent slipping.
- When hoisting cargo of this type, personnel should make a complete round turn with the chain around the cargo.



chain sling

(iv) Canvas sling.

- A canvas sling is a rope sling with a canvas sewn between the ropes.
- The canvas sling are used for handling cargo such as nitrate.

(v) Single sling

- A single sling is made of wire rope or fibre rope.
- Each end of single is made up with an eye, a hook, a ring or a thimble.
- Single slings which are made of fibre rope are used to lift light weight cargo or cargo which may damage by wire slings.

Ro-Ro vessel

Q.11) Describe the procedure for closing and securing of bow doors on a Ro-Ro vessel (4 times)

Ans:-

- Vessel must have an OMM (On-board operation & maintenance manual) describing the procedures for opening, closing & securing of the bow door & ramp/watertight door system. It should be ship specific.
- The operating procedure may vary greatly from one vessel to another. Also depends on the type of bow door: (i) bow visor door.

Precaution taken while operating bow doors:-

(ii) Side shifting bow door.

- The drawings and procedures should provide a clear picture of its operation to the officers.
- When closing the ramp & the doors, once they are closed, make sure that locking cleats & pin are locked back.
- Hinges and wire ropes are secured as per the manual.
- The sealing arrangement are undamaged and working properly once the doors are closed.
- Hydraulic bases should be secured and free from chafing.
- Drainage system between bow doors & collision bulkhead must be kept clean and free from any debris.
- A responsible officer must be present during opening/closing procedure, and monitor the indicator system for correct closing of ramp and doors.
- Hydraulic piping, flexible hoses must be inspected for leakage and deterioration.
- Inspection and adjustment of sensors, limit switches must be carried out at recommended interval & during each operation.
- Indicators on the bridge must be tested.
- Power supply & back up system must be tested independently.

Q.12) How will you prepare the car decks for the loading of trailers & vehicles (3 times)

Ans:-

- The inside of the hold should be thoroughly cleaned of moisture, salt, dust, rust chips and cargo particles left from the previous voyage.
- The inspection and maintenance should be performed so that rust and salt water is prevented from falling onto the vehicles.
- The hatch covers should be checked for water-tightness.

- The safety sign and NO SMOKING sign should be in place.
- Any object suspended overhead should be indicated by black & yellow strip
- Slip prevention measures should be taken for shore ramp, the inner ramp & car deck near the ramp.
- The deck numbers and the height clearance of each deck should be indicated in a noticeable place.
- Cargo handling material such as lashing material, dunnage, booster cables and wheel blocks should be prepared.
- Cargo handling equipment such as moveable lumps, hydraulic devices, cranes and shore ramp lifting wire should be serviced.
- The ventilation and illumination equipment should be adequately operated.
- Vehicle route signs should be put in the hold so that collisions or near collisions can be avoided.

Q-13) Describe main hazard on a Ro-Ro vessel and give reasons for same.

- Ans:-
- Lock of bulkheads:**
 - Ro-Ro ships need undivided longitudinal space to roll-on/roll-off cargo which cause less subdivisions.
 - Hence Ro-Ro ships have lower water tight integrity. The free surface effect created in large undivided cargo spaces can result in rapid loss of stability and eventually capsizing.
 - Lack of bulkhead also lead to rapid spreading of fires.
 - Improper cargo stowage & securing:**
 - Proper cargo stowage & securing is very critical on Ro-Ro ships; any loose cargo can cause a chain reaction leading to heavy cargo shift.
 - The shipment on a Ro-Ro vessel are normally scheduled where most of the route are predetermined. This may put pressure on Master to sail out even when the cargo is not fully secured.
 - Freeboard:**
 - In the earlier built Ro-Ro ships, cargo access door were very close to the waterline. So in case of listing, door can get submerged & if it get damaged, it can lead water ingress inside, which may result in rapid loss of stability and eventually capsizing.
 - The modern Ro-Ro ships have very high freeboard which get affected by beam wind and therefore experience great difficulty in turning.

(iv) Open or damaged cargo access doors: In case of listing, door can get submerged and if it get damaged, it can lead water ingress inside, which may result in rapid loss of stability and eventually capsizing.

(v) Location of life-saving appliances: The location of lifeboats and liferafts on ro-ro ships is very high, which make it very difficult to lower them at sea in heavy weather.

(vi) Heavy weather condition: • Ro-Ro ships are more effected by side wind due to high accomodation and large exposed area which can lead to heavy roll.

• Heavy rolling can cause cargo shifting which can further lead to hull damage and even capsizing.

• In Ro-Ro ships, it is important to maintain safe speed through bad weather.

(vii) Improper cargo loading: • It is difficult to have a sequential loading of cargo as cargo arrives on terminal at different intervals.

• This further leads to uneven cargo distribution especially when heavier cargoes arrive last.

Q-14) On a Ro-Ro vessel, what are all the precautions that must be taken while loading cars?

Ans:-

1. The cargo space in which wheel based cargo is to be stowed should be dry, clean and free from grease and oil.
2. Start vehicles only when directed by vehicle director or other competent authority.
3. After starting the vehicle, immediately perform a brake check by driving forward several feet and then applying the brakes.
4. Do not leave vehicle engines running unattended.
5. -Vehicles will not exceed 5 miles per hour while moving about the ship.
6. Only qualified and screened drivers are permitted to operate vehicles.
7. Do not operate (move) vehicles about the ship without a vehicle director present. Vehicle director assistants shall be stationed at locations where potential traffic hazards exist, such as intersections, ramp approaches, or departure points.
8. Do not back vehicles without supervision from ground guides stationed to one side and to the rear of the vehicle being backed.
9. Use traffic guides at ramps and watertight doors to clear the area of unnecessary personnel, and to warn personnel of oncoming vehicles, when moving vehicles through the various levels and holds of the ship.
10. Operate vehicles with lights on.
11. Only one vehicle may transit a ramp at any time.
12. Secure cargo loaded within vehicles to prevent movement and shifting.
13. Operate vehicles in low range only and, when possible, in maximum wheel drive mode.
14. Remain clear of engine exhaust.
15. Take care to avoid the presence of loose paper within the RO/RO areas. These papers can be sucked into the ventilation system, blocking airflow and allowing the buildup of noxious gases.
16. All personnel working in vehicle operating areas MUST wear hearing protection.

Q.15) List the precaution to be taken for safe stowage and securing of vehicles on RO-RO ship.

Ans:-

Precautions to be Taken for Safe Stowage and Securing

- The stowage/securing arrangements of units should be supervised by a responsible Ship's Officer assisted by at least one other competent person.
- Vehicles should, as far as possible, be aligned fore and aft, with sufficient distance between vehicles so as to allow access through the vehicle deck.
- The parking brake on each vehicle/unit should be applied and where possible the unit should be placed in 'gear'.
- Where drop loads or uncoupled units are being carried these should be landed on trestles or equivalent support, prior to being secured by chain or other suitable securing constraint
- All vehicle/cargo units should be secured prior to the vessel leaving the berth and such securing should be at the master's discretion to be most effective.
- While on route these lashings should be regularly inspected to ensure they remain effective during the time at sea. It should also be realized that personnel so engaged on vehicle deck inspections should take extreme caution against injury from swaying vehicles. As such,
 - Masters may feel it appropriate to alter the ship's course while such inspections are ongoing to reduce the motion on the vehicle deck.
- Vehicles intended for the carriage of cargo in sea transport shall be in sound structural condition and have an adequate number of securing points of sufficient strength. These shall be so as to withstand the forces, in particular the transverse forces, which may arise during the sea transport. The stowage of vehicles and trailers shall be in accordance with CSM.
- The maximum securing load, MSL, of lashings should not be less than 100 kN. Lashings are attached to the securing points with hooks or other devices so designed that they cannot disengage from the aperture of the securing point if the lashing slackens during the voyage. Lashings should be attached to the securing points on the vehicle in such a way that the angle between the lashing and the horizontal and vertical planes lies preferably between 30° and 60°.
- Road vehicles should be stowed so that the chassis are kept as static as possible by not allowing free play in the suspension of the vehicles. Where jacks are used on a vehicle, the chassis should be strengthened in way of the jacking-up points and the position of the jacking-up points should be clearly marked. Vehicles with diesel engines should not be left in gear during the voyage. Parking brakes, where provided, of each vehicle or each element of a combination of vehicles shall be applied.
- Wheel-based cargoes, which are not provided with rubber wheels or tracks with friction increasing lower surfaces, should always be stowed on wooden dunnage or other friction increasing material such as soft boards, rubber mats, etc. The brakes of a wheel-based unit, if so equipped, should be set. The wheels of wheel-based cargoes should be blocked to prevent shifting.
- To prevent any lateral shifting of wheel-based cargoes not provided with adequate securing points, such cargoes should, where practicable, be stowed close to the ship's side and close to each other, or be blocked off by other suitable cargo units such as loaded containers, etc. Any movable external components attached to a wheel-based unit, such as derricks, arms or turrets should be adequately locked or secured in position.

DAMAGE TO CARGO SPACES – INSPECTION & REPORTING / CARGO GEAR INSPECTION



YouTube : SMART MARINER

Prepared by : Anupam Singh Rajput

(10) **DAMAGE TO CARGO SPACE-INSPECTION & REPORTING/CARGO GEAR INSPECTION**

Q.1) Write a short note on Dock safety regulation (7 times) (Marks 15)

- Ans:-
- These rule may be called the Dock Workers, (Safety, Health and welfare) Rules, 1990.
 - The Regulation's primary objective is to ensure that safe work environment are provided to the labours/crew on-board as well as in port.
 - For a port, an inspector is appointed whose duty is to make examination of the ship's/dock lifting appliances, loose gear, lifting device, staging, transport equipment, warehouse or other premises used or to be used for any dock work.
 - He examines document related to dock workers employment.
 - He has power to hold an enquiry in case of any accident or dangerous occurrence which he has reason to belief has caused due to failure of lifting appliance/devices or loose gear, transport equipment etc.
 - This regulation aim on creating a safe work place on-board as well as on dock.
 - It requires ship owners/port authorities to look into any hazards which are likely to occur.
 - It requires ship owner/port authorities to provide precautionary measures like clearance of passage (clear from loose gears etc), providing railing and fencing at dangerous areal (booty hatch, cargo hold, stairway etc), illumination on deck as well as on jetty etc.
 - It requires a supply of life-saving appliances to be kept in readiness on the wharf or quay.
 - It requires a suitable and sufficient fire fighting equipment to be placed where dock workers are employed.
 - It requires every lifting appliances and every item of loose gear shall be clearly marked with its safe working load.
 - It requires that winches and crane operators should be competent, reliable, medically fit and should not be less than 18 years of age.
 - Penalties: The person responsible to comply with this regulation, if commits any breach of regulation shall be called as an offence and he/she will be punishable with imprisonment upto 6 month or fine upto 5000 rupees or with both.

in regard to the
affected hazard

Q.2) With reference to dock labour regulation, define (15 marks)

(i) Authorized person (5 times)

Ans:- Authorized person means a person authorised by the employer, master of the ship or responsible person to undertake a specific task which hold necessary technical knowledge and experience for undertaking the task.

(ii) Competent person (5 times)

Ans:- Competent person means

- a person who is approved by the chief inspector for the purpose of testing, examination or annealing and certification of lifting appliances, loose gears or wire ropes.
- or any other person who is recognized as competent for issuing certificates in other countries under the relevant regulation in force adopted by International Labour conference.

(iii) Responsible person (5 times)

Ans:- A responsible person is one who can be trusted to act without needing strict supervision, because they are accountable for their own behaviour.

- It is also a person appointed by the employer, master of the ship, owner of the gear or port authorities.
- It is a person responsible for performance of a specific duties for which he/she has sufficient knowledge and experience.

Q.3) List all checks you will do prior putting a cargo gear for use for lifting heavy lifts. (7 times) (10 Marks) (* This come with Q. NO.1)

Ans:- **1. Keep the Load Below Safe Working Load Value (SWL):** Ensure to operate all the lifting equipment below their Safe Working Load Value (SWL) marked on the lifting equipment body. The only time the SWL of any lifting equipment is allowed to be crossed the limit is during load testing.

2. Appropriate Certificates: All lifting appliances on ships must have valid certificates which are certified by a competent shore body. These certificates ensure that the lifting equipment are in the right condition to carry heavy loads.

- 3. Only the Right Person Should Operate the Equipment:** Only the most responsible personnel onboard having the right knowledge and skills should operate the lifting equipment. Also, enough number of crew must be provided for assisting the lifting operation.
- 4. Know the Equipment:** The operator must know the switches and automation involved in lifting equipment along with the radius and height covered by the swinging arm and boom. He/she must also know the maximum amount of load the equipment is allowed to carry.
- 5. Efficient Lubrication:** Ensure that all the required parts of the lifting equipment are well lubricated and hydraulic oil is at the minimum marked level.
- 6. Check the Wires:** The wire of the lifting appliances must be checked and renewed at required intervals of time. Wire deformation, corrosion, stranding etc. must be checked and if the defects require repair, the wires must be renewed before using the lifting gear.
- 7. Use the Securing Clamp:** Ensure that the securing clamp is fitted in the hook whenever a load is lifted in order to avoid slippage. Also, check that it is also provided with a spring loaded system, which will not open even when the load exerts pressure on the hook.
- 8. Check the Weight of the Load:** It is the duty of the ship operator to check and confirm the load of the object to be lifted. It's a general practice to self-estimate the load of an object with only visual check.
- 9. Check the Predicted Path:** Check the predicted path of the load when shifting the load by the crane for any obstruction. The planned path of cargo movement must be cleared before the load is hooked to the crane.
- 10. Check for Cracks in the Base:** The load bear by the lifting equipment is transferred to the ships structure via foundation. Check the base/ foundation of the lifting equipment for any kind of cracks or deformation to avoid material failure.
- 11. Check Proper Lighting:** Ensure that the crane area, including the load shifting path is well lit. Moreover, the rays from any of the light fittings in the vicinity should not impair the vision of crane operator or the signal man during the lifting operation.



Q.4) Explain the need for periodical inspection and load testing of cargo gear.
How frequently should such ~~such~~ inspections and tests be conducted. (4 times)

Ans:-

1. It is a requirement of the ISM system that lifting gear is correctly maintained and inspected at regular intervals.
2. There are two basic requirements when maintaining cargo gear:
To keep the equipment in good safe working order and
To keep the supporting documentation in good order.
3. Before Arrival in port, inspection are required to ensure that they comply in every respect with the requirements on the flag state and of the port to be visited.
4. The purpose of an inspection is to find out whether there is any item having abnormal wear and tear, malfunction, oil leakage, overheating, corrosion, unusual noise, dislocation, visual cracks, misalignment, overloading, abnormal slackening or elongation, and excessive vibration, etc.
5. If found any damage, the necessary subsequent remedial actions should be taken such as repair and replacement of the defective parts, or to stop the lifting appliance or lifting gear from further use if a critical condition exists.

Frequency of inspection.

- (1) Before being taken into use for the first time or after It has undergone any repairs liable to affect its strength or stability and also once at least in every five years, all lifting appliances including all parts and gears thereof, whether fixed or moveable, shall be tested and examined by a competent person in the manner set out In Schedule I.
- (2) All lifting appliances shall be thoroughly examined by a competent person once at least in every 12 months. Where the competent person making this examination forms the opinion that the lifting appliance cannot continue to function safely, he shall forthwith give notice in writing of his opinion to the owner of the lifting appliance or in case of lifting appliance carried on board a ship not registered in India, to the Master or officer-in-charge of the ship.
- (3) Thorough examination for the purpose of this regulation shall mean a visual examination, supplemented if necessary by other means such as hammer test, carried out as carefully as the conditions permit, in order to arrive at a reliable conclusion as to the safety of the parts examined; and if necessary for this purpose, parts of the lifting appliance and gear, shall be dismantled.

Q.5) As per dock labour act, define

- i) **Lifting Appliances** - "Lifting appliance" means all stationary or mobile cargo handling appliances including their permanent attachments such as cranes, derricks etc used on shore or on board ship for shifting, loading or discharging cargo or moving them from one position to another.
- ii) **Dangerous Cargo** - A dangerous good (also known as hazardous material or hazmat) is any substance or material that is capable of posing an unreasonable risk to health, safety and property when transported in commerce. Identifying dangerous goods is the first step to reduce the risks posed by the product with proper packaging, communication, handling, and stowage.

Q.6) Write contents and endorsement of chain register. (5 times)

- Ans:-
- It is a booklet called form 99, in an approved format which is to be maintained upto date as per requirement of dock safety regulation and endorsed & signed by a competent person as required.
 - It contains certification of tests and registers all reports of examination of load bearing machinery, chains and wire ropes before they put in use.
 - The tests, examinations and inspections indicated in this register are based on the requirement of ILO convention.
 - It is intended to ensure that ships having lifting appliances are certified by a competent person.

The contents of chain register:

- | | | |
|---------------------------|---------------------|-----------------------|
| • Cover: 1) Name of ship. | 4) Port of Registry | 7) Date of Issue |
| 2) Official number | 5) Name of owner | 8) Issued by |
| 3) Call sign | 6) Register No. | 9) Signature & stamp. |
- Part I: It contains entries concerning four yearly examinations and annual examinations.
 - Part II: It contains entries concerning thorough annual examination of cranes, winches and hoist.
 - Part III: It contains entries concerning thorough annual examination of gear exempted from annealing.
 - Part IV: For entries concerning the annealing of gear.
 - The last page contains some recommended factor of safety.
 - e.g. chain/wire = 5
 - Rope = 6
 - Derrick = 9
 - Test certificates are attached to the register by means of gummed strips provided on the inside of the cover.
 - The register is designed by dockyard for 8 years and it must be retained on-board for a period of 4 years after the new one came into force.

X

Q. 7) Explain how & why ^{stevedore} damage report shall be made and what is the purpose it serve. (OR) How would you make a stevedore damage report. (4-times)

Ans :-

WHY

In case a hull damage accident has occurred due to stevedores, the Master and Chief Officer need to take necessary measures.

If possible, the Master should try to have the stevedores repair the damaged portion to restore it to the original state before departure.

If any damage has affected the vessel's seaworthiness, the Master will not depart from the port until suitable repairs are carried out. Moreover, a Class Survey has been done as necessary.

Action to take on observing damage must be documented in accordance with the relevant clauses in the charter party.

All parties concerned must be notified immediately i.e charterers, stevedores, agents, managers etc.

As much information as is available is to be included in this type of report to assist in any claims which may have to be made against third party.

In this connection it is the master's responsibility to impress upon the officer on watch the importance of being diligent w.r.t damage caused by stevedores to ship's structure and or cargo, and to report such damages immediately to chief officer who is to initiate the appropriate damage report.

It is the master's responsibility to notify the parties concerned and to obtain an acknowledgment of receipt of damage report from these parties.

HOW

The responsible person incharge must prepare a report, which as a standard should contain details regarding:

- Name of vessel,
- Name of owner/manager/charterer,
- Voyage details,
- Position or port of incidence,
- Date & time of incident/damages caused,
- Bill of lading (if relevant)
- Kind/type and location of damage w.r.t ship's frame no. or any other relevant marks. Approximate volume of cargo or persons injured and estimation of extent of damages caused
- Possible causes of damages or loss
- Limit any report to facts only, no personal opinions
- Do not give an opinion, especially in the accident report that who was responsible
- Don't allow crew members to express opinions towards third party outside the vessel
- Do not already admit any liability either verbally or in writing
- Do not sign a document which you know contains incorrect information
- Do not think the problem will go away if you don't do anything
- The report should be conveyed to the company immediately

Q-8)

How will you ensure the water/weather tightness of hatch cover? (4 times)

Ans:-

(a) Hose water Test:

- In this test a water spray from a nozzle of 12mm diameter is sprayed over the joint of hold and cover from a distance of 1m to 1.5 m with a pressure of 0.5 m/ second water jet.
- The limitation or drawbacks of this test is that it requires two persons and hatch cover to be tested must be empty.
- The leakage if very minimal cannot be identified by naked eye and cannot be performed in sub zero or cold weather.

(b) Ultrasonic Test:

- The Ultrasonic testing is a more accurate method of testing water tightness of hold and its cover.
- In this system an ultrasonic generator is kept inside a closed and intact cargo hold.
- A sensor of that unit is passed all over the compression joint and any low pressure area or point detected by the instrument can be a leakage point.
- Few drawbacks of this instrument is it is not normally kept onboard and qualified person is required to perform this test.

(c) Chalk Test:

- This is the oldest or most traditional method for testing hold cover compression, but it cannot test the water tight integrity of the hold.
- A layer of chalk powder is applied all over the steel back of the hatch and then the hatch cover is closed and tightened to its normal values.
- The impression of chalk on the rubber packing is then studied to check lack of compression point shown by gap in the chalk marks.

Maintenance for Hatch Covers

Hatch covers of cargo hold are generally made from light weight steel or high tensile steel. They are fitted over a steel bar of the hold with a rubber packing inserted in between them to avoid water ingress.

A proper routine maintenance to be performed by qualified officer on ship which must includes-

- Examination of hatch cover, hatch beams for corrosion, cracks and material failure
- Keep Cleats, hauling wire, rollers, chains and wedges in operational condition at all time
- Keep clean hatch cover tops and all drainage holes to be kept clear
- Look for any broken or missing gasket and replace it immediately. The length of renewed gasket must be minimum 1 m
- Before renewing rubber gasket, check and rectify steel to steel fault
- Gasket rubber to be of approved type by class
- Grease all the moving parts
- Check for any hydraulic system leakage if cover is oil operated
- Oil test to be performed for hydraulic system
- Call surveyor after any major repair in the cover and its concerned parts

Q.9) Explain the causes of corrosion in cargo and ballast tank.

Ans:- The main factor influencing corrosion rates on board are:-

- temperature
- percentage of frequency of ballasting/detballasting.
- moisture content of empty tank
- temperature of cargo or fuel in adjacent tank.
- Cathodic protection, design and anode distribution.
- Coating type and application, including steel surface preparation.
- maintenance of corrosion protection system.
- structural design of ship & tank
- frequency and method of tank washing.
- clean or dirty ballast.
- cargo type and composition, including contamination.
- use and type of inert gas.
- trade speed and sailing route.

Q.10) What is the purpose of 'enhanced survey programme' and when ships are required to adopt this survey? (4 times)

Ans:- IMO adopted a resolution A.744(18) in "1994 SOLAS conference" with guidelines on the Enhanced survey programme for inspection and surveys of bulk carrier and tankers.

Requirement
When ships are required to adopt

Enhanced survey is required for bulk carriers of 10 years and above & tankers of 15 years and above.

purpose

• Since, at this (vessel's) age, the structural integrity may be effected because of corrosion, wastage of ship's structure are likely inside cargo/ballast spaces, and there are need for close up inspection including thickness measurement, and repairs or renewals of wasted structures are carried out.

• This way the older ship will continue service in good condition and will not be at risk of accident due to sudden failure of any structure which would have gone unnoticed otherwise.

• The main purpose is to maintain the safety of the ship while at sea or at port.

Also detail the procedure, planning, documentation and report of ESP?

• Enhanced Survey Programme is a guideline for shipping companies and owner to prepare their ship for special surveys to maintain the safety of ship while at sea or at port.

procedure • A survey programme is to be prepared by the owner and is to be submitted to the recognized authorities like classification societies, 6 month prior to the survey.

planning • Enhanced survey programme is developed in such a way that it can be integrated with other surveys such as annual survey, intermediate survey, Dry dock survey and renewal survey.

ESP is conducted to check the water-tight integrity of ship by inspecting the following areas of the ship:

- Close-up survey of the structures such as shell frames, bulkheads etc.
- Thickness measurement of hull
- Inspecting and testing of cargo tanks
- Inspecting and testing of ballast tanks
- Inspecting and testing of Hatch cover and coamings.
- Inspecting and testing fuel oil tanks, side and double bottom tanks.

In ESP, the basic checks are:

- Ship's structural damage or deformation
- corrosion
- condition of hull
- Pitting
- condition of coating
- watertight integrity of ship.

* After the survey, following reports are made by the inspector, who copies are to be kept and maintained on-board as part of necessary documentation:

- Reports of structural surveys
- Condition evaluation reports.
- Thickness measurement reports.