2014

MEO CLASS 4 SAFETY(COSCPOOL)ORAL PREPARATION FILE PART 3

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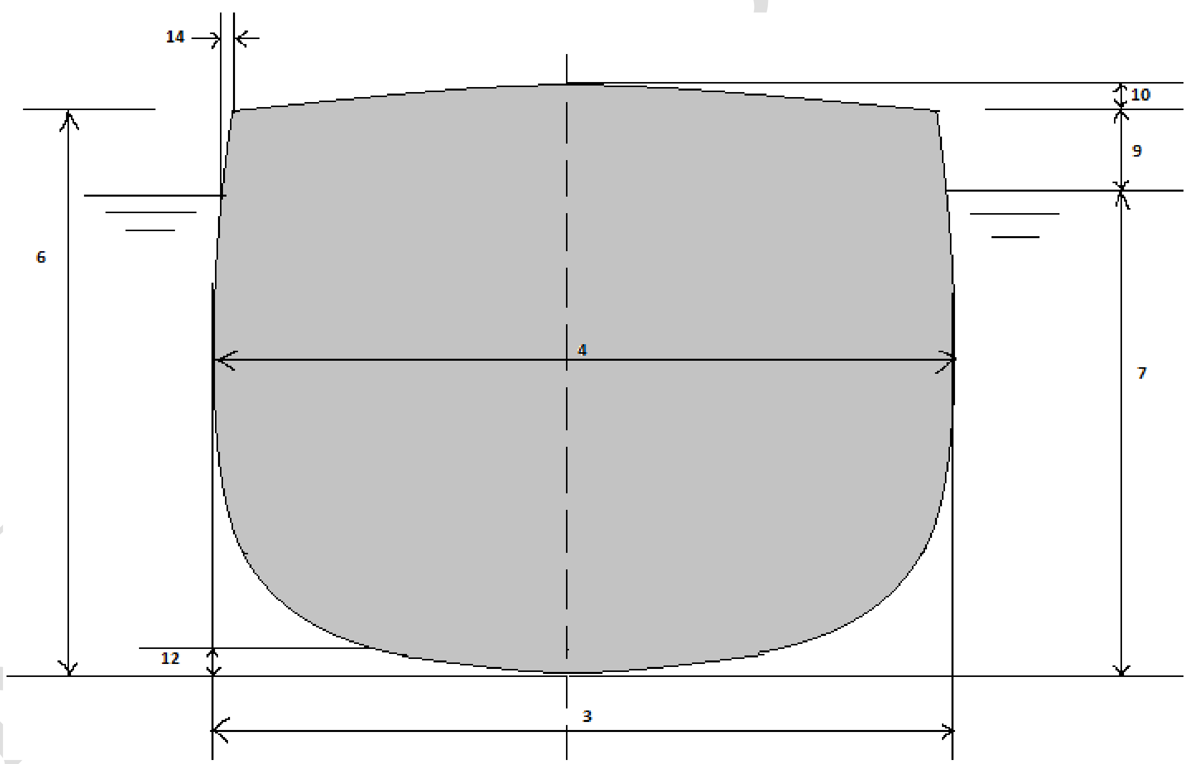
03-MAR-14

NAVAL ARCHITECTURE & SHIP CONSTRUCTION

Q 30: Basic Defination which are generally asking by surveyor?

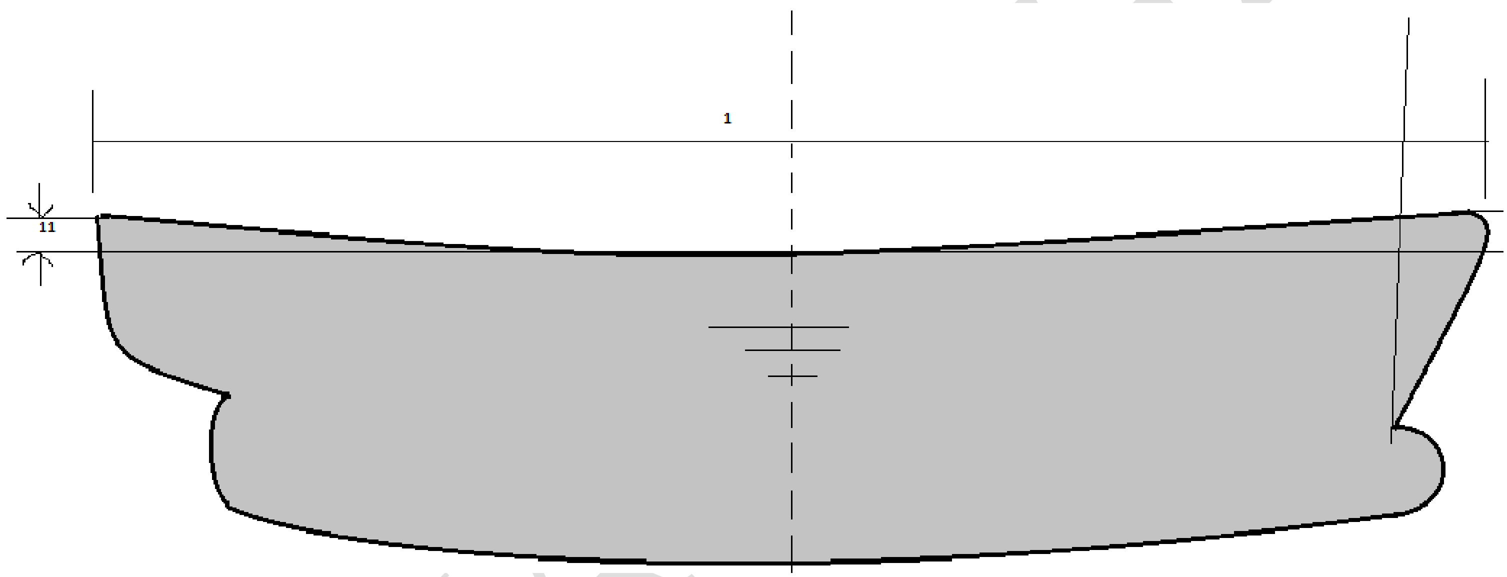
A 30:

1. **Length overall** :The distance from the extreme fore part of the ship to a similar point aft and is the greatest length of the ship. This length is important when docking.
2. **Length between perpendiculars :**The fore perpendicular is the point at which the Summer Load Waterline crosses the stem.
   The after perpendicular is the after side of the rudder post or the centre of the rudder stock if there is no rudder post.
   The distance between these two points is known as the length between perpendiculars, and is used for ship calculations.
3. **Breadth extreme :**The greatest breadth of the ship, measured to the outside of the shell plating.
4. **Breadth moulded :**The greatest breadth of the ship, measured to the inside of the inside strakes of shell plating.
5. **Depth extreme :**The depth of the ship measured from the underside of the keel to the top of the deck beam at the side of the uppermost continuous deck amidships.
6. **Depth moulded :** The depth measured from the top of the keel.



7. **Draught extreme :** The distance from the bottom of the keel to the waterline. The load draught is the maximum draught to which a vessel may be loaded.
8. **Draught' moulded :** The draught measured from the top of the keel to the waterline.

9. **Freeboard:** The distance from the waterline to the top of the deck plating at the side of the deck amidships.
   Freeboard represents the safety margin showing to what depths a ship may be loaded under various service conditions—e.g., the type of cargo, the waters to be navigated, and the season of the year.
   Purpose of Freeboard
   - To ensure that she can not be loaded beyond her strength.
   - To provide ship with adequate Reversed Buoyancy
   - To keep the deck high enough from water, to enable the crew to navigate and handle her in all weather condition.



10. **Camber or round of beam:** The transverse curvature of the deck from the centreline down to the sides. This camber is used on exposed decks to drive water to the sides of the ship. Other decks are often cambered. Most modern ships have decks which are flat transversely over the width of the hatch or centre tanks and slope down towards the side of the ship.
11. **Sheer:**The curvature of the deck in a fore and aft direction, rising from midships to a maximum at the ends. The sheer forward is usually twice that aft. Sheer on exposed decks makes a ship more seaworthy by raising the deck at the fore and after ends further from the water and by reducing the volume of water coming on the deck.

12. **Rise of floor:** The bottom shell of a ship is sometimes sloped up from the keel to the bilge to facilitate drainage. This rise of floor is small, 150 mm being usual.
13. **Bilge radius:** The radius of the arc connecting the side of the ship to the bottom at the midship portion of the ship.

14. **Tumble home:** In some ships the midship side shell in the region of the upper deck is curved slightly towards the centreliie, thus reducing the width of the upper deck and decks above. Such tumble home improves the appearance of the ship.
15. **ARCHIMEDES' PRINCIPLE:** If a solid body is immersed in a liquid there is an apparent loss in weight. This loss in weight is the upthrust exerted by the liquid on the body and is equal to the weight of the volume of liquid which the body displaces.
16. **Displacement:** When a ship is floating freely at rest the mass of the ship is equal to the mass of the volume of water displaced by the ship and is therefore known as the displacement of the ship.
17. **T.P.C:** The tonne per centimetre immersion (TPC) of a ship at any given draught is the mass required to increase the mean draught by 1 cm.

T.P.C: $$\frac{A_w \text{(waterplane area)} \times \rho}{100}$$

18. **Metacentre:** The point where a vertical line through a centre of buoyancy of an inclined ship intersects the vertical line through the centre of gravity when it is floating in equilibrium.
19. **Water plane area coefficient: (Cw):** is the ratio of the area of the waterplane to the product of the length and breadth of the ship.
20. **Midship section area coefficient (Cm):** the ratio of the area of the immersed portion of the midship section to the product of the breadth and the draught.
21. **Block coefficient (*Cb):*** is the ratio of the volume of displacement to the product of the length, breadth and draught.
22. **Prismatic coefficient (*Cp):*** is the ratio of the volume of displacement to the product of the length and the area of the immersed portion of the midship section.
23. **Wetted surface area:** The wetted surface area of a ship is the area of the ship's hull which is in contact with the water. This area may be found by putting the transverse girths of the ship, from waterline to waterline, through Simpson's Rule and adding about f per cent to allow for the longitudinal curvature of the shell. To this area should be added the wetted surface area of appendages such as cruiser stern, rudder and bilge keels.

DENNY's EQUATION $$S = 1.7Ld + \frac{\nabla}{d}$$

TAYLOR's EQUATION $$S = c\sqrt{\Delta L}$$

24. **Centre of gravity**: The centre of gravity of an object is the point at which the whole weight of the object may be regarded as acting. If the object is suspended from this point, then it will remain balanced and will not tilt.
25. **Centre of buoyancy**: the point through which the total force of buoyancy is considered to act.

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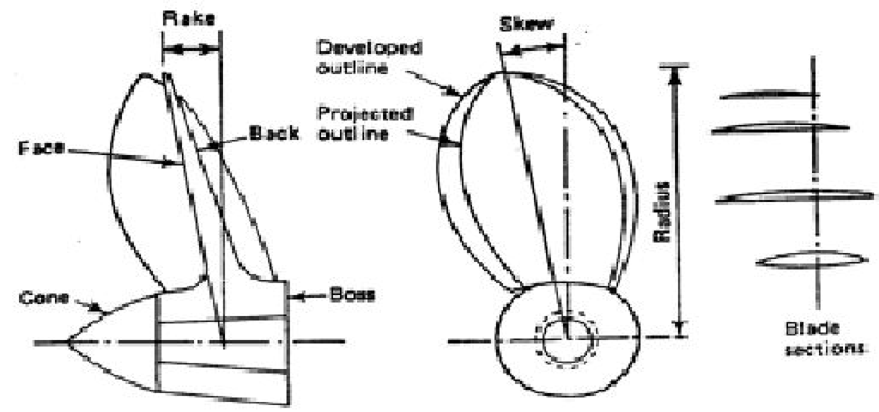
26. **Metacentric height**: distance between C.O.G and transverse metacenter (M).
27. **Pitch of propeller**: one revolution of the shaft the propeller will move forward a distance.
28. **Diameter of propeller**: diameter of the circle or disc cut out by the blade tips.
29. **Pitch ratio**: it is the face pitch divide by diameter.



30. **Theoretical speed (Vt)**: distance the propeller would advance in unit time if working in an ungielding fluid. Thus if the propeller turns N rev/min.

    Vt=P x N m/min

    $= \frac{\mathbf{P \times N \times 60}}{\mathbf{1852}}$ knots

31. **Wake**: water which is in motion at the stern of a ship as a result of a ship's movement, the moving water known as wake.
32. **Wake fraction**: ratio of the wake speed to the speed of advance.
33. **Speed of advance**: speed of ship relative to the wake is termed the speed of advance Va.
34. **Real slip or True slip**: difference between theoretical speed and the speed of advance.

    Real slip $= \frac{\mathbf{Vt - Va}}{\mathbf{Vt}} \mathbf{\times 100\%}$

35. **Skew**: offset of a propeller blade from the vertical in the plane od rotation, it is always a distance in the direction opposite to rotation.
36. **Slip**: the difference between the actual distance travelled by a ship and the theoretical distance given by the product of the propeller pitch and the no. of revolution. It is usually expressed as a percentage and can have a negative value if a current or following wind exists.
37. **Apperent slip**: the propeller work in water the ship speed V will normally be less than theoretical speed, or

    the difference between the two speed known.
38. **Longitudinal Centre of Flotation**: it is the point about which the ship will Trim when weight are loaded or discharged, if the weight added at L.C.F point, trim will not change only draft change.

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39. **Permeability (μ):** ratio of volume with the space which is assumed to be occupied by water to the total volume of that compartment. ***μ for M/C space: 85%, for accommodation: 95%, for cargo hold average: 60%***
40. **Buoyancy:** the upthrust exerted by the water on the ship. If the ship float freely the buoyancy is equal to the weight of ship.
41. **Reserve buoyancy:** it is the potential buoyancy of a ship and depends upon the intact watertight volume above the waterline of ship. If the mass added to ship or buoyancy lost due to bilging the reserve buoyancy is converted into buoyancy by increasing draught.
42. **Strake:** external hull of a ship consists of bottom shell, side shell and deck which are formed by longitudinal strips plating called strake. **Or** continue range of plate forming the side of vessel, **or** metal plate extending ship's hull from stem to stern.
43. **Bilge strake:** strake at the turn of the bilge called.
44. **Stealer strake:** No.of adjacent strakes fitted at the end of ship called.
45. **Garboard strake:** strake adjacent to the keel on each side of ship called.
46. **Sheer strake and its importance:** it is largest continue strake at the top og the side of vessel on maindeck. Or uppermost strake of side plating which meet the upper deck. It is 10-20% thicker than other side plating.

    IMPORTANCE: when vessel is bending to forces from tension to compression and sheer strake is subjected to maximum compressive and tensile stress. Which is contribute to the strength of the hull.
47. **Stringer:** the stiffners used to strengthening the sides surface of the ship called, without stringer the hull shape doesnot formed.
48. **Coffin plate:** used to connect stern frame to the flat plate keel.
49. **Shoe plate:** used to connect stem to the flat plate keel.
50. **Margin plate:** at bilges, the tank top may be either continued straight out to the shell by means of a tank margin plate. Which is water tight and set an angle of about 45^0 to the tank top and meeting the shell almost at right angle.
51. **Bulwark:** It is solid wall that extends above the weather deck or any other deck to exposed to weather and fitted for the safety of the crew. Atleast 1 m in height spacing of stays and is not exceed 1.2 m on the forecastle.

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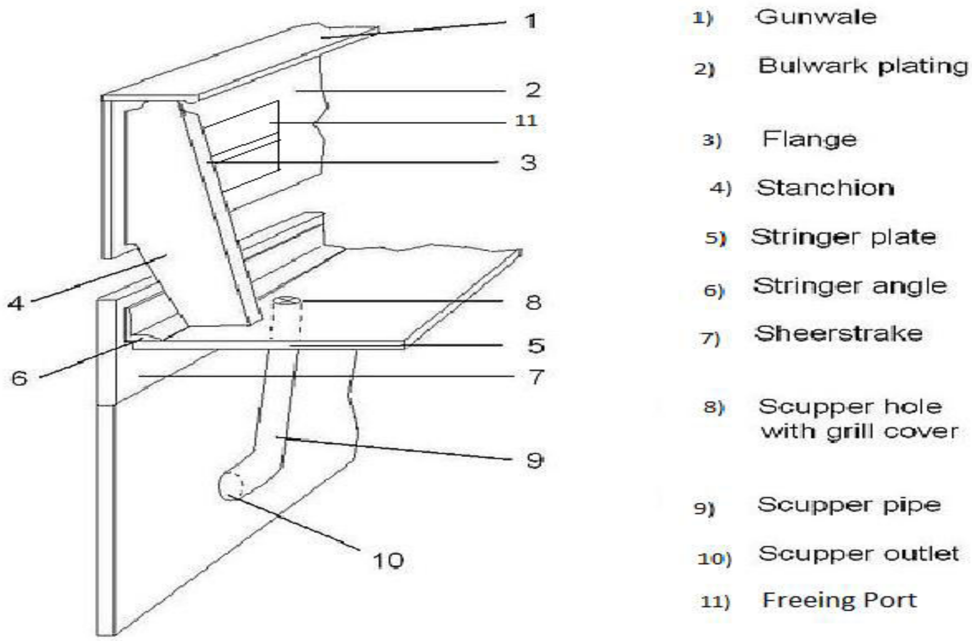

52. **Freeing port:** the area of freeing port on each side depend on the length of well deck, the lower edge of the port must be as near to the deck as possible and opening are to be protected by rails spaced approx. 230 mm apart. When hinged flaps are fitted the hings must be of non-corrodible.
53. **Gunwale:** the upper edge of a ship' s side where the sheer strake meets the deck plating called.
54. **Margin line**: is a line drawn at least 76 mm below the upper surface of the bulkhead deck at side.

It is the imaginary line, which is drawn 76mm below the uppermost continuous deck. It denotes the limit, up to which ship can be flooded/ loaded without sinking.

For a ship which has a continuous bulkhead deck, the margin line is to be taken as a line drawn not less than 76 mm below the upper surface of the bulkhead deck at side, except that where there is a variation in the thickness of the bulkhead deck at side the upper surface of the deck should be taken at the least thickness of deck at side above the beam.

If desired however, the upper surface of the deck may be taken at the mean thickness of the deck at side above the beam as calculated for the whole length of the deck, provided that the thickness is no greater than the least thickness plus 50 mm.

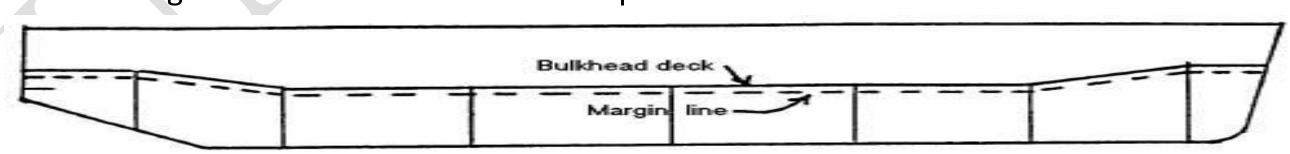

figure 2.1.2.1 a)

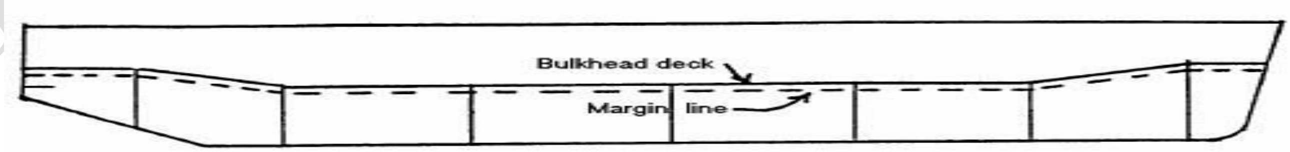

figure 2.1.2.1 b)

55. **Trsnsom space:** situated in S.G. room there you can find manhole door near Rudder Trunk this purpose is to inspect Rudder Trunk condition, Lubrication etc.. you can enter inside this place for carried out inspection in Port only and in calm weather or sea.
56. **Buttock line:** It is equidistant transverse section line from the midship to fwd of the ship, such that they give you the cross section are at various station at all possible draft and trim.
They are mainly used for knowing the light weight displacement at the time of end of construction phase of a ship.

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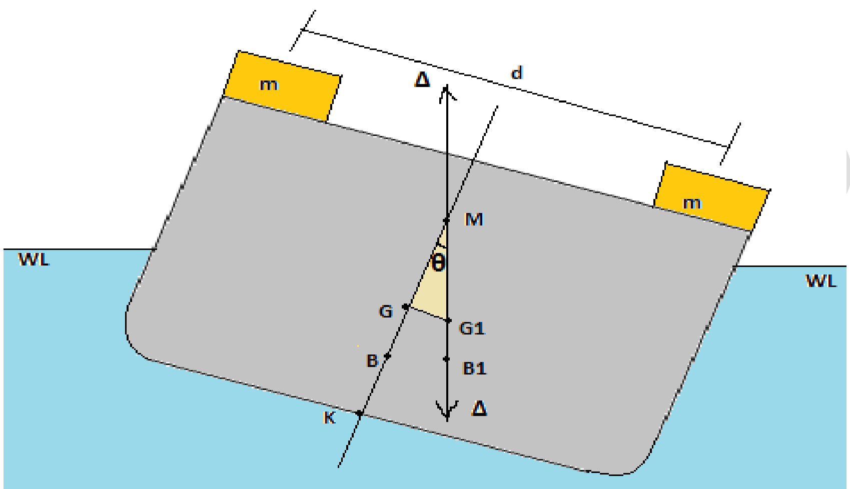
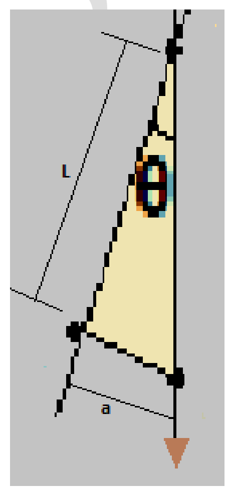
<u>Q 31: Explain inclining experiment? Why it is carried out? Define calculation? Draw tender and stiff ship?</u>

A 31:





INCLINING EXPERIMENT

- ***This is a simple experiment which is carried out on the completed ship to determine the metacentric height, and hence the height of the centre of gravity of the ship.***
- If the height of the centre of gravity of the empty ship is known, it is possible to calculate its position for any given condition of loading.
- It is therefore necessary to carry out the inclining experiment on the empty ship (or **as** near to empty as possible).
- The experiment is commenced with the ship upright.
- A small mass *m* is moved across the ship through a distance d.This causes the centre of gravity to move from its original position G on the centreline to G1.
- If A = displacement of ship

Then $GG_1 = \frac{m \times d}{A}$

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- The ship then heels to angle θ, when the centre of buoyancy moves from B to B1, in the same vertical line as G1. But the vertical through B1 intersects the centreline at M, the transverse metacentre.

$$GG_1 = GM \tan\theta$$

$$GM \tan\theta = \frac{m \times d}{\Delta}$$

$$GM = \frac{m \times d}{\Delta \tan\theta}$$

- To determine the angle of heel it is necessary to suspend a pendulum from, say, the underside of a hatch.
- The deflection a of the pendulum may be measured when the mass is moved across the deck.
- Thus if L = length of pendulum

$$\tan\theta = \frac{a}{L}$$

and

$$GM = \frac{m \times d \times L}{\Delta \times a}$$

- The height of the transverse metacentre above the keel may be found from the metacentric diagram and hence the height of the centre of gravity of the ship may be determined.

$$KG = KM - GM$$

How to conduct this experiment on board?

For this experiment we can use STABILOGRAPH

- The experiment must be carried out very carefully to ensure accurate results.
- At least two pendulums are used, one forward and one aft. They are made as long **as** possible and are suspended from some convenient point, e.g. the underside of the hatch.
- A stool is arranged in way of each pendulum on which the deflections are recorded.
- The pendulum bobs are immersed in water or light oil to dampen the swing.
- Four masses A, B, C and D are placed on the deck, two on each side of the ship near midships, their centres being as far as possible from the centreline.
- The mooring ropes are slackened and the ship-to-shore gangway removed. The draughts and density of water are read as accurately as possible.
- The inclining masses are then moved, one at a time, across the ship until all four are on one side, then all
  four on the other side and finally two on each side.
- The deflections of the pendulums are recorded for each movement of mass.
- An average of these deflections is used to determine the metacentric height.
- The experiment should be carried out in calm weather.

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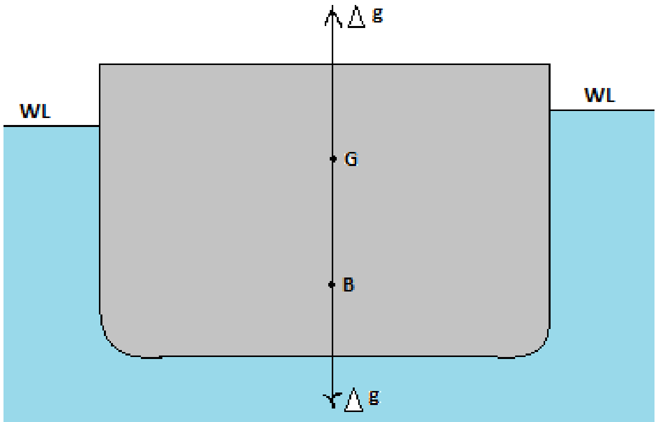
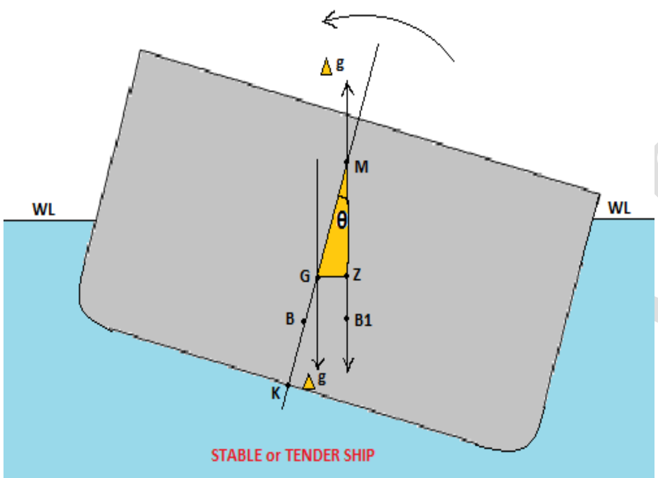
Q 32: Draw and explain equilibrium, tender, stiff ship?

A 32:



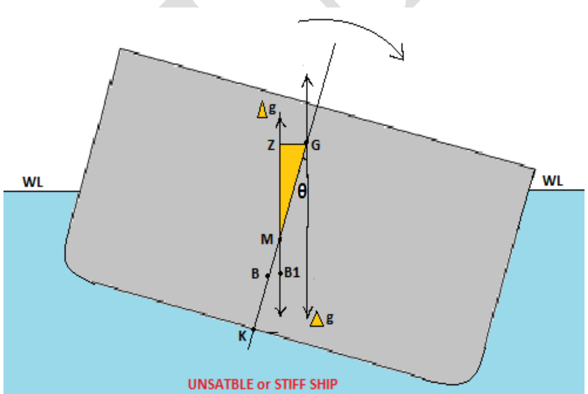
1) In the upright position **,** the weight of the ship acts vertically down through the centre of gravity G, while the upthrust acts through the centre of buoyancy B. Since the weight is equal to the upthrust, and the centre of gravity and the centre of buoyancy are in the same vertical line, **the ship is in equilibrium.**



2) When the ship is inclined by an external force to an angle θ,the centre of gravity remains in the same position but the centre of buoyancy moves from B to B1. The buoyancy, therefore, acts up through *B1* while the weight still acts down through G, creating a moment of Δ *g x* GZ which tends to return the ship to the upright. Δ g x GZ is known as the *righting moment* and GZ the *righting lever.*

Since this moment tends to right the ship the vessel **is said to be stable or tender ship**.

Tender ship*: small metacentric height GM, will have small Righting lever GZ, at any angle and will roll easily.*



GM is said to be POSITIVE when G is lies below M and vessel is stable.

3) If the centre of gravity lies above the transverse metacenter the moment acts in the opposite direction, increasing the angle of heel. The vessel is then ***unstable*** and will not return to the upright, the metacentric height being regarded as ***negative.***

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Stiff ship: *large metacentric height GM, will have large righting lever GZ, at any angle resistance to rolling.*

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Q 33: what is Free Surface Effect? And method to reduce it? How it will effect on GM?

A 33:

Free Surface Effect: When a tank on board a ship is not completely full of liquid, and the vessel heels, the liquid moves across the tank in the same direction as the heel.

- **C.O.G moves away.**
- **Reduce metacentric height GM.**
- **Reduce righting lever GZ.**
- **Increase angle of heel.**

RESULT: SHIP is UNSTABLE.

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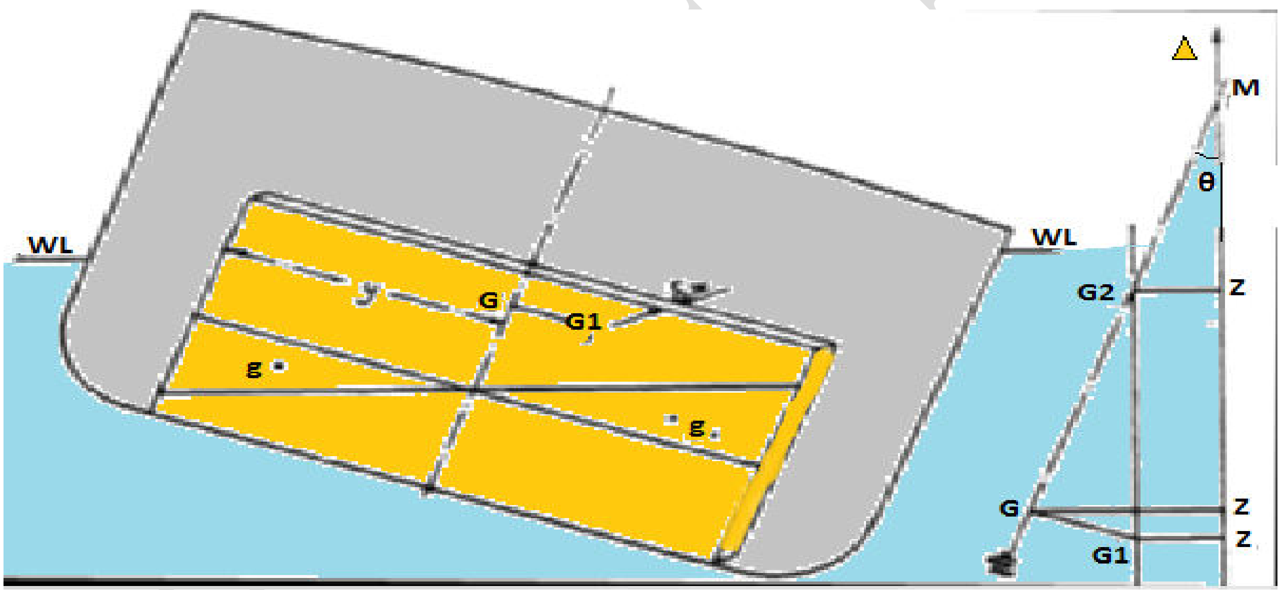
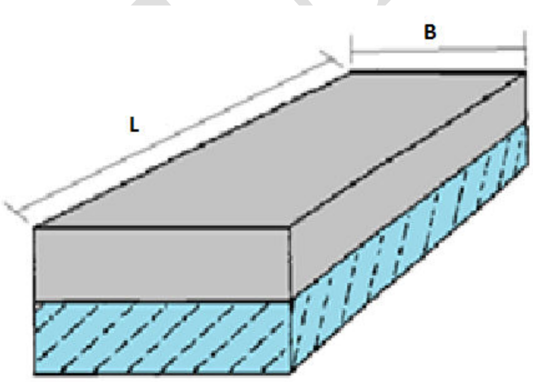
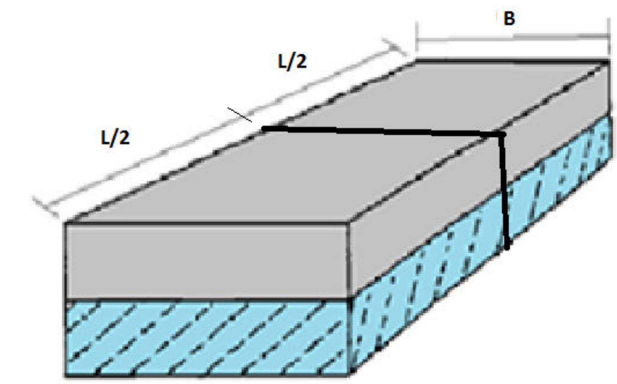




without division

without division

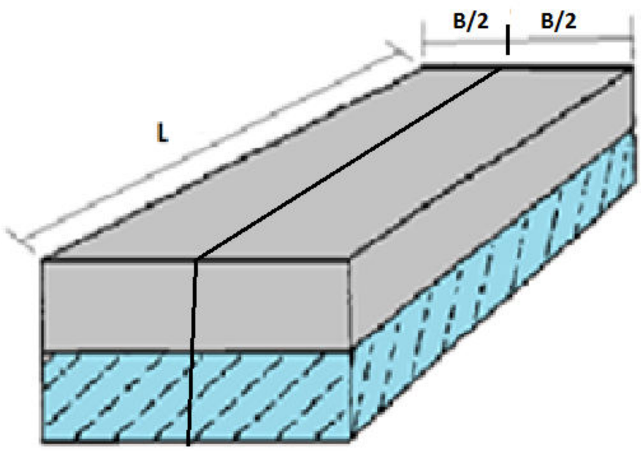
$$GG_2 = \frac{L\,B^3}{12\,\nabla}$$



with transverse division

With transverse division

$$GG_2 = \frac{L\,B^3}{12\,\nabla}$$



with longitudinal division

With longitudinal division

$$GG_2 = \frac{1}{4} \times \frac{L\,B^3}{12\,\nabla}$$

It may be seen that the F.S.E is still further reduced by the longitudinal division

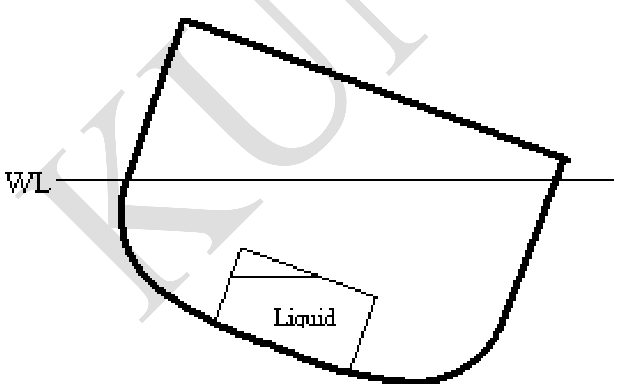
If a tank is subdivided by N longitudinal division forming equal tank, than

$$GG_2 = \frac{1}{(N+1)^2} \times \frac{L\,B^3}{12\,\nabla}$$

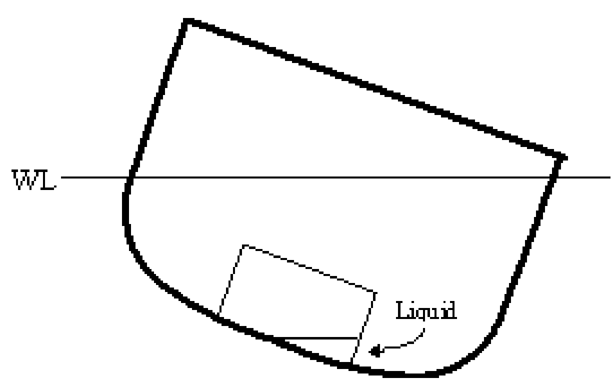
Another method for reducing F.S.E

POCKETING

- Free Surface Effect can be reduced, to some extent, by creating pocketing. Pocketing occurs when the surface of the liquid contacts the top or bottom of the tank, reducing the breadth (B) of the free surface area.



Pocketing with top of tank.



Pocketing with bottom of tank.

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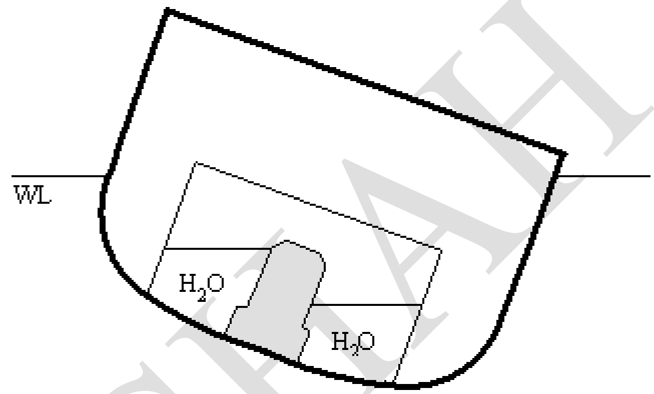
- Since the effects of pocketing can not be calculated, it is an indeterminate safety factor.
- The Free Surface correction will therefore indicate less overall stability than actually exists.

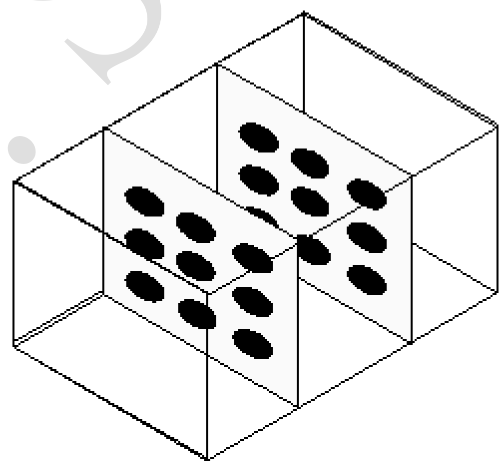
SURFACE PERMEABILITY

- Impermeable objects (engines, pumps, piping systems, etc) inside a flooded space project through and above the liquid surface.
- These objects inhibit the moving water and the "shifting of the wedge" may or may not be complete, thus reducing Free Surface Effect.
- The impermeable objects also occupy volume, reducing the amount of flooding water (movable weight) that can fill the space.



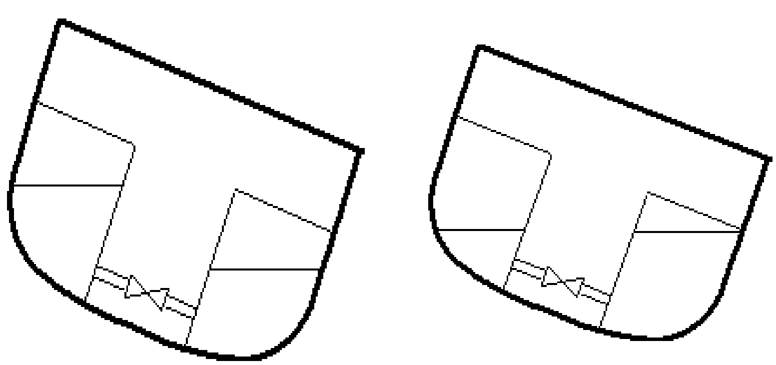
SWASH BULKHEADS (BAFFLE PLATES)

- In addition to some structural support, these bulkheads are designed to reduce Free Surface Effect.
- They are longitudinal bulkheads that hinder, but do not prevent, the flow of liquid from side to side as the ship rolls or heels.
- They are found in tanks, voids, double bottoms, bilges, etc.



SLUICE VALVES

- Sluice valves allow opposing tanks to be cross-connected.
- When large, partially filled tanks are connected, Free Surface Effect increases, and the vessel becomes less stable.
- Ships like oilers and tenders use these valves to create long, slow roll periods during ammunition handling and refueling



Sluice Valve Closed: **Sluice Valve Open:**

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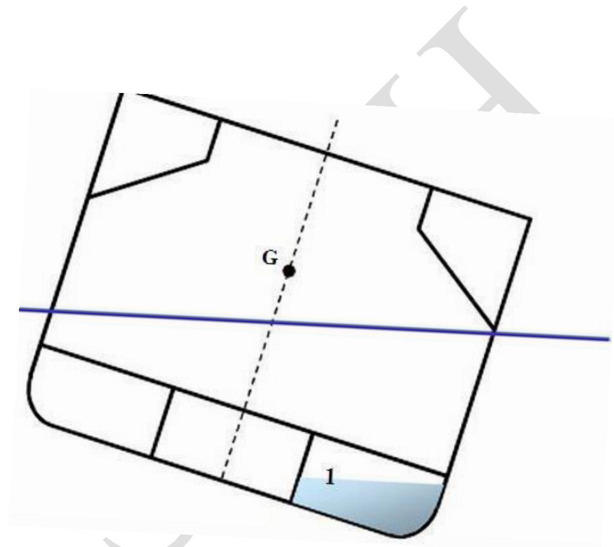
Q 34: Explain Angle of loll? How you will correct it? And lot more question asking from this theory.

A 34:

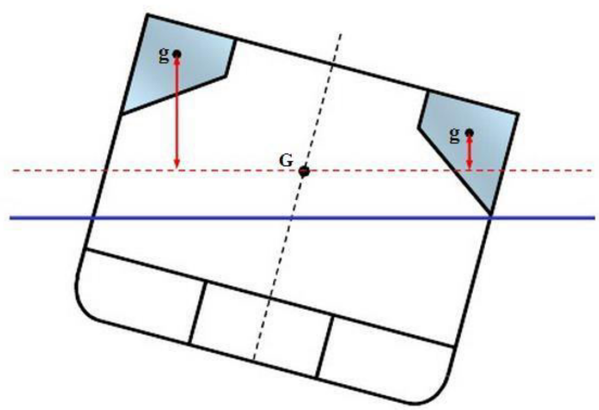
ANGLE OF LOLL



ANGLE OF LOLL:

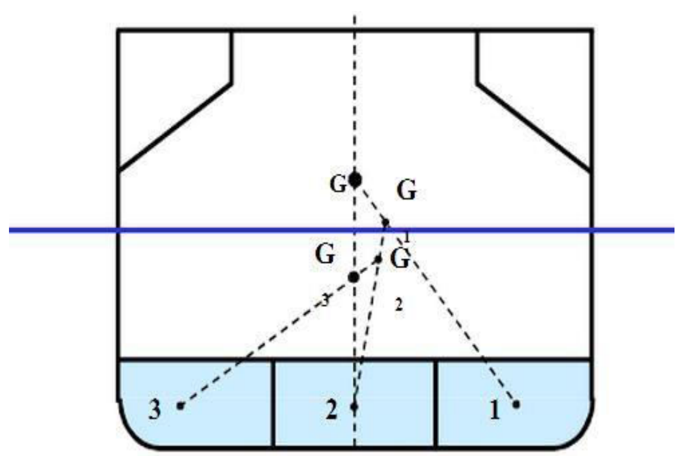
- **It is the angle at which the ship with initial negative Metacentric height will lie at rest in still water. If the ship is further inclined to an angle less than angle of loll, the ship will sink.**
- **An initially unstable ship heels to a certain angle and ends up in neutral stability. That angle is called angle of loll**

At angle of loll ., GM = 0 OR KG = KM



CORRECTIVE ACTION

- First check if the vessel is listed or lolled.
- Always presume it is lolled for safety and work accordingly.
- Calculate the vol of all tanks check for any slack tanks if any for the reason listed .
- If the port and starboard listing moments are same then confirm its lolled
- In a listed condition always try to lower the centre of gravity by discharging the high side of the ballast first
- start filling low side of the tanks (prefer smaller tanks to minimise free surface effect during filling) (coz if you fill the other side of the tank, the listing moment will be enough to capsize).
- gradually start filling the mid tank and then the port side tank.
- now the vessel should be upright , even if it is not ., try ballasting other tanks in the same method



WHERE DOES ANGLE OF LOLL OCCUR

- Occurs in timber carriers., - timber s on the deck absorb moisture and increases the COG.
- Moreover, while sailing, consumption of fuel and water from the lower tanks also increases the COG.

NOTE :- DURING LOLL – NEVER BALLAST THE HIGH SIDE OF THE TANK , BECOZ , THE SHIPS LISTING MOMENT TO THE OTHER SIDE IS ENOUGH FOR IT TO CAPSIZE

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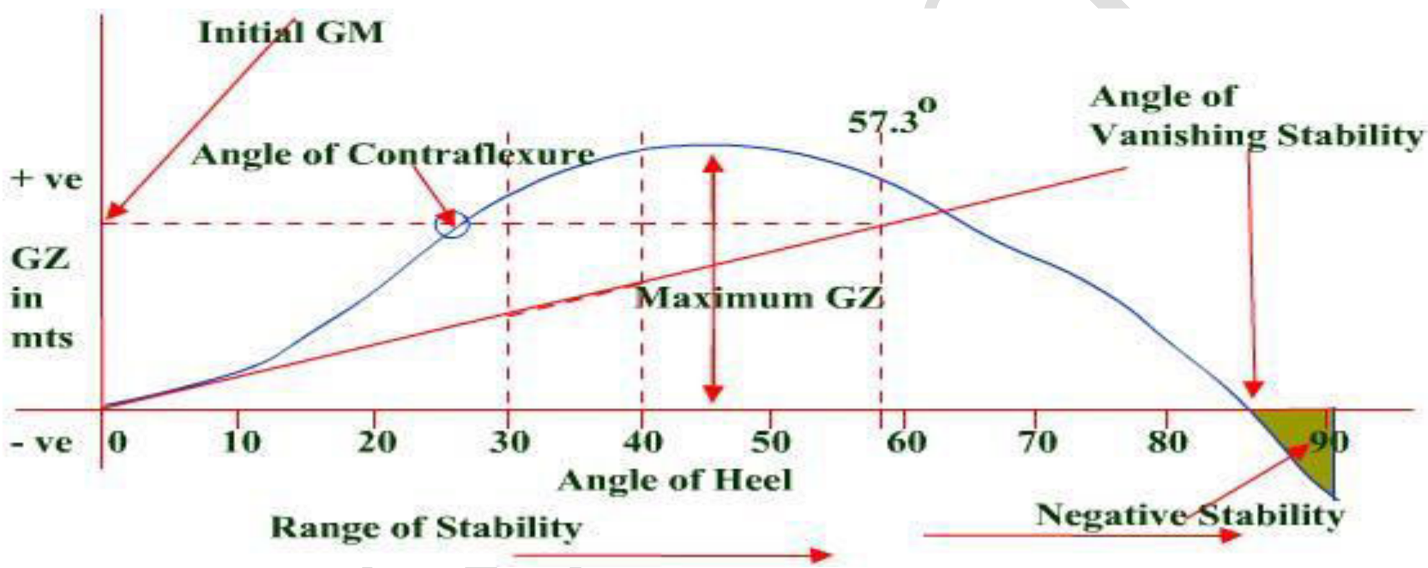
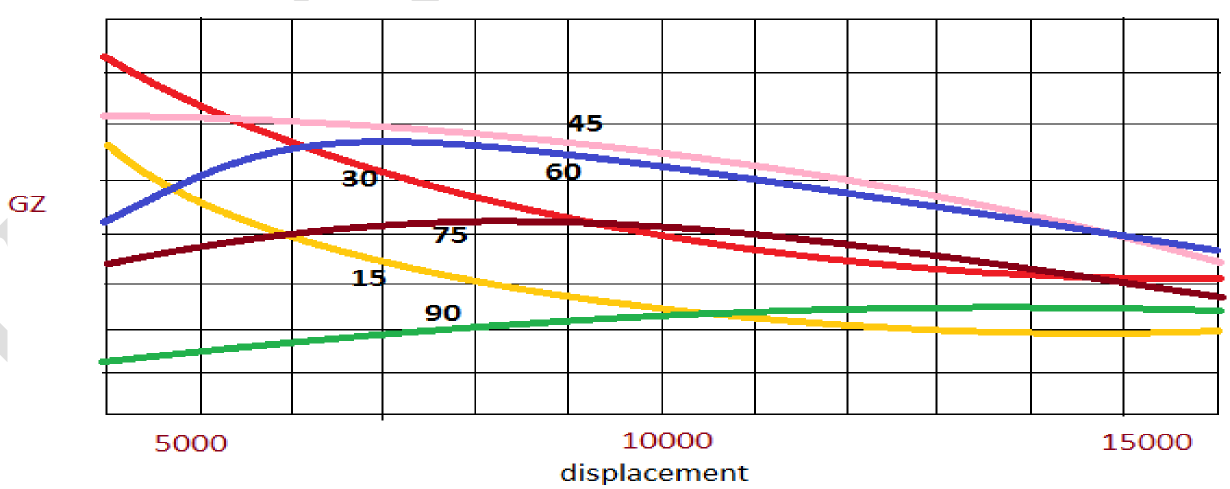
Q 35 : GZ and GM curves, Explain stability in it, at what angle will vessel lose its stability?

A 35:





CROSS CURVE OF STABILITY

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Cross curve of stability:

- To draw static stability curve with the help of Cross curve of stability, to plot Static stability curve we required value of GZ at various angle of heel.
- Cross curve of stability is nothing but curve by GZ angle of heel at various displacement.

GZ cross curves of stability:

- These are the set of curves from which the righting lever about an assumed center of gravity for any angle of heel at any particular displacement may be found by inspection.
- The curves are plotted for an assumed KG and if the actual KG of ship differs from this, a correction must be applied to the righting levers taken from the curves.

KN cross curves of stability:

- It has already been shown that the stability cross curves for a ship are constructed by plotting the righting levers for an assumed height of the centre of gravity above the keel.
- In some cases the curved are constructed for an assumed KG of zero.
- The curves are then referred to as KN curves, KN being the righting lever measured from the keel.

STATIC STABILITY REQUIREMENTS :

- The initial metacentric height GM should not be less than 0.15 m
- GZ should not be less than 0.2 m at heel = 30'
- Max righting lever should occur at angle of heel > 30' (in any ways not less than 25').
- The area under the GZ curve should be
  0.055 m rad upto heel = 30'
  0.09 m rad upto heel = 40'
  0.03 m rad between 30'<heel<40' or 30'<heel< Angle of downflooding

(angle of downflooding means = angle at which deck immersion takes place)

CURVES OF STATIC STABILITY :

- This curve is plotted for every voyage and its for a particular KG and displacement .
- FROM THIS CURVE YOU CAN FIND INITIAL GM
- A tangent drawn to the curve at initial point where it meets at 1 rad (that h = Initial Metacentric height)

ANGLE OF CRONTRAFLEXURE:

- The angle till which the rate of GZ increases with increase in heel. Though after this GZ may increase, the rate of increase is slower ANGLE AT WHICH MAX GZ occurs.

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ANGLE OF VANISHING STABILITY:

- Beyond which the vessel will capsize
- RIGHTING MOMENT AT ANY ANGLE CAN BE FOUND
  - GZ x Displacement

MOMENT OF DYNAMIC STABILITY AT ANY PARTICULAR ANGLE

= Disp X A where Displacement in tons and A in meter

(DYNAMIC STABILITY: Its nothing but the work done in heeling the ship to a particular angle)

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Q 36 : Explain about chain locker? Location of it?

Q 36 a: Explain bitter end and its location? How it is connected?

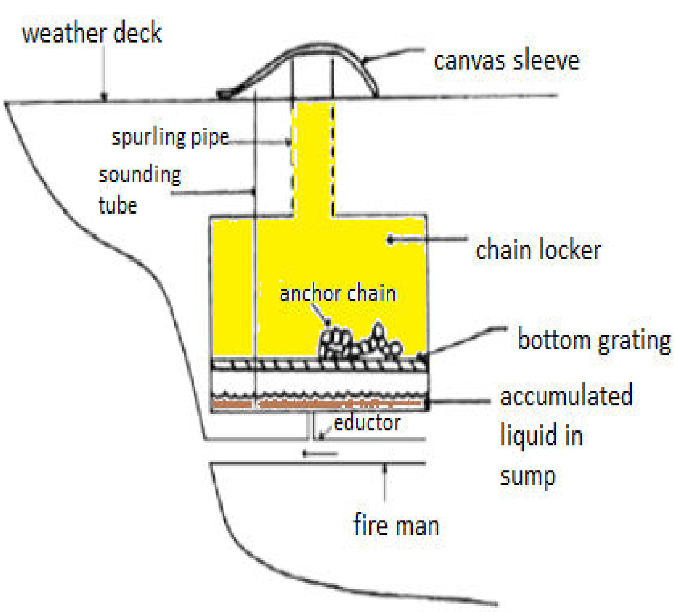
Q 36 b: Spurlingpipe and Hawspipe location?

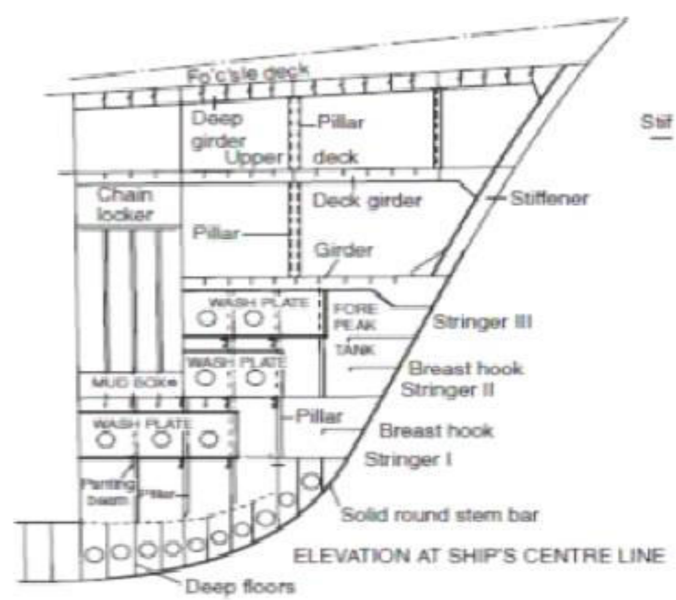
A 36, 36 a, 36 b:

CHAIN LOCKER

Location:

- *Fitted between upper and second deck, below second deck or in forecastle.*
- ***Usually FWD of the collision bulkhead.***
- *It is not carried out to ship side.*
- *It must have sufficie nt volume to allow adequate head room when the anchor are in the stowed position.*





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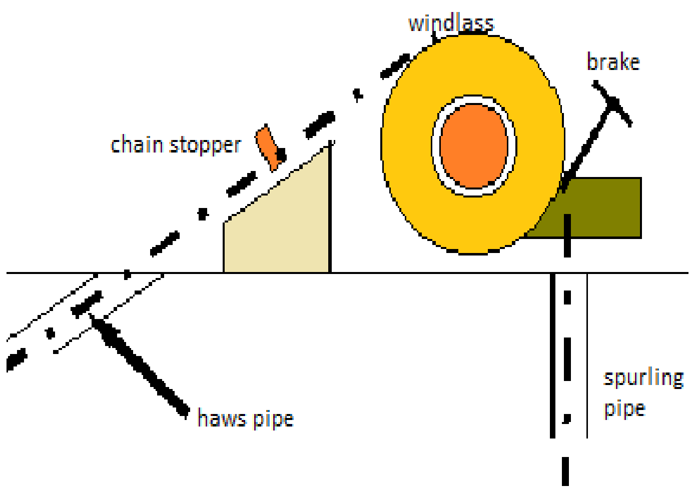

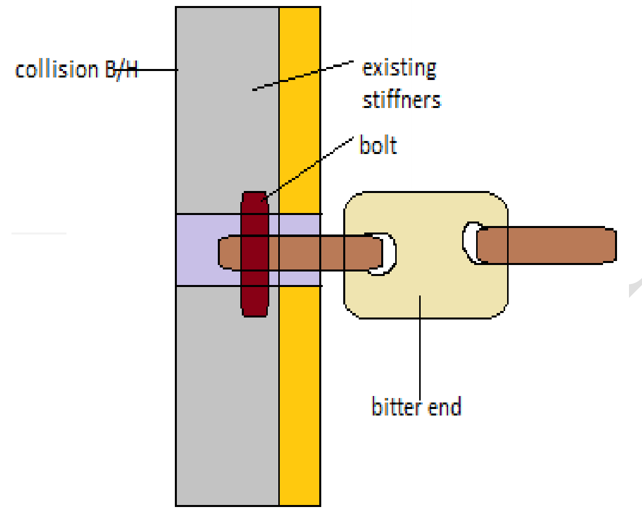

Connection and Construction:

- **Spurling pipe or Chain pipe connected chain locker to the deck.**
- **Haws pipe runs from deck to hull of the ship. When anchor chain remove from the S.W, mud will stuck on it, so a fire hose line is in haws pipe to clean anchor chain.**
- Top of the chain or spurling pipe have Canvas Sleeve to keep the water from enterning into chain locker.
- Any fluid accumulated in chain locker is removed **by educator for directly discharge overboard**.
- **Chain stopper** is fasting with hinged lever, used to lock the chain in any desired position and it will release the load from the windlass either when it is out or stowed.
- **Cable lifter** are arranged over to the spurling pipe to ensure a direct lead for the cable onto locker.
- The end of a chain secured in the chain locker of a vessel which is attached to the hull by a quick release mechanism known as the **"BITTER END".**
- End of the cable connected to deck or B/H in chain locker.
- **Existing stiffners fitted** to the fore side of the collision B/H, two similer section are fitted horizontally back to back reverted to the B/H and welded to the stiffners.
- **Stiffeners are fitted outside the locker to prevent damage from the chains.**
- A space allowed between the horizontal bars to allow the end link of the cable to slide in and be secured be
  a bolt.
- Centerline division fitted to separate the two chains (port & stbd).
- If the locker fitted in forecastle the B/H may be used to support the windlass.
- **Hinged door** is fitted in FWD B/H giving access to the locker from the store space.
- **Locker fitted with false floor to allow drainage** of water and mud with help of drain plug in FWD B/H.

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Q 37 : Explain Bulbous Bow? How it improve propulsion efficiency?

A 37:

BULBOUS BOW

LOCATION: Just below the water line and in front of the ship's hull.

WORK:

- **it reduce the hull wave making resistance of a ship, which is the major residuary frictional resistance of a ship.**
- when water will be cut by Bulbous bow there is two type of wave will generate.
- Primary wave which formed by bow just in front of Bow will cut the Secondary Wave formed by ship hull and will reduce dragging.
- **So hull wave making resistance is reduced so more efficient and lesser fuel oil consumption.**

ADVANTAGE OF BULBOUS BOW:

- **Increase propulsion efficiency.**
- **Reduce pitching.**
- **Increase stability.**
- **Increase buoyancy.**
- **Reduce dragging**
- **Increase the ship speed.**
- Reduce fuel oil consumption.
- It work as a Robust " BUMPER" in the event of collision.
- Allow the installation of the bow thruster at a foremost position making it more efficient.
- **Extra protection for panting and pounding effect.**
- **Increase range fuel efficiency.**

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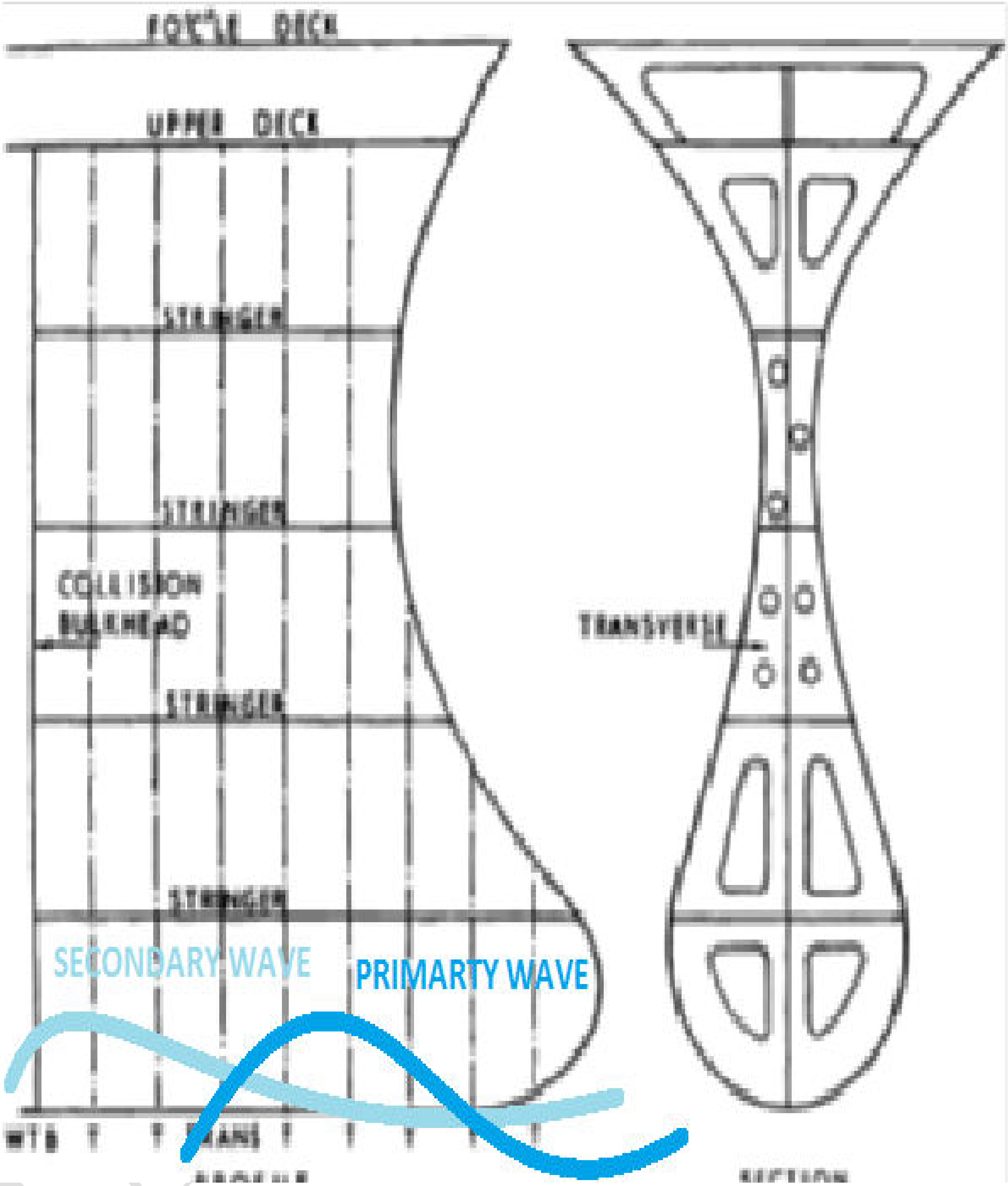
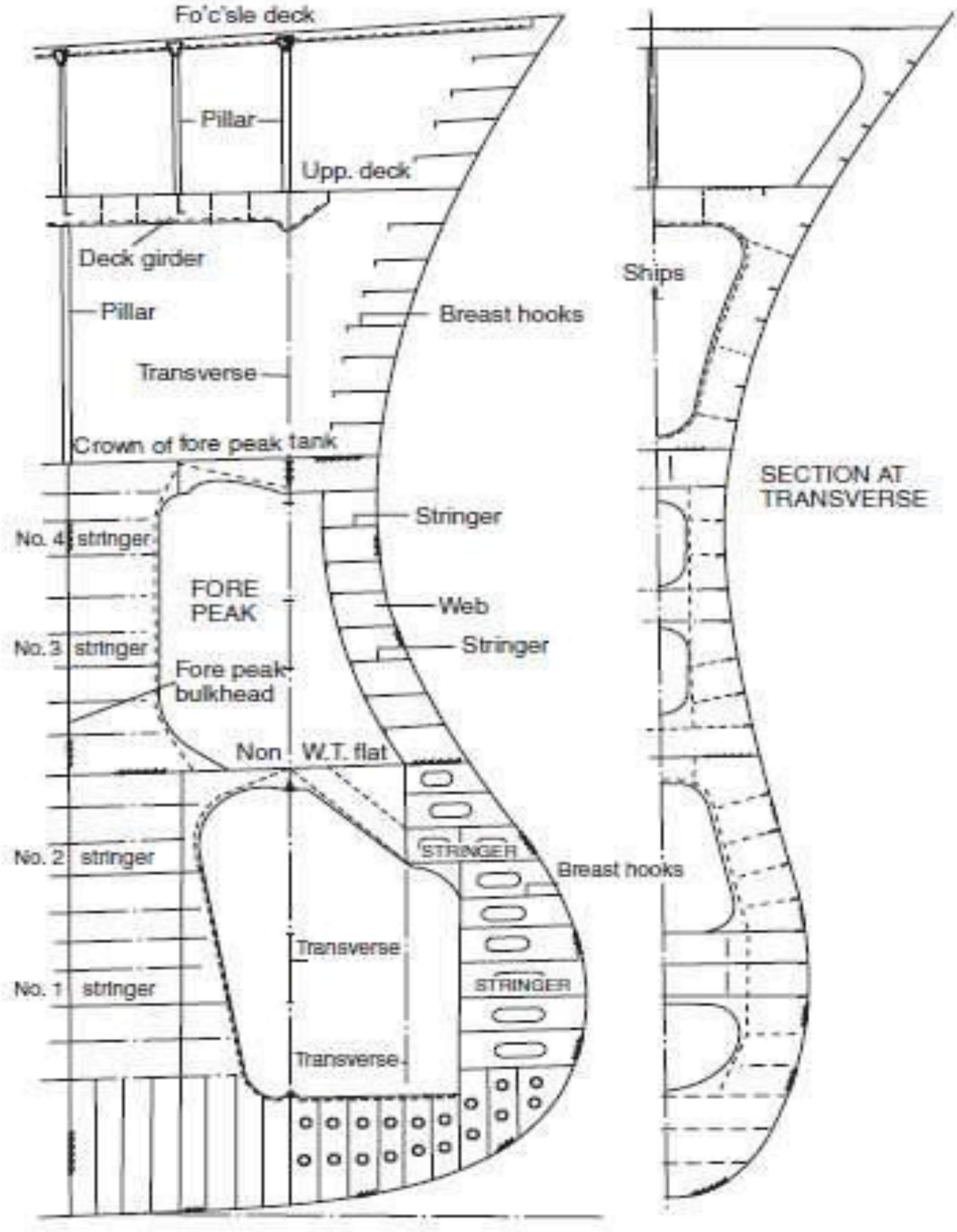

UPPER DECK
STRINGER
STRINGER
COLLISION
BULKHEAD
STRINGER
STRINGER
SECONDARY WAVE
PRIMARTY WAVE
TRANSVERSE


Fo'c'sle deck
Pillar
Upp. deck
Deck girder
Pillar
Breast hooks
Transverse
Crown of fore peak tank
Ships
SECTION AT TRANSVERSE
Stringer
No. 4 stringer
FORE PEAK
Web
Stringer
No. 3 stringer
Fore peak bulkhead
Non W.T. flat
STRINGER
No. 2 stringer
Breast hooks
Transverse
STRINGER
No. 1 stringer
Transverse

==

Q 38 : How many type of keel used in ship construction? Explain all of them?

A 38:

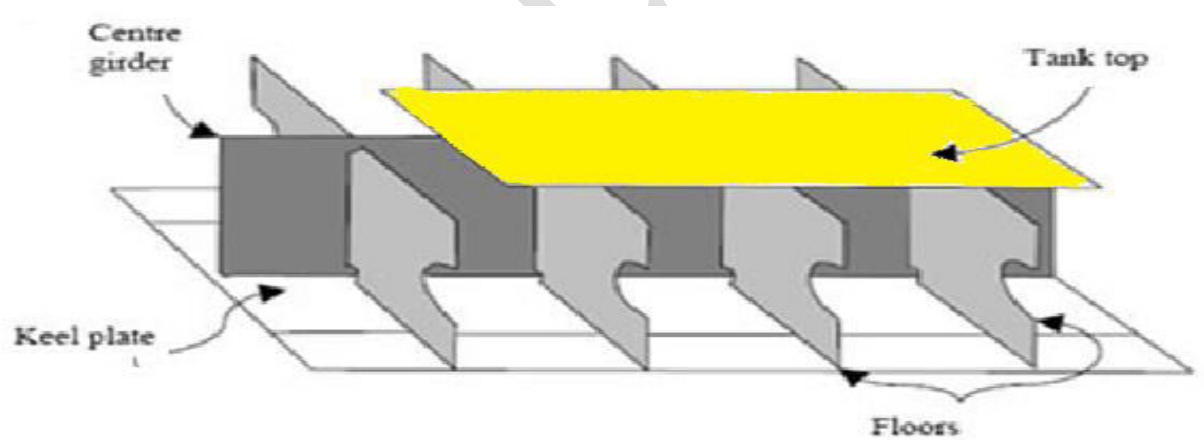
- Runs along the centreline of the bottom plate.
- For most ships it is of flat plate construction
- ***Centre Girder*** – a watertight longitudinal division which runs along the centreline from fore peak to aft peak bulkhead.

Types Of Keel:

- **FLAT KEEL**
- **BAR KEEL**
- **DUCT KEEL**

FLAT KEEL:

- Used in all types of sea going vessels
- Flat keel would basically mean a single bottom
- In the olden days, above the floors, a wooden plank was placed to facilitate cargo carriage. (now u might wonder that makes it a sort of double bottom right ? – ans is , its not, coz if it's a double bottom, it should be water tight

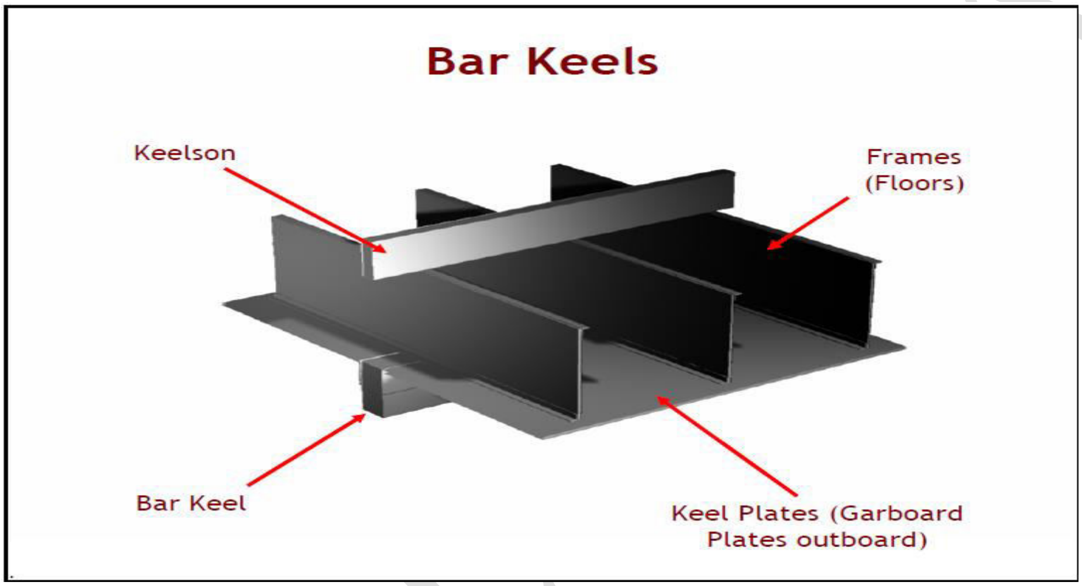


- Keel Plate – may be 1-2 m wide.
- Must be of full thickness for 3/5th L amidships – may be gradually reduced towards the ends of ship
- Centre girder is connected to keel plate and inner bottom plating

BAR KEEL:

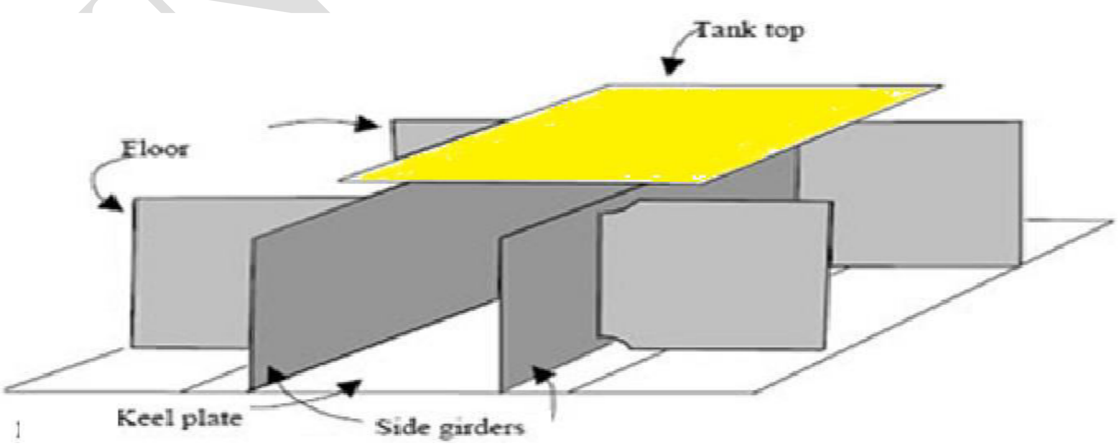
- A bar is placed in the center of the keel called bar keel.
- These consist one or more solid bar which are supported by frames running around the vessel.
- **The either side of the hull attached to the bar keel is called Garboard strake**
- These types of keels are incorporated in ferries or boats that are to be grounding.
- **Keelson plate: longitudinal beam on top of the keel of a vessel for strength & stiffners.**

-



DUCT KEEL:

- Some double bottoms have a duct keel fitted along the centreline
- Internal watertight passage running along the length of the ship, usually from collision bulkhead /forepeak to for'd machinery space bulkhead.



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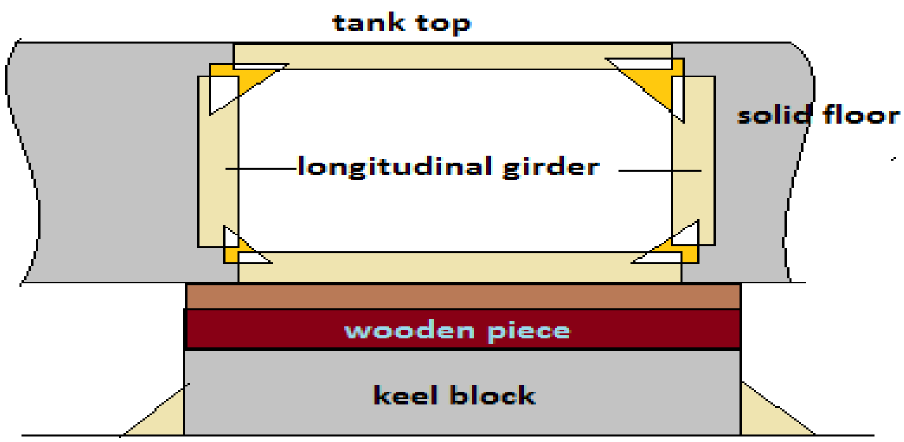

- **Used to carry pipework along the length of the ship to various holds/tanks.**
- **Prevent any construction which could occurs if pipe rupture with cargo.**
- Usually accessed a by a watertight manhole at the for'd end of machinery space
- Not required in machinery space or further aft – pipework runs along top of E/R double bottom and along shaft tunnel
- **Two longitudinal girders not more than 1.83 m apart. Ensures girders rest on docking blocks**
- **Keel Plate and tank top above duct keel must have increased scantlings to compensate for reduced strength of the transverse floors**
- **Stiffeners are fitted to shell and bottom plating at alternate frame spaces and are bracketed to the longitudinal girders**
- Also called as **BOX KEEL,** allows pipes and other services throughout the keel length.
- **This is fitted from the FWD of the E/R bulkhead to the aft of the collision bulkhead.**
- **AFT side we cant required Duct keel bcoz pipe will pass through to the " SHAFT TUNNEL"**
- This keel facilitates pipe passing through the cargo holds and thus isolating piping from cargo contact
- This enables lines to pass through that facilitate draining.

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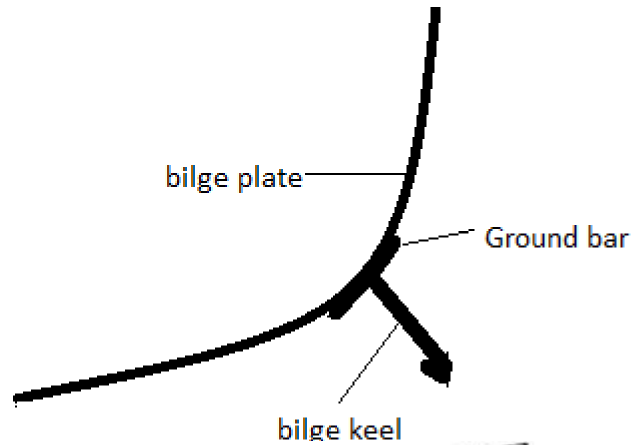
<u>Q 39 : Expalin Bilge Keel? How it is connected ? How much length it is? Purpose of it?</u>

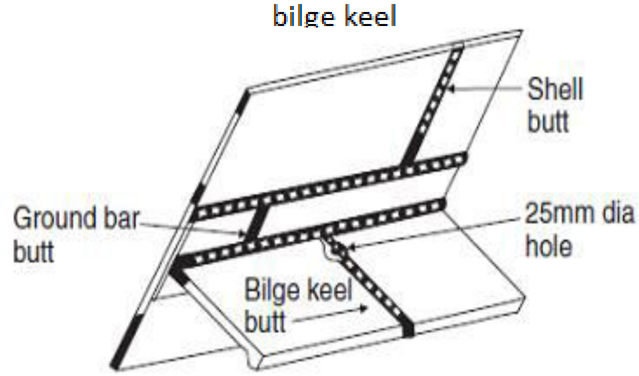
A 39:

<u>BILGE KEEL</u>

<u>PURPOSE:</u>

- **Dump the rolling motion of the vessel.**
- **Protected of bilge on grounding.**
- **Increase the longitudinal strength.**





LOCATION & CONSTRUCTION:

- **Bilge keel are about one half of length of ship**.
- **Runs over the midship portion of hull extended FWD & AFT of a midship**
- These projections are arranged at the bilge to lie above the line of the bottom shell and within the breadth of the ship, thus being partially protected against damage.
- The depth of the bilge keels depends to some extent on the size of the ship but there are two main factors to be considered;

  (a) the web must be deep enough to penetrate the boundary layer of water travelling with the ship

  (b) if the web is too deep the force of water when rolling may cause damage.
- **Bilge keels 250 mm to 400 mm.in depth are fitted to oceangoing ships.**
- **keel tapered gradually at the ends tp prevent stress concentration can cause bilge plating to crack**
- **Bilge keel not directly welded to bilge plate but ground bar is attached to bilge plate**.
- Connection of ground bar to shell is by continuous fillet welds.
- Ground bar thickness is at least that of bilge plate or 14 mm whichever is less.
- material is same as bilge plating.

===

Q 40 : What is frame spacing? Any example of it?

A 40:

Frame spacing: In the main body of the ship, frame spacing may not exceed 1 meter between collision bulkhead and a point one fifth of ship's length abaft the stem. It must not exceed 700 mm. in peak tank and cruiser sterns it must not exceed 610 mm.

CANT FRAME & CANT BEAM:

- **A *cant frame* is one which is set at an angle to the centreline of the ship.**
- **Such frames are fitted 610 mm apart, thus dividing the perimeter of the cruiser stem into small panels**.
- At the top, these frames are bracketed to cant beams which also lie at an angle to the centreline.

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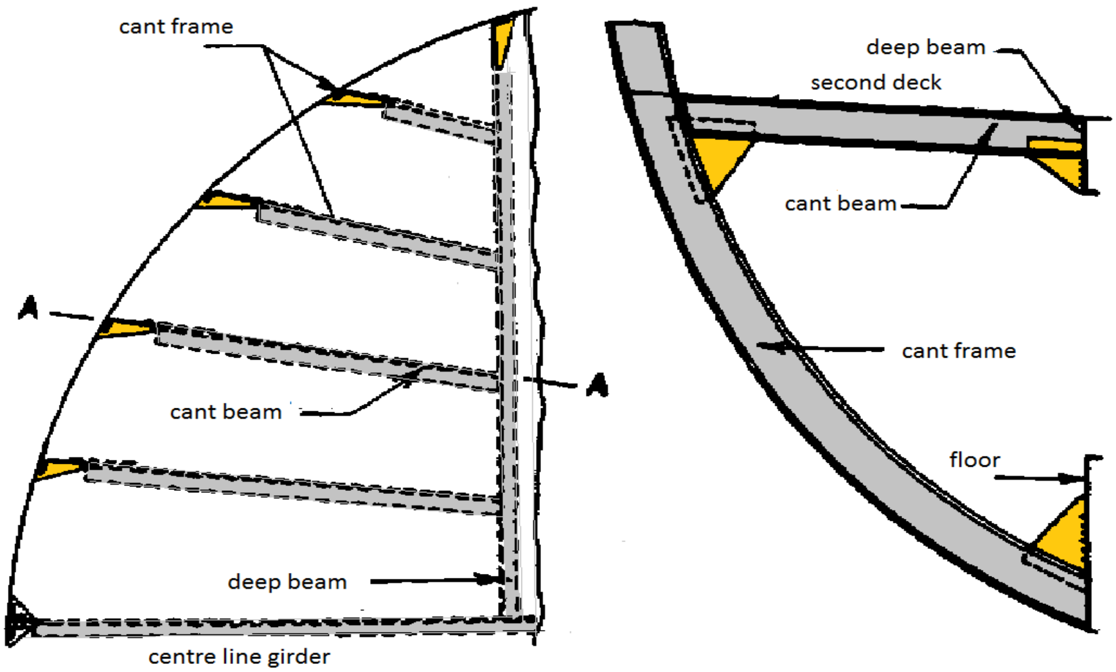
- **The forward ends of the cant beams are connected to a deep beam extending right across the ship.**
- At the lower ends, the cant frames are connected to a solid floor.



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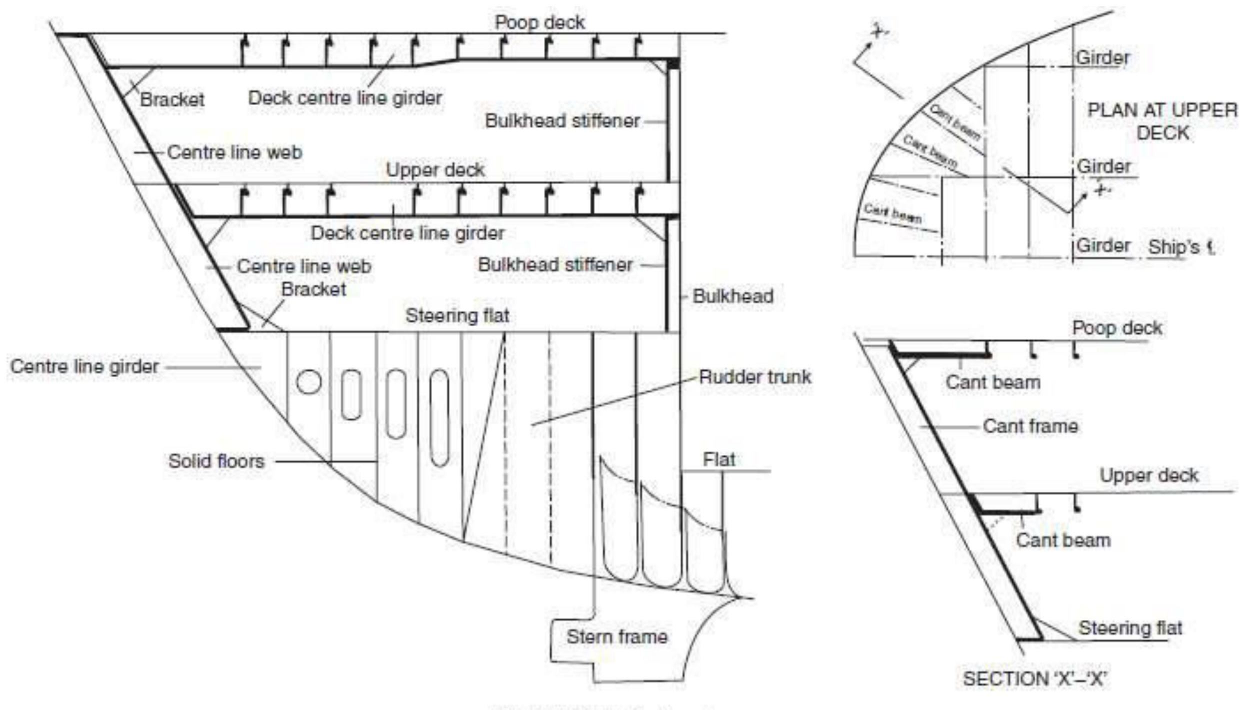
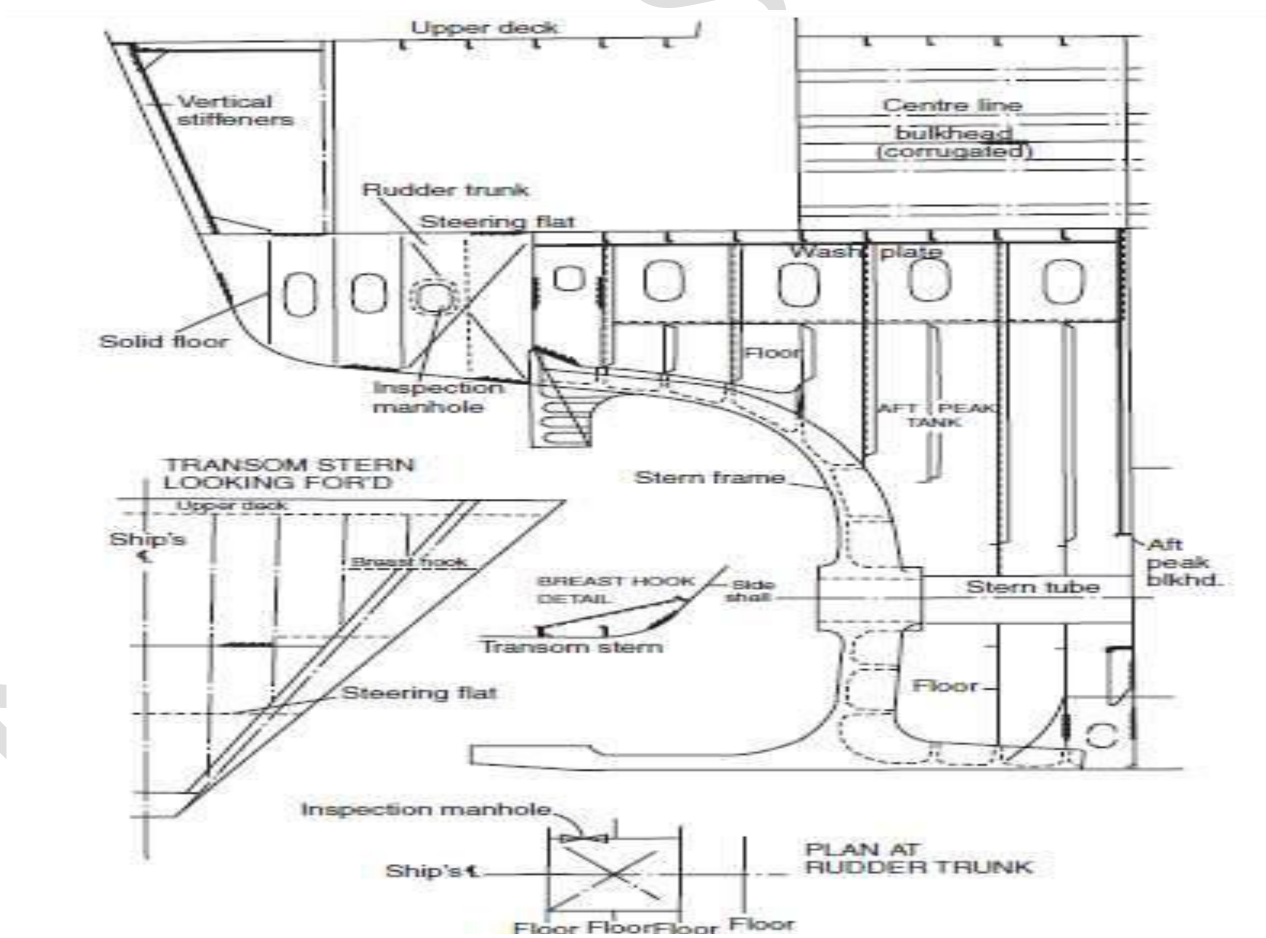
Q 41 : Draw and Explain Cruiser Stern and Transom Stern?

A 41:

- **As the cruiser stern overhang may be subjected to large slamming forces a substantial construction with adequate stiffening is required.**
- Solid floors are fitted at every frame space, and a heavy centre line girder is fitted right aft at the shell and decks.
- The stern plating is stiffened by cant frames or webs with short cant beams supporting the decks and led to the adjacent heavy transverse deck beam.
- **Further stiffening of the plating is provided, or adopted in lieu of cant frames, by horizontal stringers extending to the first transverse frame**.
- **Cant frames are not required where the transom stern is adopted, as the flat stern plating may be stiffened with vertical stiffeners .**
- Deep floors and a centre line girder are provided at the lower region of the transom stern construction.

- Stern is flat which reduce the production costs, while at some time reducing the bending moment on the after structure.





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Q 42 : Explain Collision bulkhead? In detail?

A 42:

COLLISION BULKHEAD

Purpose:- Avoids flooding of ship in case of damage to bows.

Location & Construction:-

- Location is such that it is not so much forward as to get damaged on impact , Neither it should be too far aft so that compartment flooded forward causes extensive trim by head.
- As a rule located at minimum distance to get maximum space for cargo.
- **For Passenger ship, the collision bulkhead is placed aft of the forward perpendicular, at a distance of not less than 0.05L and not more than 0.05L + 3 m. For cargo ships, the distance should not be less than 0.05L, where L is the overall length of the ship.**
- Minimum at 1/20 of ships length from forward perpendicular.
- The collision bulkhead is continuous to upper most continuous deck.
- **The collision bulkhead is 20% stronger than other bulkheads.**
- Collision bulkhead is 5 to 8 percent of ships length from forward.
- All ships are required to have a watertight collision bulkhead which rises up to the uppermost continuous deck.
- No opening is allowed in the collision bulkhead except ballast line for the forepeak. This line should have a valve for isolation
- **The collision bulkhead is stiffened by 180 mm vertical bulb plates spaced about 600 mm apart inside the peak. It is usual to fit horizontal plating because of the excessive taper on the plates which would occur with vertical plating.**
- The structure in the after peak is similar in principle to that in the fore peak, although the stringers and beams may be fitted 2.5 m apart. The floors should extend above the'stern tube or the frames above the tube must be stiffened by flanged tie plates to reduce the possibility of vibration.
- **The collision bulkhead, as the forepeak bulkhead, and the aft peak bulkhead are tested for watertightness by filling the peaks with water to the level of the load waterline.**
- Where the bulkheads form the boundaries of deep tanks, they are tested by filling them with water up to the top of the air pipe.

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Why collision B/H kept at L/20 of the ship?

- In the event of collision and grounding standard of subdivision has to give good chance that the ship remains afloat under such emergencies.
- Transverse B/H are reliable in this case and classification society requires a watertight collision b/h within reasonable distance from forward.
- If the ship supposed to have Wave Through a midship there will be excess weight a midships and excess buoyancy at the ends, hence the ship will be sagging.
- If the ship is supposed to have Wave Crest a midships there will be excess weight at the ends and excess buoyancy a midship hence ship will be hogging.
- By " Trochoidal Theory" Wave height from through to crest is 1/20 of the wave length.
- Therefore maximum shearing force usually occurs at about L/20 of the ship from each end.
- For this reason collision B/H located L/20 of the ship length.

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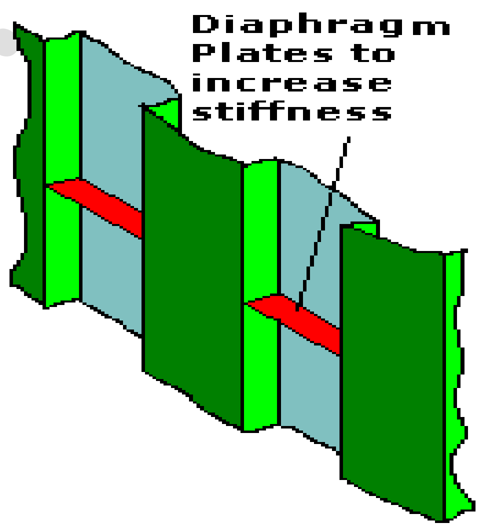
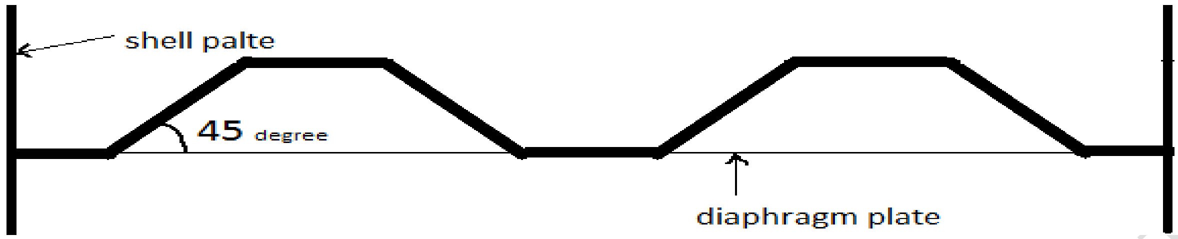
Q 43 : Explain Corrugated Bulkhead in detail?

A 43 :



CORRUGATED BULKHEAD

- **By using plain B/H lot of extra strengthening is needed to added to a withstand hydrostatic pressure.**
- **By using Corrugated B/H the strength is inherently formed in construction this result in a large reduction in weight**.
- mostly in Dry Cargo ships, offen in oil tanker used.
- these are the bulkheads constructed on some ships for avoiding the frames. These have tool spaces and shedder plates within them. Sounding plates and hold ladder pass through them.
- The edge of B/H which join shell plating may have stiffened flat plate fitted to increase transverse strength.
- A corrugated plate is stronger than a flat plate if subject to a bending moment or pillar load along the corrugations.



- Corrugations (or swedges) are formed on a corrugated bulkhead to eliminate the need to fit the vertical stiffener, as in those of the plain bulkhead.
- The elimination of vertical stiffeners also results in saving in steel weight and cost of stiffeners.
- The angle of corrugation is normally about 45 degrees.
- **The troughs are vertical on transverse bulkheads but must be horizontal on continuous longitudinal bulkheads, which form part of the longitudinal strength of the ship.**
- **Diaphragm plates or horizontal stringers are fitted on the bulkhead to keep the corrugation in place.**
- **This B/H form very smooth surface in oil tanks allowed improve drainage and easy of cleaning.**

==

Q 44 : Explain Watertight B/H in Detail?

A 44:

WATERTIGHT BULKHEAD

FUNCTION:

- **They divide the ship into watertight compartments and thus restrict the volume of water which may enter the ship if the shell plating is damaged.**
- In passenger ships, complicated calculations are carried out to ensure an arrangement of bulkheads which will prevent the ship sinking if the ship is damaged to a reasonable extent.
- **The watertight compartments also serve to separate different types of cargo and to divide tanks and machinery spaces from the cargo spaces.**
- In the event of fire, the bulkheads reduce to a great extent the rate of spread.
- **The transverse strength of the ship is increased by the bulkheads which have much the same effect as the ends of a box.**
- **They prevent undue distortion of the side shell and reduce racking considerably.**

CONSTRUCTION:

- Longitudinal deck girders and deck longitudinals are supported at the bulkheads which therefore act as pillars, while at the same time they tie together the deck and tank top and hence reduce vertical deflection when the compartments are full of cargo.

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- **it is found that a bulkhead required to withstand a load of water in the event of flooding will readily perform the remaining functions.**
- The number of bulkheads in a ship depends upon the length of the ship and the position of the machinery space.
- **In ships more than 90 m in length, additional bulkheads are required, the number depending upon the length.Thus a ship 140 m long will require a total of 7 bulkheads if the machinery is amidships or 6 bulkheads if the machinery is aft, while a ship 180 rn in length will require 9 or 8 bulkheads respectively**.
- Each ship must have a collision bulkhead at least one twentieth of the ship's length from the forward perpendicular, which must be continuous up to the uppermost continuous deck.
- The stern tube must be enclosed in a watertight compartment formed by the sternframe and the after peak bulkhead which may terminate at the first watertight deck above the waterline.
- **A bulkhead must be fitted at each end of the machinery space although, if the engines are aft, the after peak forms the after boundary of the space. In certain ships this may result in the saving of one bulkhead.**
- These bulkheads must extend to the freeboard deck and should preferably be equally spaced in the ship.
- The bulkheads are fitted in separate sections between the tank top and the lowest deck, and in the 'tween decks.
- Watertight bulkheads are formed by plates which are attached to the shell, deck and tank top by welding.
- Since water pressure increases with the head, and the bulkhead is to be designed to withstand such a force, it may be expected that the plating on the lower part of the bulkhead is thicker than that at the top.
- **The bulkheads are supported by vertical stiffeners spaced 760 mm apart. Any variation in this spacing results in variations in size of stiffeners and thickness of plating.**
- The ends of the stiffeners are usually bracketed to the tank top and deck although in some cases the brackets are omitted, resulting in heavier stiffeners.
- ***The bulkheads are tested for watertightness by hosing them using a pressure of 200 kN/m^2.***
- ***If hose test is not practicable bcoz of possible damage to M/C, Electrical equipment insulation, it may be replaced by careful visual examination of welded connection.***
- ***Tank which are intended to hold liquids, and which form part of the watertight subdivision of the ship shall be tested for tightness and structural strength with water head. The water head is in no case to less than top of the air pipes or to a level of 2.4 m above the top of the tank whichever is greater.***
- ***We can do by dye penetrant test or an ultrasonic test.***
- The test is carried out from the side on which the stiffeners are attached.

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- It is essential that the structure should be maintained in a watertight condition.
- **If it is found necessary to penetrate the bulkhead, precautions must be taken to ensure that the bulkhead remains watertight**.
- The after engine room bulkhead is penetrated by the main shaft, which passes through a watertight gland, and by an opening leading to the shaft tunnel.
- **This opening must be fitted with a sliding watertight door. When pipes or electric cables pass through a Bulkhead , the integrity of the bulkhead must be maintained**.

==

<u>Q 45 : Explain NON-Water tight B/H?</u>

A 45:

<u>NON-WATERTIGHT BULKHEADS</u>

- Any bulkhead which does not form part of a tank or part of the watertight subdivision of the ship may be non-watertight.
- Many of these bulkheads are fitted in a ship, forming engine casings and partitions in accommodation. 'Tween deck bulkheads fitted above the freeboard deck may be of non-watertight construction, while many ships are fitted with partial center line bulkheads if grain is to be carried.
- Center line bulkheads and many deck-house bulkheads act as pillars supporting beams and deck girders, in which case the stiffeners are designed to carry the load. The remaining bulkheads are Lightly stiffened by angle bars or welded flats.

==

<u>Q 46 : Explain Hatch Cover and Hatch Coaming?</u>

A 46:

<u>HATCH COVER</u>

<u>FUNCTION:</u>

- Cargo holds are fitted with hatch covers to prevent the contact of cargo with outer atmosphere i.e. air, moisture, weather and water and to avoid cargo from getting wet.
- Another important function of hatch cover is to maintain the water tight integrity of the ship at all sea going condition by not allowing any ingress of water inside the cargo hold and disrupting the stability of the ship.
- Large hatches must be fitted in the decks of dry cargo ships to facilitate loading and discharging of cargo.

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- It is usual to provide one hatch per hold or 'tween deck, although in ships having large holds two hatches are sometimes arranged.

- The length and width of hatch depend largely upon the size of the ship and the type of cargo likely to be carried.
- General cargo ships have hatches which will allow cargoes such as timber, cars, locomotives and crates of machinery to be loaded.
- A cargo tramp of about 10 000 tonne deadweight may have five hatches, each 10 m long and 7 m wide, although one hatch, usually to No. 2 hold, is often increased in length.
- Large hatches also allow easy handling of cargoes. Bulk carriers have long, wide hatches to allow the cargo to fill the extremities of the compartment without requiring trimming manually.

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

Testing of Hatch Covers:

After maintenance procedure it is advised to test the water tight integrity of the hatch cover by different methods. The three methods to check water tightness of hold covers are:

1. 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.

2. 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.
- An ultrasonic test is carried out using type-approved, efficient and reliable testing equipment.
- This equipment consists of two parts: an ultrasound multi-transmitter and a hand-held detector.
- The multi-transmitter is placed in the hold in a central position. It produces a uniformly distributed omnidirectional sound throughout the hold space.
- The sound energy is measured by the hand-held detector.
- The transmitter sound is produced in a narrow frequency (kHz) band, and the detector is only tuned to filter out this band. As inspectors wear headphones and read data off a digital display, they are not hampered by surrounding noise and can detect any leaks.
- The detector's built-in memory function also records the dB values, making the data downloadable to a PC, so that it can be safely logged for reports.
- For swift, clean and easy testing, ultrasonic technology can be used to check any opening on board a ship that needs to be sealed
- ***Few drawbacks of this instrument is it is not normally kept onboard and qualified person is required to perform this test.***

3. 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.

HATCH COAMING

- **The hatches are framed by means of hatch coamings which are vertical webs forming deep stiffeners.**
- ***The heights of the coamings are governed by the International Load Line Rules.***
- On weather decks they must be at least 600 mm in height at the fore end and either 450 mm or 600 mm aft depending upon the draught of the ship.
- Inside superstructures and on lower decks no particular height of coaming is specified.
- it is necessary, however, for safety considerations, to fit some form of rail around any deck opening to a height of 800 mm.
- It is usual, therefore, at the weather deck, to extend the coaming to a height of 800 mm.

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- In the superstructures and on lower decks portable stanchions are provided, the rail being in the form of a wire rope.
- These rails are only erected when the hatch is opened.
- The weather deck hatch coamings must be 11 mm thick and must be stiffened by a moulding at the top edge. Where the height of the coaming is 600 mm or more, a horizontal bulb angle or bulb plate is fitted to stiffen the coaming which has additional support in the form of stays fitted at intervals of 3 m.

==

Q 47 : What is Dye Penetration test ? Why it is done ? & How ?

A 47:

- This is the most common test method used to detect cracks in components on board ship.
- Penetrant is same penetrating oil used to loose a rusted nut & bolt except it contains a Dye which will find its way in to the smallest of cracks, even those invisible to the naked eye.
- Some of them are FLUORESCENT DYE, which then used in conjunction with an ULTRAVIOLET LIGHT, which makes the cracks Glow Green when ordinary lighting is reduced.
- Some of them are DEVELOPER which makes the Dye stand out as a Red line.
- This type usually comes in 3 aerosols
  - **FIRST IS CLEANER, WHICH IS SPRAYED ON IT.**
  - **THEN THE COMPONENT IS ALLOWED TO DRY.**
  - **THEN THE PENETRATING DYE IS SPRAYED ON & AFTER 5 MINUTES THE EXCESS COATING ON SURFACE IS WIPED OFF.**
  - **THE DEVELOPER IS SPRAYED ON WHICH WILL HIGHLIGHT ANY CRACK PRESENT**.

==

Q 48 : Explain Deep tank? Where it is located ? and function of it?

A 48:

DEEP TANK

FUNCTION:

- **Used to carry certain amount of water ballast.**
- **Used to carry Dry cargo normally but water ballast when ship is light.**
- **Used to carry Oil cargo provided that its Flash point not less than 60^0 c.**

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LOCATIN & CONSTRUCTION:

- **Tank extending from bottom or inner bottom up to higher than lowest deck.**
- **It is FWD of M/C space to provide sufficient ballast capacity.**
- **They are fitted with Hatches so they also may be used for Dry cargo, vegetable oil, as cargo.**
- **Hatches prevent water to enter.**
- **A wash plate must be fitted at the centerline to reduce the Free surface effect.**
- B/H stiffeners must be spaced not more than 600 mm apart and must be bracketed at the head and foot.
- Deck plating which forms the tank top must be at least 1 mm thicker than that boundary of B/H.
- The tank structure is designed to a head of water up to top of the overflow pipe.
- ***The tank being tested to this head or to height of 2.45 m above the top of the tank whichever is higher***.

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Q 49: Draw and explain Double Bottom Tank?

A 49:

DOUBLE BOTTOM TANK

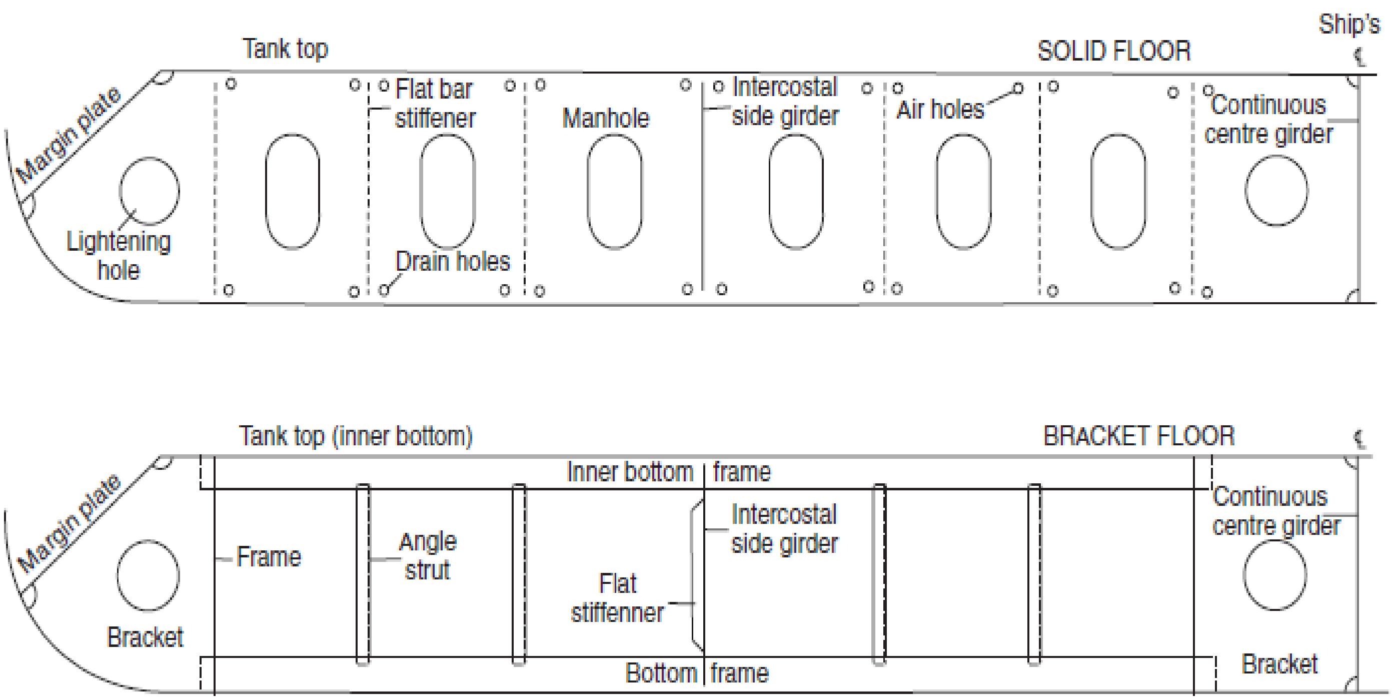

FIGURE 16.4 Transversely framed double bottom construction

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TRANSVERSELY FRAMED DOUBLE BOTTOM

- If the double bottom is transversely framed, then transverse solid plate floors, and bracket floors with transverse frames, provide the principal support for the inner bottom and bottom shell plating.
- Solid plate floors are fitted at every frame space in the engine room and in the pounding region.
- Also they are introduced in way of boiler seats, transverse bulkheads, toes of brackets supporting stiffeners on deep tank bulkheads, and in way of any change in depth of the double bottom.
- **Where a ship is regularly discharged by grabs, solid plate floors are also fitted at each frame. Elsewhere the solid plate floors may be spaced up to 3.0m apart, with bracket floors at frame spaces between the solid floors.**
- **The plate brackets of bracket floors are flanged and their breadth is at least 75 percent of the depth of the center girder at the bracket floors.**
- **To reduce the span of the frames, which should not exceed 2.5 meters, at the bracket floor, vertical angle or channel bar struts may be fitted.**
- Vertical stiffeners usually in the form of welded flats will be attached to the solid plate floors, which are further strengthened if they form a watertight or oil tight tank boundary.
- **One intercostal side girder is provided port and starboard where the ship’s breadth exceeds 10 m but does not exceed 20 m and two are fitted port and starboard where the ship’s breadth is greater.**
- In way of the bracket floors a vertical welded flat stiffener is attached to the side girder.
- **Additional side girders are provided in the engine room, and also in the pounding region.**

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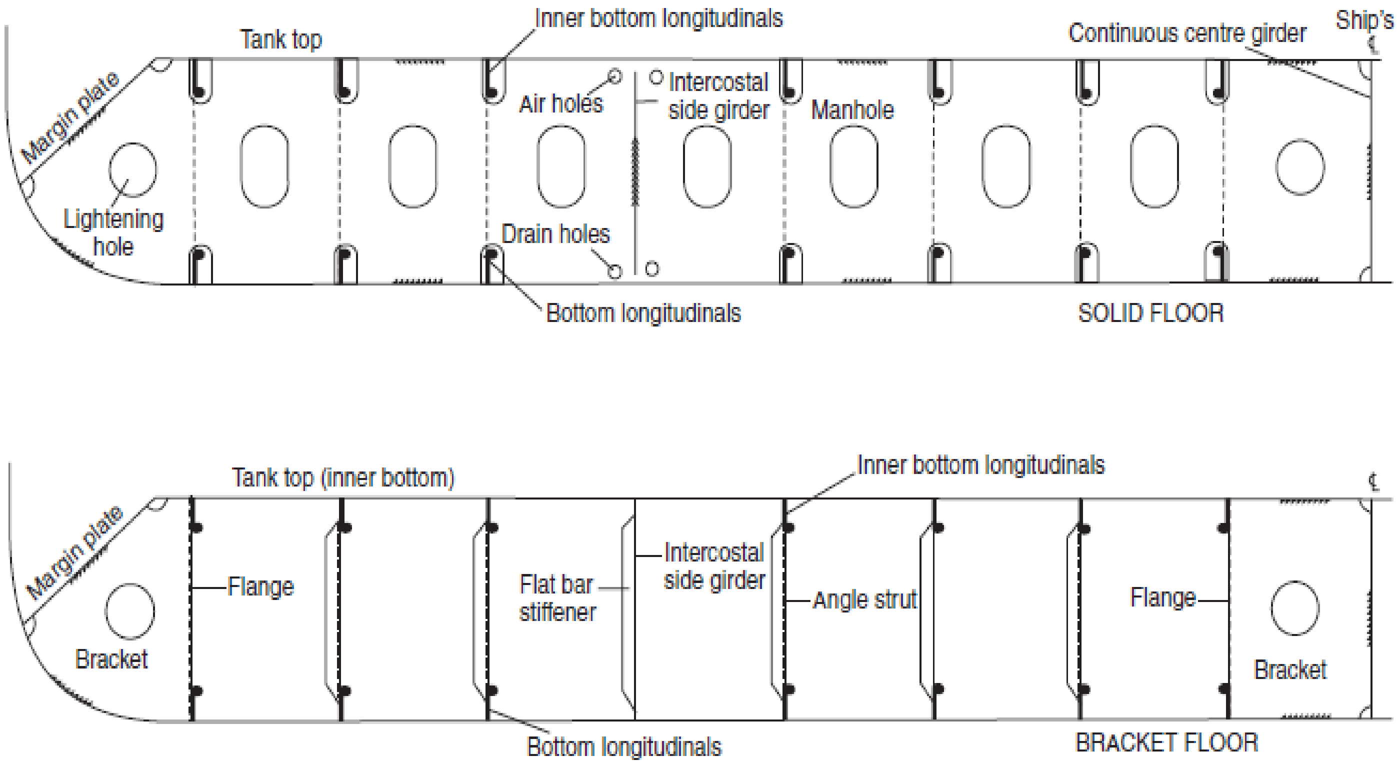
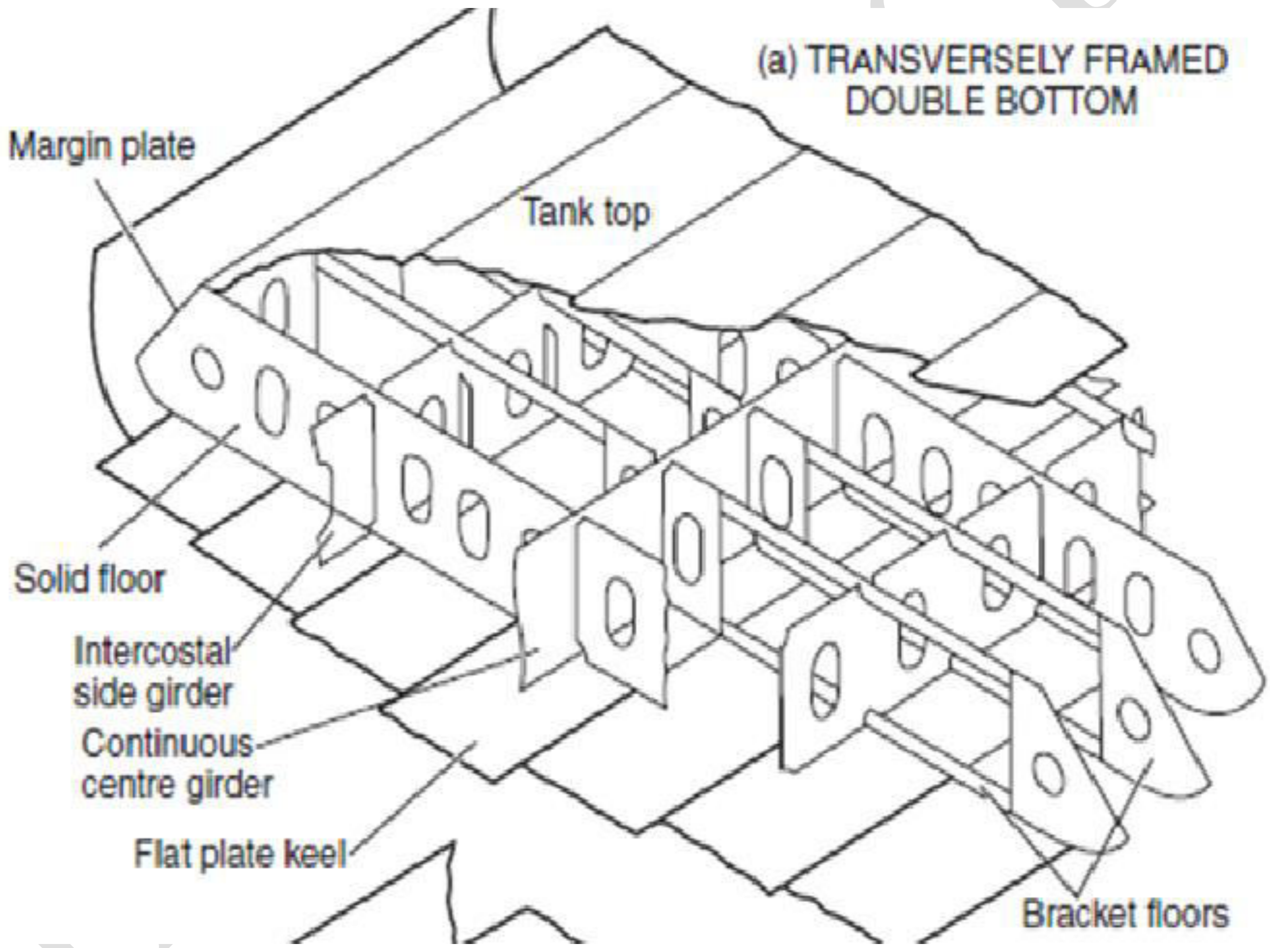


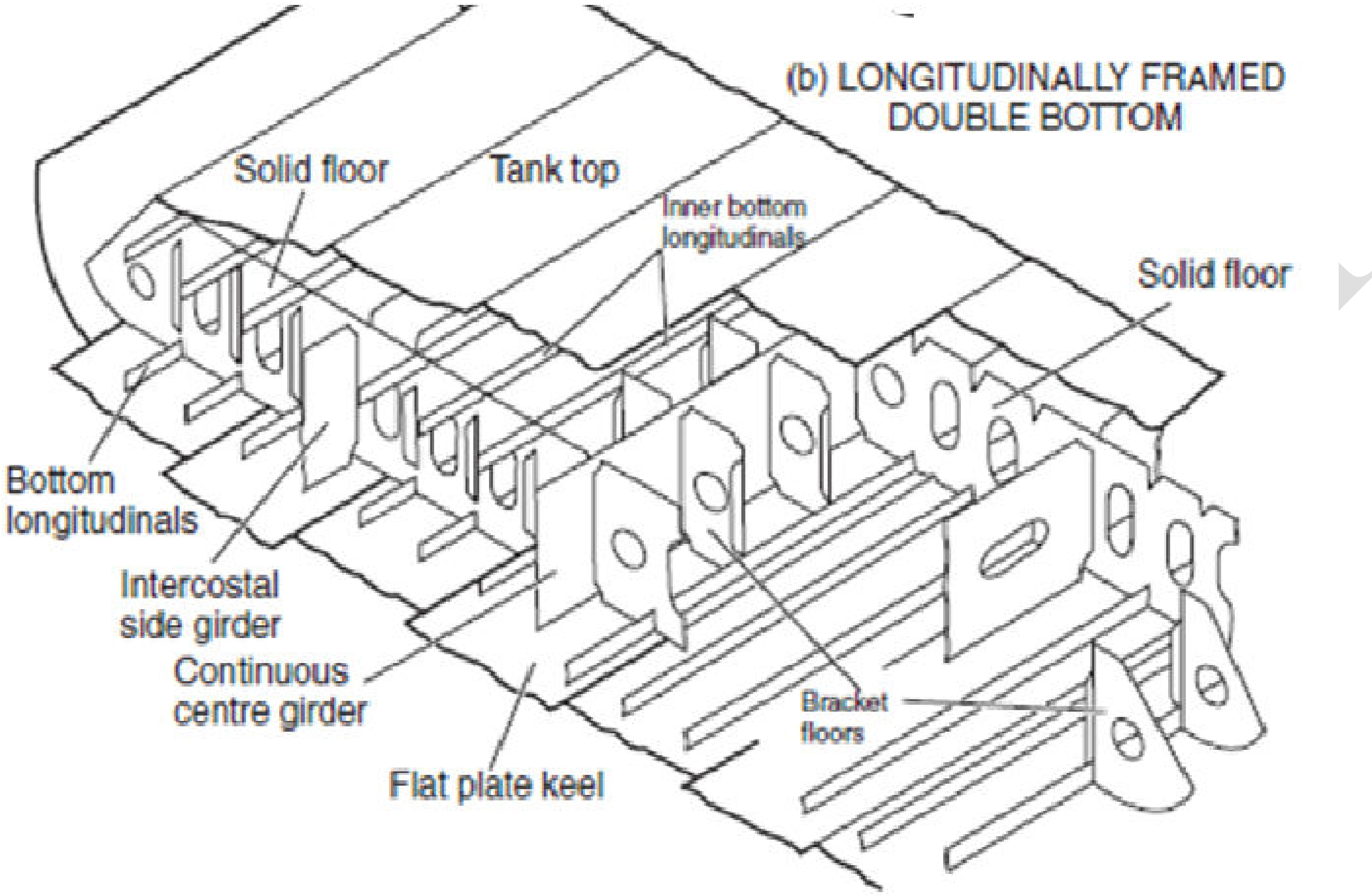
FIGURE 16.5 Longitudinally framed double bottom construction

LONGITUDINALLY FRAMED DOUBLE BOTTOM

- **In a longitudinally framed double bottom, solid plate floors are fitted at every frame space under the main engines, and at alternate frames outboard of the engine seating.**
- They are also fitted under boiler seats, transverse bulkheads, and the toes of stiffener brackets on deep tank bulkheads.
- Elsewhere the spacing of solid plate floors does not exceed 3.8m, except in the pounding region where they are on alternate frame spaces.
- **At intermediate frame spaces brackets are fitted at the tank side, and at the center girder where they may be up to 1.25 m apart.**
- Each bracket is flanged and will extend to the first longitudinal.
- **One intercostal side girder is fitted port and starboard if the ship's breadth exceeds 14 m, and where the breadth exceeds 21 m two are fitted port and starboard.**
- These side girders always extend as far forward and aft as possible.
- **Additional side girders are provided in the engine room, and under the main machinery, and they should run the full length of the engine room, extending three frame spaces beyond this space.**
- Forward the extension tapers into the longitudinal framing system. In the pounding region there will also be additional intercostal side girders.

- **As the unsupported span of the bottom longitudinal should not exceed 2.5m, vertical angle or channel bar struts may be provided to support the longitudinal between widely spaced solid floors.**





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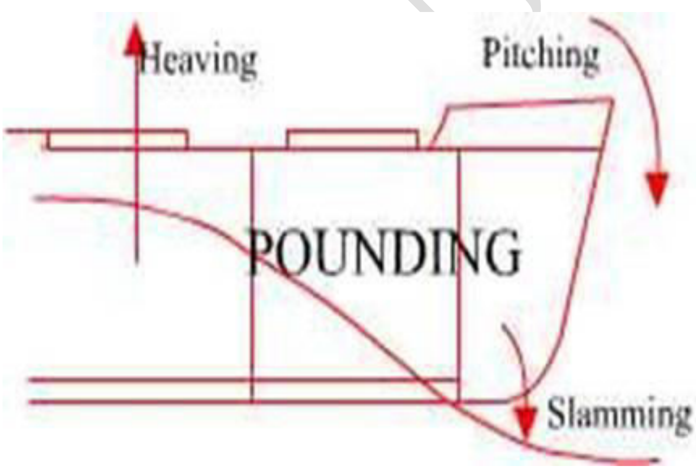
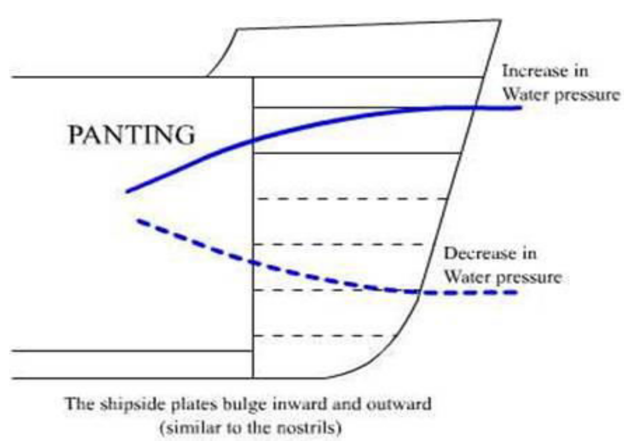
Q 50: Panting and Pounding effect? How to resist Panting and Pounding? Draw Sketch?

A 50:





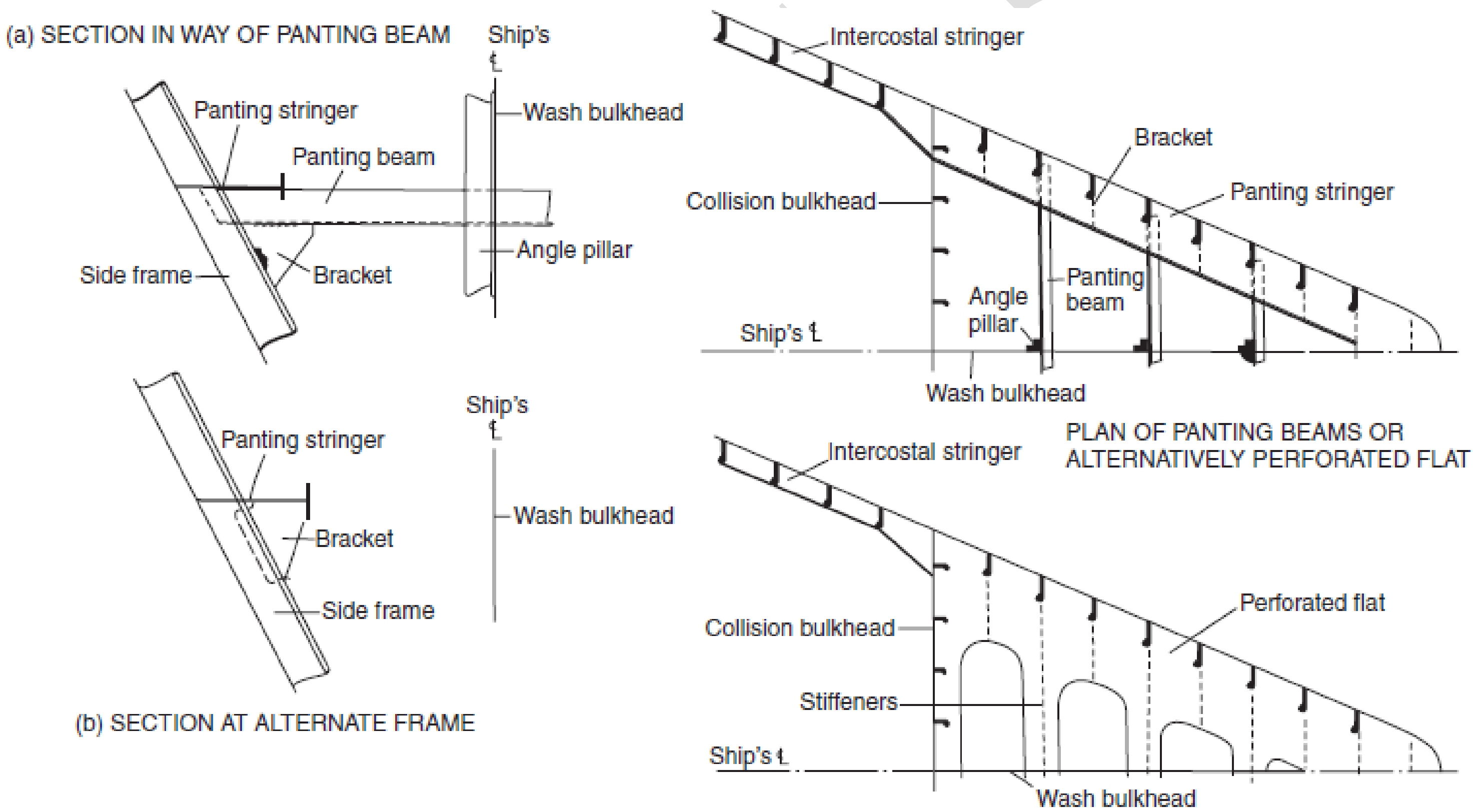
PANTING

Panting:

- **As the waves pass along the ship they cause fluctuations in water pressure which tend to create an in-and-out movement of the shell plating. The effect of this is found to be greatest at the ends of the ship, particularly at the fore end, where the shell is relatively flat.**
- Such movements are termed panting and, if unrestricted, could eventually lead to fatigue of the material and must therefore be prevented. The structure at the ends of the ship is stiffened to prevent any undue movement of the shell.

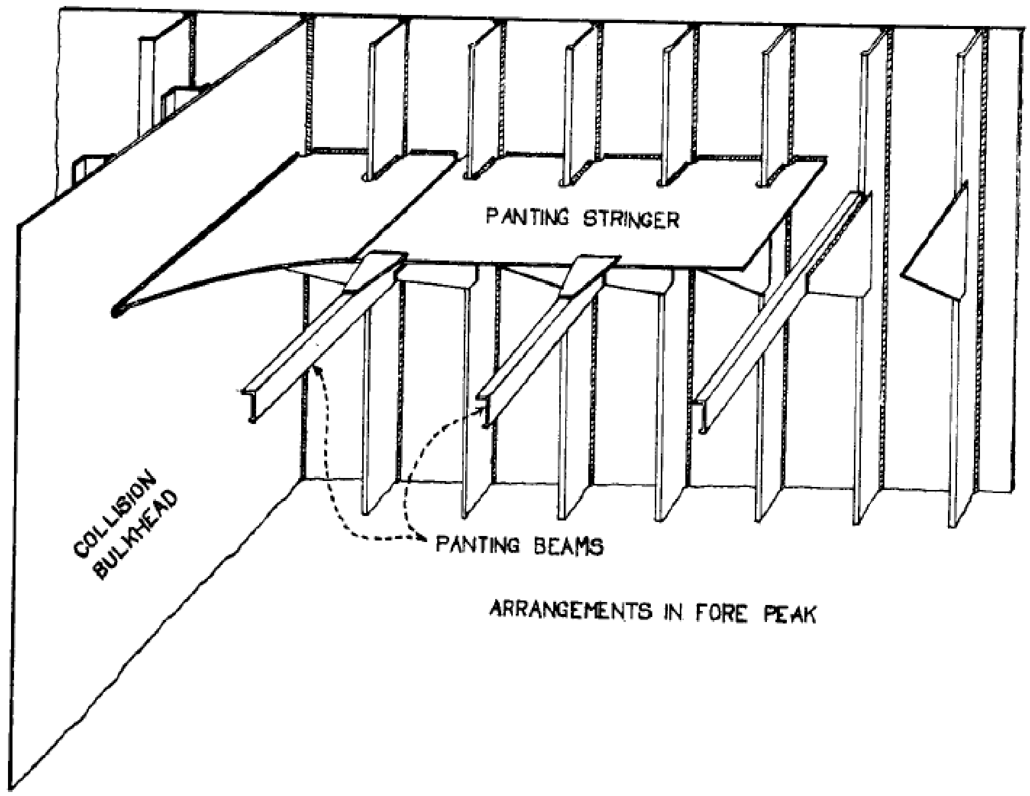
ARRANGEMENTS TO RESIST PANTING

- The structure of the ship is strengthened to resist the effects of panting from 15% of the ship's length from forward to the stem and aft of the after peak bulkhead.
- In the fore peak, side stringers are fitted to the shell at intervals of 2 m below the lowest deck.



- Panting beam are fitted FWD of the Collision B/H below the lowest deck.
- Panting beam connected to Beam knee.
- Panting beam fitted alternate frame.
- Beam space not more than 2 m apart vertically and supported by pillars.

- Panting stringer are laid on each beam.



POUNDING

Pounding:

- **When a ship meets heavy weather and commences heaving and pitching, the rise of the fore end of the ship occasionally synchronize with the trough of a wave. The fore end then emerges from the water and re-enters with a tremendous slamming effect, known as pounding.**
- While this does not occur with great regularity, it may nevertheless cause damage to the bottom of the ship forward. The shell plating must be stiffened to prevent buckling.
- **Pounding also occurs aft in way of the cruiser stern but the effects are not nearly as great**.

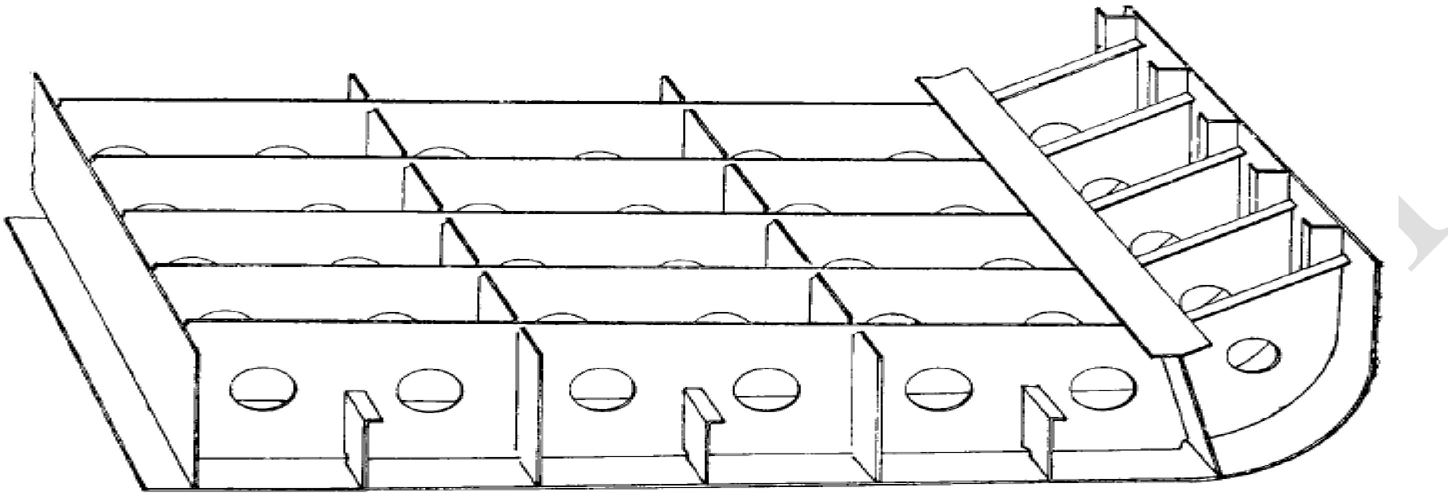
ARRANGEMENT TO RESIST POUNDING:

- **pounding effect expected in Bottom of ship 30% ship length abaft the stem.**
- **So this 30% area pounding region are additionally strengthened in ships exceeding 65 m in length.**

Transversely framed:

- Plate floor are fitted at every frame space and are connected to the outer bottom plating by continue weld.
- Longitudinal girder are fitted 2.2 m apart, extending vertically from the shell to the tank top.
- Intermediate half height girder are fitted to shell.

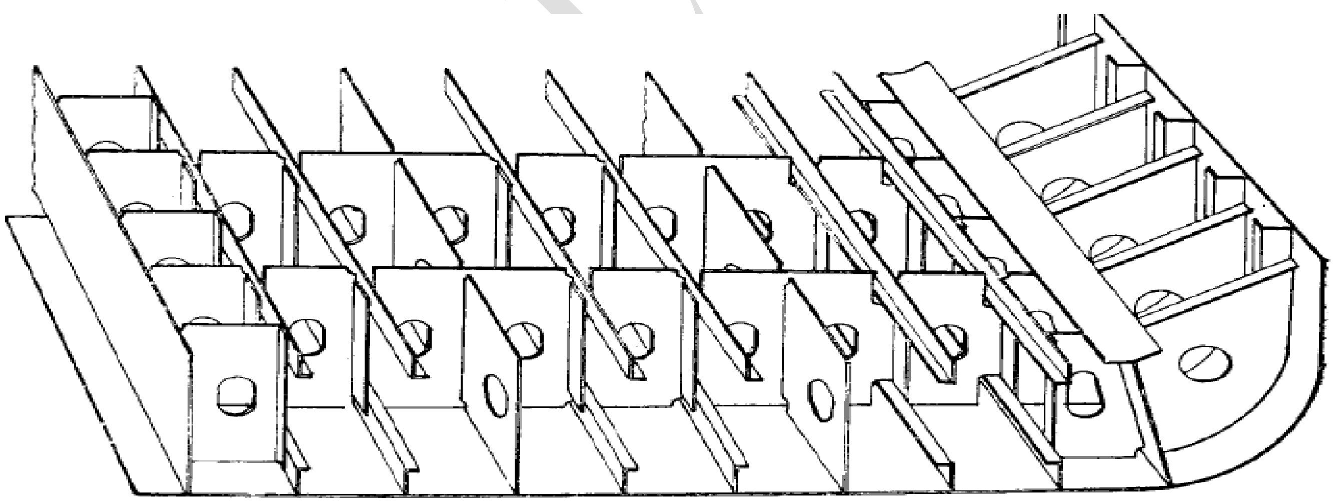
- Solid floor are fitted at every frame space and are attached to the bottom shell by continue welding.



TRANSVERSE FRAMING

Longitudinal framed:

- If bottom shell of a ship longitudinally frame the spacing between longitudinal are reduced 700 mm and are continue as FWD as practicable to the collision B/H.
- Transverse floor are fitted alternate frame.
- Side girder fitted not more 2.1 m apart.



LONGITUDINAL FRAMING

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Q 51: Explain different type of Water tight door?

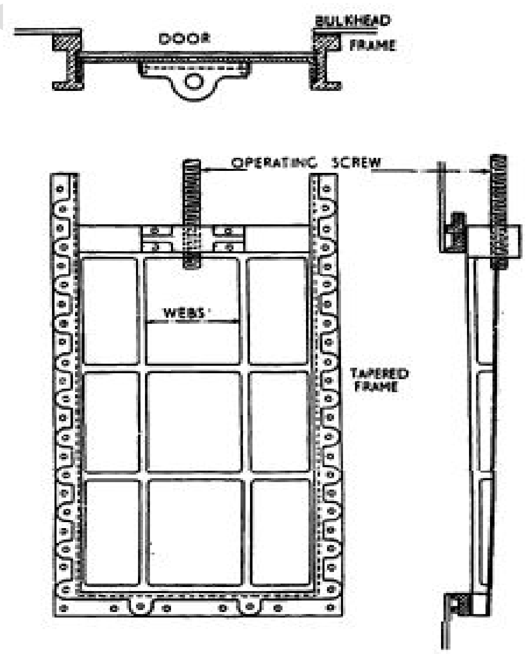
A 51:

WATER TIGHT DOOR

- Watertight door is fitted to any access opening in a watertight bulkhead. Such openings must be cut only where necessary for the safe working of the ship and are kept as small as possible, 1.4 m high and 0.75 m wide being usual.
- The doors may be mild steel, cast steel or cast iron, and either vertical or horizontal sliding, the choice being usually related to the position of any fittings on the bulkhead.
- The means of closing the doors must be positive, ***i.e.,*** they must not rely on gravity or a dropping weight.

Vertical sliding doors:

- These are closed by means of a vertical screw thread which turns in a gunmetal nut secured to the door.
- The screw is turned by a spindle which extends above the bulkhead deck, fitted with a crank handle allowing complete circular motion.
- A similar crank must be fitted at the door. The door runs in vertical grooves which are tapered towards the bottom, the door having similar taper, so that a tight bearing fit is obtained when the door is closed.
- Brass facing strips are fitted to both the door and the frame.
- There must be no groove at the bottom of the door to collect dirt which would prevent the door fully closing.
- An indicator must be fitted at the control position above the bulkhead deck, showing whether the door is open or closed.



Horizontal sliding door:

- It is operated by means of an electric motor A which turns a vertical shaft B.
- Near the top and bottom of the door, horizontal screw shafts C are turned by the vertical shaft through the bevel gears D.

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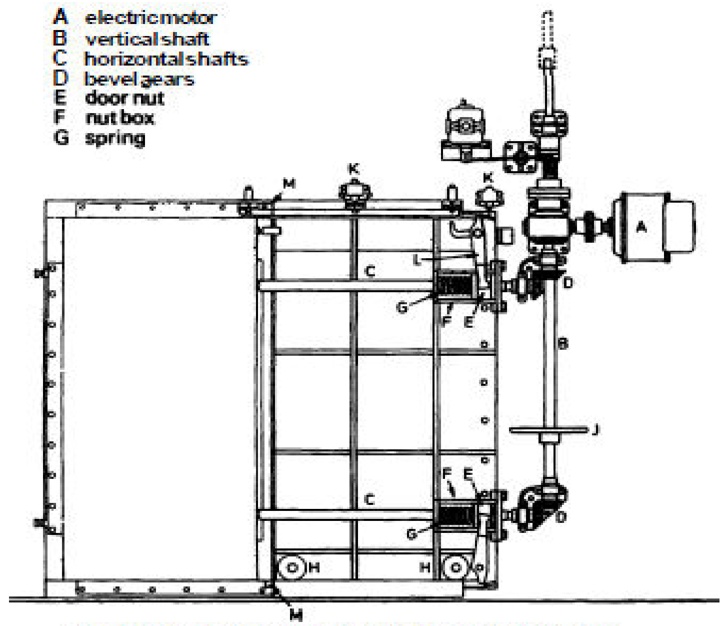
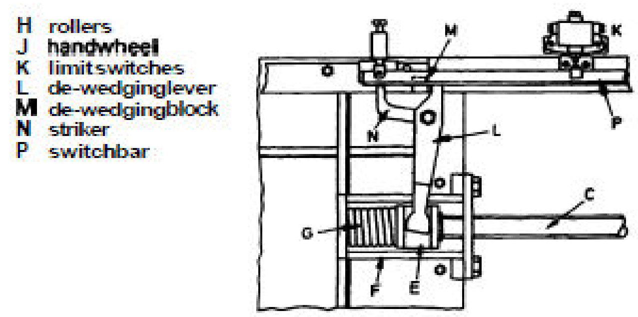
- The door nut E moves along the screw shaft within the nut box F until any slack is taken up or the spring G is fully compressed, after which the door moves along its wedge-shaped guides on rollers H.
- The door may be opened or closed manually at the bulkhead position by means of a hand wheel J, the motor being automatically disengaged during this operation.
- An alarm bell gives warning 10 seconds before the door is to close and whilst it is being closed.
- Opening and closing limit switches K are built into the system to prevent overloading of the motors.
- A de-wedging device may be fitted to release the door from the wedge frame and to avoid overloading the power unit if the door meets an obstruction.
- As the door-operating shaft turns, the spring-loaded nut E engages a lever L which comes into contact with a block M on the door frame.
- As the nut continues to move along the shaft, a force is exerted by the lever on the block, easing the door out of the wedge. Should a solid obstruction be met, the striker N lifts a switch bar P and cuts out the motor.

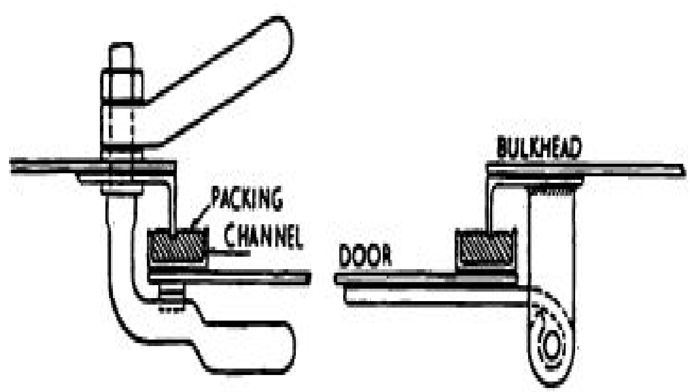


HORIZONTAL SLIDING WATERTIGHT DOORS
Fig. 6.4



DE-WEDGING DEVICE

Hinged watertight doors:



- it may be fitted to watertight bulkheads in passenger ships, above decks which are 2.2 m or more above the load waterline.
- Similar doors are fitted in cargo ships to weather deck openings which are required to be watertight.
- The doors are secured by clips which may be fitted to the door or to the frame.
- The clips are forced against brass wedges. The hinges must be fitted with gunmetal pins.

- Some suitable packing is fitted round the door to ensure that it is watertight., six clips being fitted to the frame.

WATERTIGHT DOOR	WEATHERTIGHT DOOR
	
• A watertight door prevents the passage of water when exposed to a head of water. A typical head of water for a ship could range from 3-10 meters (tested up to 20 meters resistance).	• A weather tight door is designed to be located on the deck of a ship/boat above the waterline, where they can be subject to the adverse weather conditions experienced offshore.
• Watertight doors are tested using a pressure tank where a hydrostatic pressure can be applied to the door.	• Weather tight doors are also designed to withstand brief submersion experienced from green seas. This means a weather tight door can withstand a small head of water (generally no higher than the height of the door).
• The door is generally pressurized form the inside as this is worst case scenario.	• A weather tight door is generally tested with a high pressure hose, which is directed at the seal.

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Q 52: Explain about Bow Thruster?

A 52:

BOW THRUSTER

BOW THRUSTERS FUNCTION:

- Many ships are fitted with bow thrust units to improve their manoeuvrability.
- They are an obvious feature in ships working within, or constantly in and out of harbour where close control is obtained without the use of tugs.

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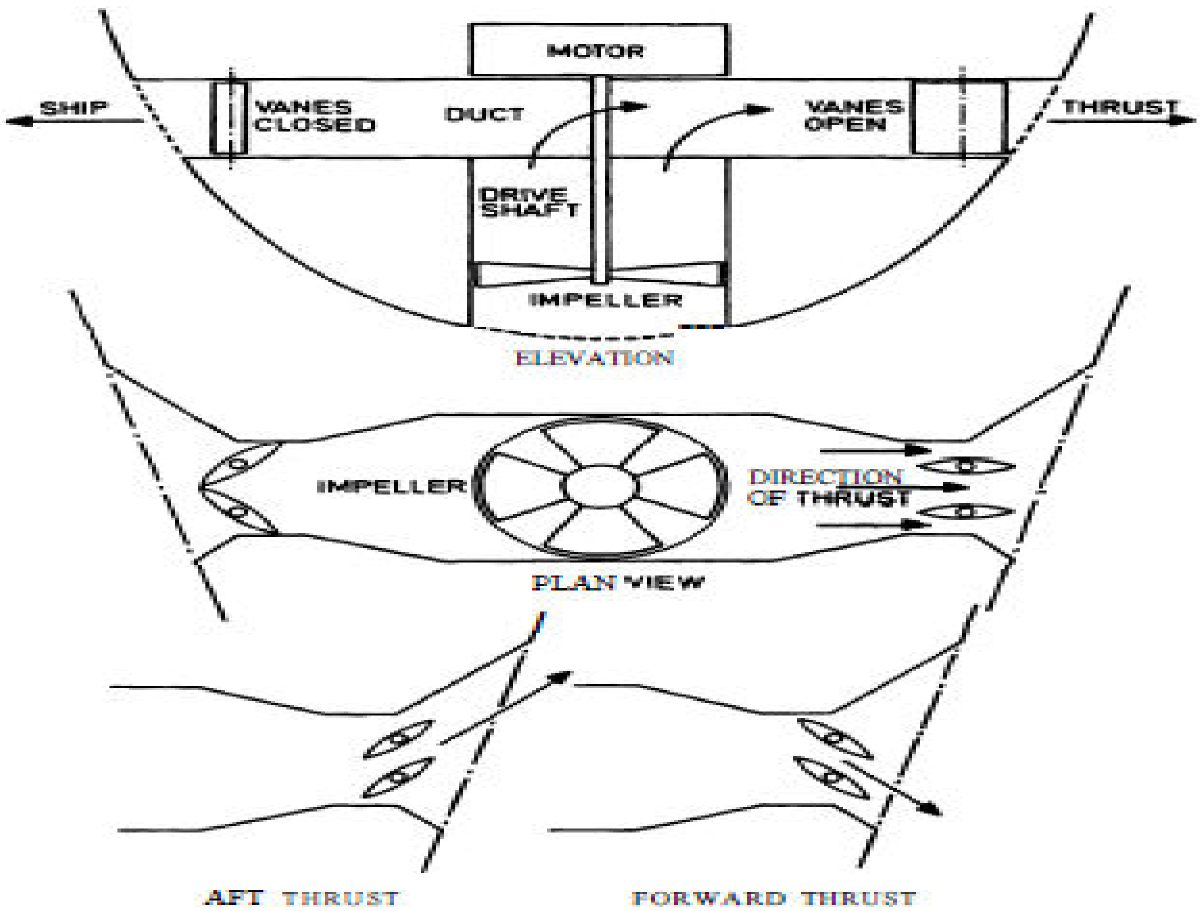
- They have also proved to be of considerable benefit to larger vessels such as oil tankers and bulk carriers, where the tug requirement has been reduced.



CONSTRUCTION:

- In all cases the necessity to penetrate the hull forward causes an increase in ship resistance and hence in fuel costs, although the increase is small.
- A popular arrangement is to have a cylindrical duct passing through the ship from side to side, in which is fitted an impeller which can produce a thrust to port or to starboard.
- The complete duct must lie below the waterline at all draughts, the impeller acting best when subject to a reasonable head of water and thus reducing the possibility of cavitation.
- The impeller may be of fixed pitch with a variable-speed motor which is reversible or has reverse gearing.
- Alternatively a controllable pitch impeller may be used, having a constant-speed drive.
- Power may be provided by an electric motor, a diesel engine or a hydraulic motor.

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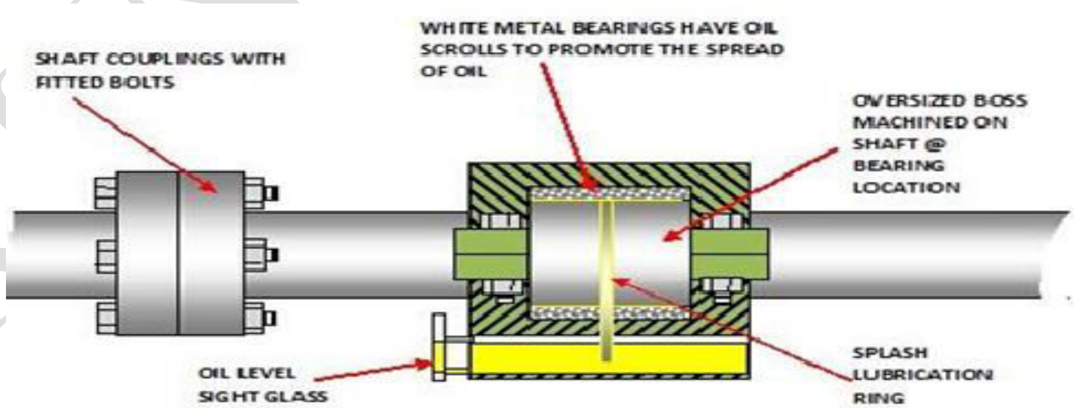
Q 53: EXPLAIN PROPELLER SHAFT WITH DIAGRAM?

A 53:

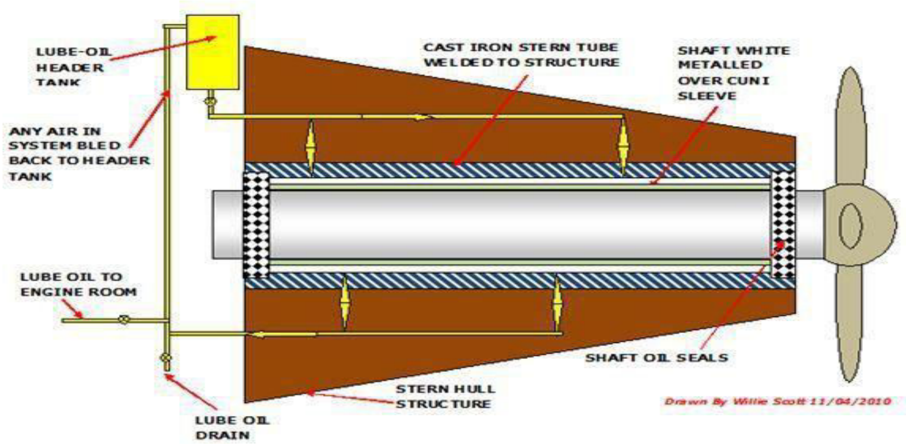
- The propeller shaft is bolted to the main engine flywheel, passing through the thrust block then along the shaft tunnel. Here it is supported by the shaft bearings before passing through the stern tube to drive the ship's propeller.
- The shaft is manufactured from forged steel, complete with coupling flanges. It is machined leaving a larger diameter at the location of the shaft bearings; this section has to have a fine finish to run within the white metal bearing.
- The shaft coupling flange faces are accurately machined and the bolt holes reamed to accept fitted bolts. They are bolted together using high tension bolting, which is tightened using hydraulic tensioning gear.
- The supporting bearings are cast in two halves and are usually white metal lined.
- These have oil scrolls cut into them to distribute the splash lubrication. Nowadays ball bearing shaft supports are being used, but they have been reported as being quite noisy with a tendency to run hot.
- A typical prop shaft white metal bearing with splash lubrication is shown here.

Propeller drop.

- the propeller shaft in the after peak tank is provided with inboard and outboard seals.these seals contain nitrile rubber or viton lip seal which seals against the bronze liner shrunk fit around the cast iron propeller shaft.
- after a few years it creates grooves on them and naturally looses sealing and sea water can easily find its way inside.this reduces the lubrication effect and creates wear if the bronze liner.
- now as there is enough clearance the shaft will come down by certain amount because of the propeller weight.this drop in propeller shaft is termed as propeller drop and is measured by POKERS gauge.



SKETCH OF A BASIC PROPELLER DRIVE SHAFT BEARING AND COUPLING ARRANGEMENT



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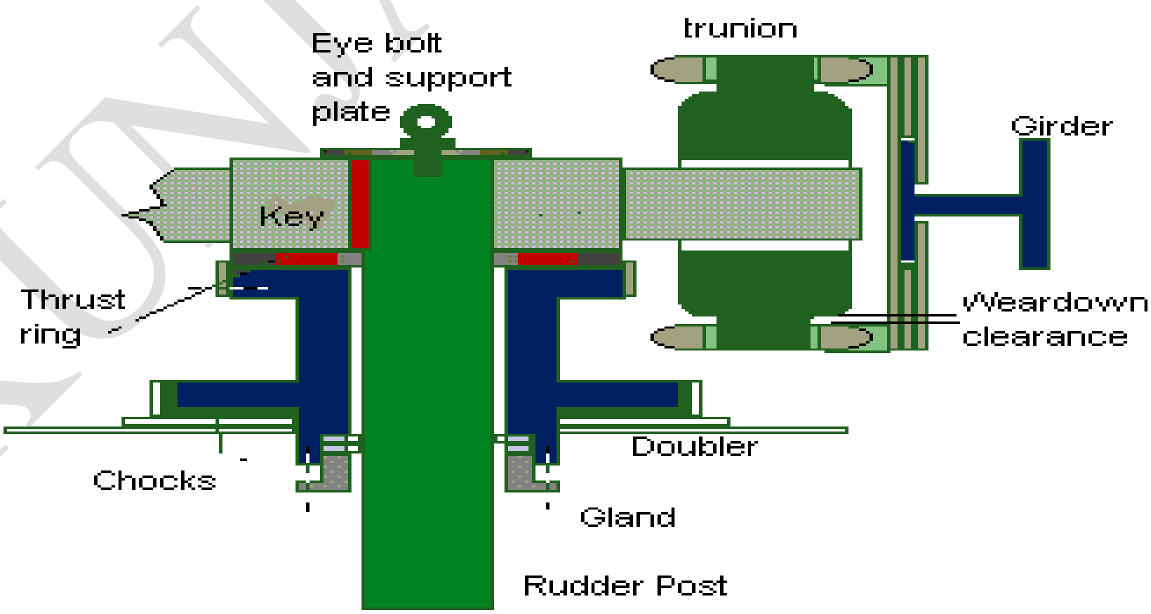
Q 54: EXPLAIN RUDDER CARRIER BEARING WITH DIAGRAM?

A 54:

- The rudder carrier bearing takes the weight of the rudder on a grease lubricated thrust face.
- The rudderstock is located by the journal, also grease lubricated. Support for the bearing is provided by a doublers plate and steel chock.
- Wedge type side chocks, welded to the deck stiffening, locate the base of the carrier bearing. The carrier is of meehanite with a gunmetal thrust ring and bush.
- Carrier bearing components are split as necessary for removal or replacement. Screw down



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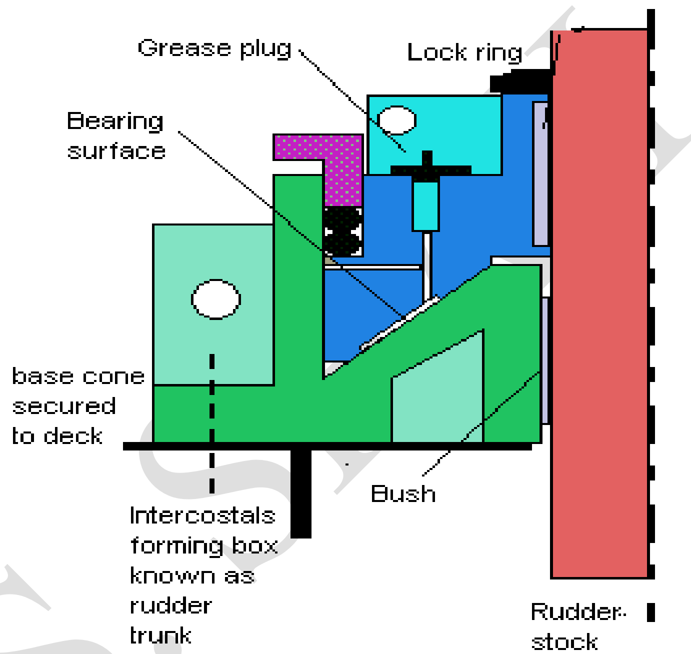
lubricators is fitted, and the grease used for lubrication is of a water resistant type (calcium soap based with graphite)

Wear down



- A small allowance is made for wear down, which must be periodically checked.
- This may be measured either between pads welded on top of the rudder and onto the rudder horn, or between the top of the rudder stock and a fixed mark on the inner structure of the steering gear flat.
- The latter generally involves the use of a 'Trammel gauge' which takes the form of a 'L' shaped rod made to fit the new condition of the gear.
- As wear down occurs it can easily be checked with this gauge.
- The rudder is prevented from jumping by rudder stops welded onto the stern frame.
- These limits refer to rudders of traditional design and are governed by both the physical layout of the rudder and actuator but also due to the stall angles of the rudder. i.e. the angle at which lift (turning moment) is reduced or lost with increasing angle of attack.
- There are designs of rudder such as Becker flap which have increased stall angles up to 45^{o}

Rudder wear down measurement: (Ram type Steering Gear)

At sea:

1)**Jumping clearance** or bouncing clearance, measured between swivel block and upper ram fork end. (limit is 19mm)

2)**Wear down clearance**, measured between swill block and bottom ram fork end. (limit is 12-19mm)

At docking:

1)**Bouncing clearance**: measured between top of rudder and jumping bar.

2)**Wear down clearance**: between the bottom of rudder and reference mark.

Reasons for critical contouring of thrust face;

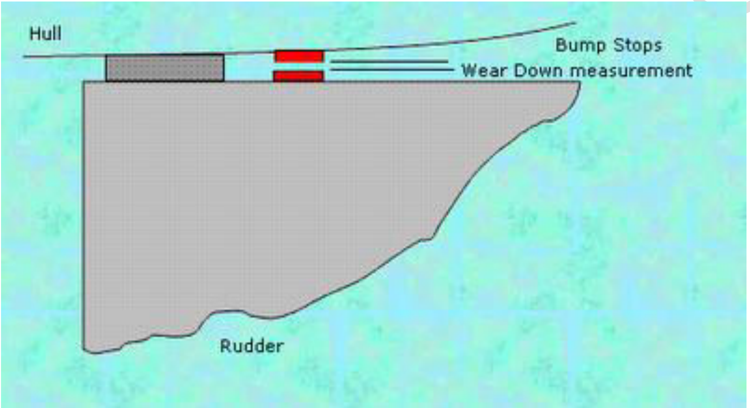
I. For lubrication

ii. Conical in order to prevent sideslip and centralize rudder

iii. Projected area gives greater bearing area allowing smaller diameter bearing

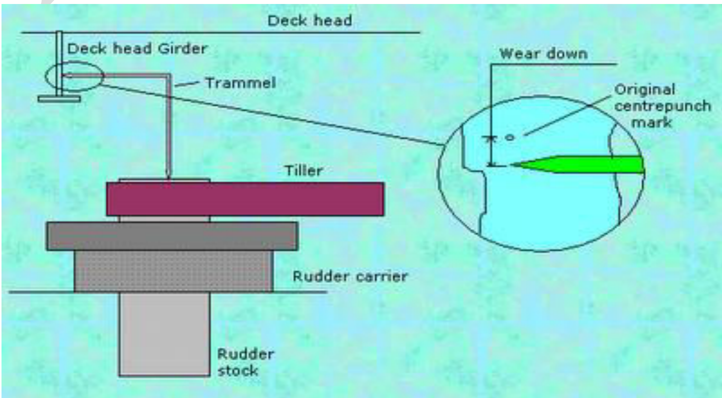
Rudder wear

- down refers to the measurements taken generally during a docking period to indicate excessive wear in the steering gear system particularly the rudder carrier.
- This wear down or rudder drop is measured using a special L shaped instrument called Tramel.
- When the vessel is built a distinct centre punch mark is placed onto the ruder stock and onto a suitable location on the vessels structure, here given as a girder which is typical.
- The trammel is manufactured to suit these marks As the carrier wears the upper pointer will fall below the centre punch mark by an amount equal to the wear down.



Rudder Clearance

- Pads are welded to the hull and rudder. A clearance is given (sometimes refered to as the jumping clearance). As the carrier wears this clearance will increase



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Q 55: Explain Shaft tunnel?

A 55:

SHAFT TUNNEL

- **When the machinery space is divided from the after peak by one or more cargo holds, the main shafting must be carried through the holds.**
- A tunnel is then built round the shaft to prevent contact with the cargo and to give access to the shaft at all times for maintenance, inspection and repair.
- **The tunnel is watertight and extends from the after machinery space bulkhead to the after peak bulkhead.**
- It is not necessary to provide a passage on both sides of the shaft, and the tunnel is therefore built off the centreline of the ship, allowing a passage down the starboard side.
- **The top of the tunnel is usually circular except in a deep tank when it is more convenient to fit a flat top.**
- **The tunnel stiffeners or rings are fitted inside the tunnel although in insulated ships and in tunnels which pass through deep tanks, the rings are fitted outside the tunnel.**
- The rings may be welded to the tank top or connected by angle lugs.
- The plating is attached to the tank top by welding or by a boundary angle fitted on the opposite side of the plating to the stiffeners.
- **The stiffeners and plating must be strong enough to withstand a water pressure without appreciable leakage in the event of flooding.**
- The scantlings are therefore equivalent to those required for watertight bulkheads. Under the hatches the tunnel top plating is increased by 2 mm unless wood sheathing is fitted.
- One of the side plates is arranged so that it may easily be removed, together with the stiffeners, to allow the main shafting to be unshipped.
- **The shaft tunnel is used as a pipe tunnel, the pipes being carried along the tank top with a light metal walking platform fitted about 0.5 m from the tank top.**
- **The shaft is supported at intervals by bearings which are fitted on shaft stools.**

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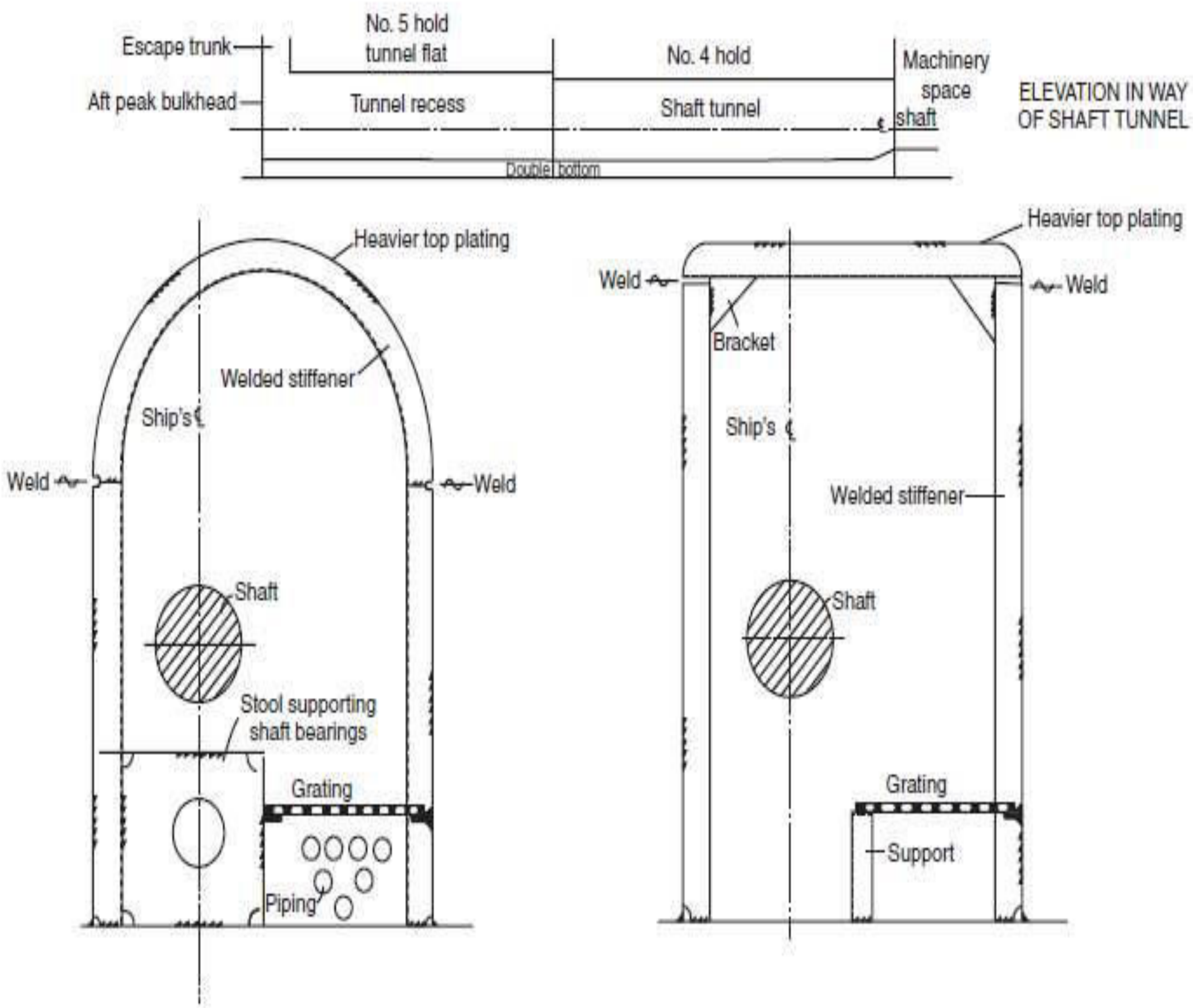

- The tops of the stools are lined up accurately to suit the height of the shaft, although adjustments to the height of bearings are made when the ship is afloat.
- **The stools are constructed of 12 mm plates, riveted or welded together, the latter being the most usual.**
- **They are attached to the tunnel rings to prevent movement of the bearings which could lead to damage of the shaft.**
- The loads from the bearings are transmitted to the double bottom structure by means of longitudinal brackets.
- **Manholes are cut in the end plates to reduce the weight and to allow inspection and maintenance of the stools.**

==

Q 56: Explain different type of method to reduce Rolling?

A 56:

Various Methods of Reducing Rolling are:-

1) **Fin stabilizer**

- These work very much like aircraft wing in that they provide lift, positive or negative depending upon their aspect relative to water flow.
- Fins are of aero foil cross section and are provided with tail flaps which can be moved relative to the main fin.
- This is accomplished automatically as the main fin is rotated. Main fins usually have a maximum movement of 20 degrees up or down whilst the tail can move a further 30 degrees relative to the main flap.
- Two fins extend from the ship side at about bilge level.
- They are turned in opposite directions as the ship rolls.
- The forward motion of the ship creates force on each fin and hence produces a moment opposing the roll. When the fin is turned down, the water exerts an upward force.
- When the fin is turned up, the water exerts a downward force.
- The fins are usually rectangular, having aero foil cross-section, and turn through about 20".
- Many are fitted with tail fins which turn relative to the main fin through a further 10".
- The fins are turned by means of an electric motor driving a variable delivery pump, delivering oil under pressure to the fin tilting gear.
- The oil actuates rams coupled through a lever to the fin shaft.
- Most fins are retractable, either sliding into fin boxes transversely or hinged into the ship. Hinged. fins are used when there is a restriction on the width of ship- which may be allocated, such as in a container ship.

2) **Bilge keel**

- When ships were first built of iron instead of wood a bar keel was fitted, one of its advantages being that it acted as an ant rolling device.
- With the fitting of the flat plate keel the ant rolling properties were lost. An alternative method was supplied in the form of bilge keels which are now used in the majority of ships.
- These projections are arranged at the bilge to lie above the line of the bottom shell and within the breadth of the ship, thus being partially protected against damage.
- The depth of the bilge keels depends to some extent on the size of the ship but there are two main factors to be considered;

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(a) the web must be deep enough to penetrate the boundary layer of water travelling with the ship

(b) if the web is too deep the force of water when rolling may cause damage.

- Bilge keels 250 **mm** to 400 mm.in depth are fitted to oceangoing ships.
- The keels extend for about one half of the length of the ship amidships and are tapered gradually at the ends.

3) Tank stabilizer

There are three basic systems of roll-damping using free surface tanks:

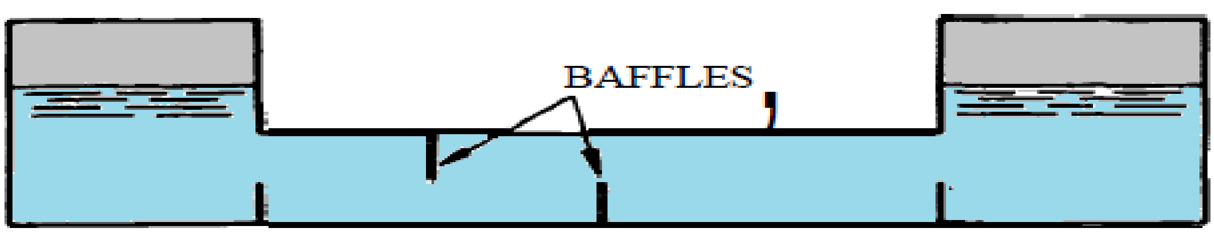
(a) Passive Tanks

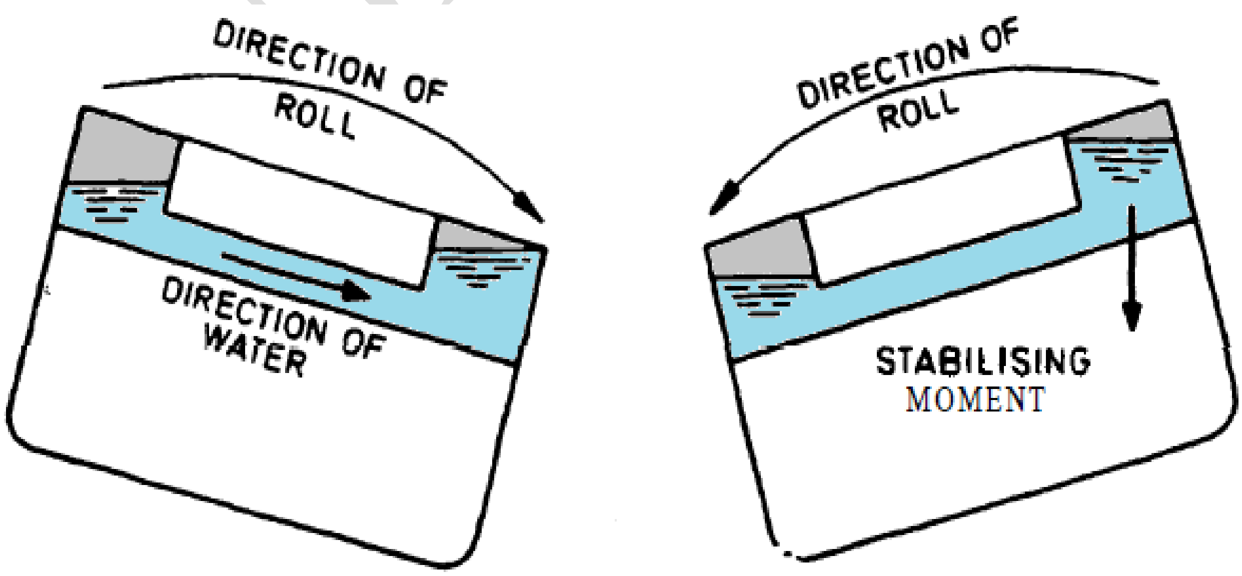
(b) Controlled Passive Tanks

(c) Active Controlled Tanks

- These systems do not depend upon the forward movement of the ship and are therefore suitable for vessels such as drill ships.
- In introducing a free surface to the ship, however, there is a reduction in stability which must be considered when loading the ship.

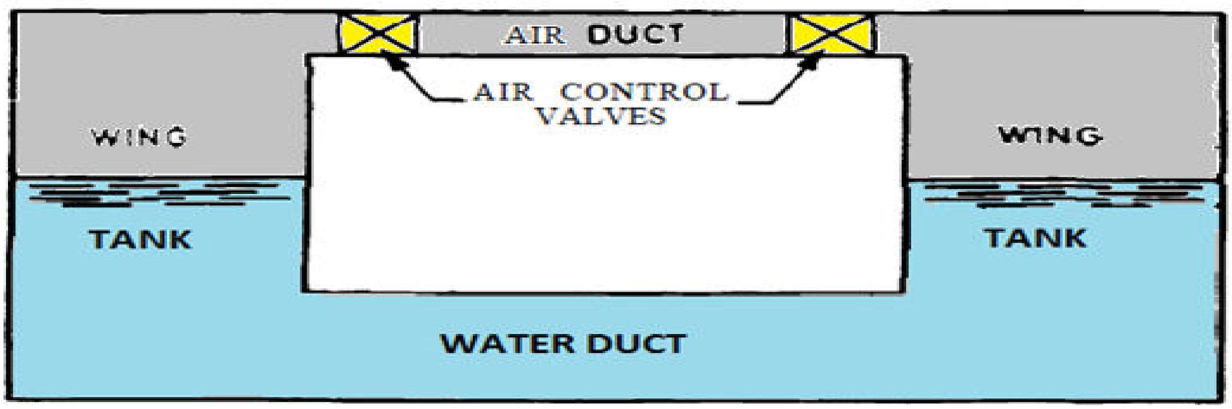
(a) Passive Tanks





- Two wing tanks are connerted by a duct having a system of baffles .
- The tanks are partly-filled with water.
- When the ship rolls, the water moves across the system in the direction of the roll. As the ship reaches its maximum angle and commences to return, the water, slowed by the baffles, continues to move in the same direction.
- Thus a moment is created, reducing the momentum of the ship and hence the angle of the subsequent roll.
- The depth of water in the tanks is critical and, for any given ship, depends upon the metacentric height.
- The tank must be tuned for any loaded condition by adjusting the level, otherwise the movement of the water may synchronize with the roll of the ship and create dangerous rolling conditions.
- Alternatively the cross-sectional area of the duct may be adjusted by means of a gate valve.

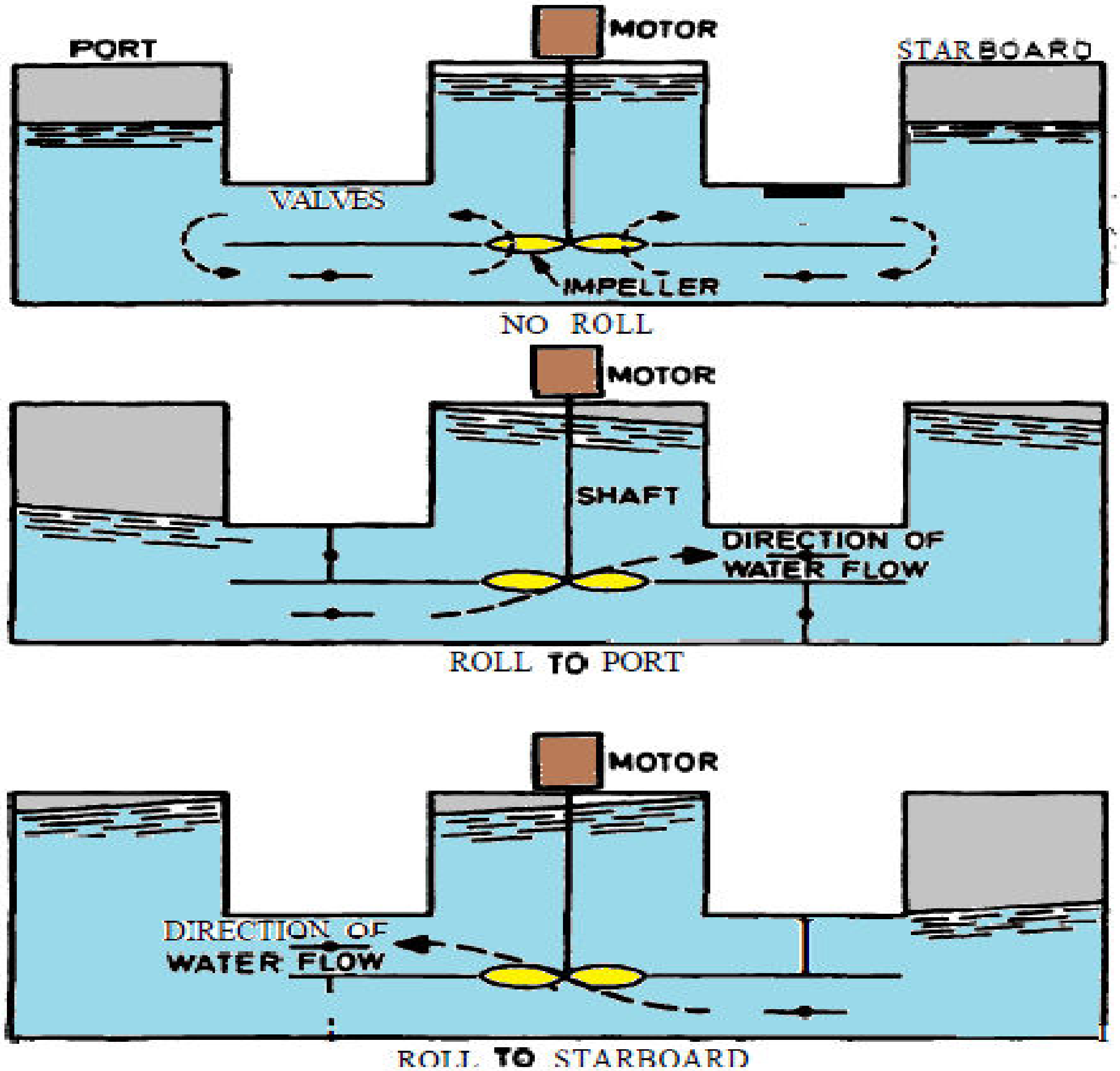
(b) Controlled Passive Tanks



- The principle of action is the same as for the previous system, but the transverse movement of the water is controlled by valves operated by a control system similar to that used in the fin stabiliser.
- The valves may be used to restrict the flow of water in a U-tube system, or the flow of air in a fully-enclosed system.
- The mass of water required in the system is about 2% to **2+%** of the displacement of the ship.

(c) Active Controlled Tanks

- In this system the water is positively driven across the ship in opposition to the roll. The direction of roll, and hence the required direction of the water, changes rapidly.
- It is therefore necessary to use a uni-directional impeller in conjunction with a series of valves.
- The impeller runs continually and the direction of the water is controlled by valves which are activated by a



- Careful design of the tank in terms of its shape , water capacity and vertical positioning in the ship allows control to be exercised with respect to rolling.
- With correct design of tank the water oscillating period will equal the roll period of the ship but its motion will lag behind that of the ship by one quarter of the roll period and behind the wave by half of the roll period.
- Water in the tank thus opposes the wave action producing the roll. Water movement between the tanks is regulated to some extent by the air valves.
- With the valves closed the system is put out of action. With this arrangement, known as the controlled passive system, the mass of water to about 2 to 2.5% of the ships displacement.

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Q 57: Explain & Draw Torsion Box? Location of it? (most imp question for container ship)

Q 57 a: what is Racking and how to resist it?

Q 57 b: Why in Tanker there is no Torsion Box?

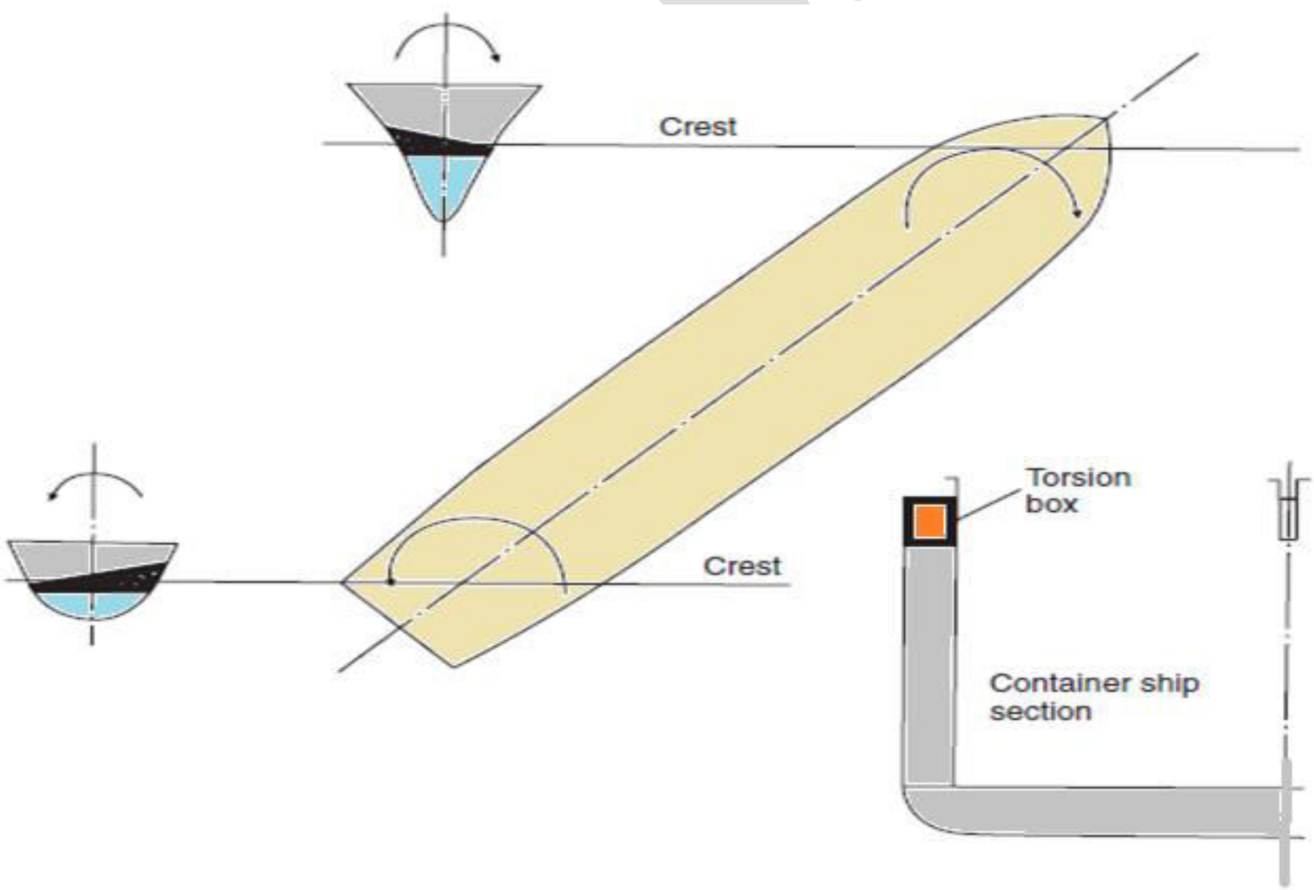
A 57, 57 a, 57 b:

TORSION BOX

LOCATION : Runs from Collision B/H to AFT peak B/H in both PORT & STBD side.

PREVENT:

- **Torsional bending on ships due to the torsional moment on ship caused by the dynamic movement of the wave.**
- **To avoid Racking Effect caused by the Sheer Stress on the vessel.**



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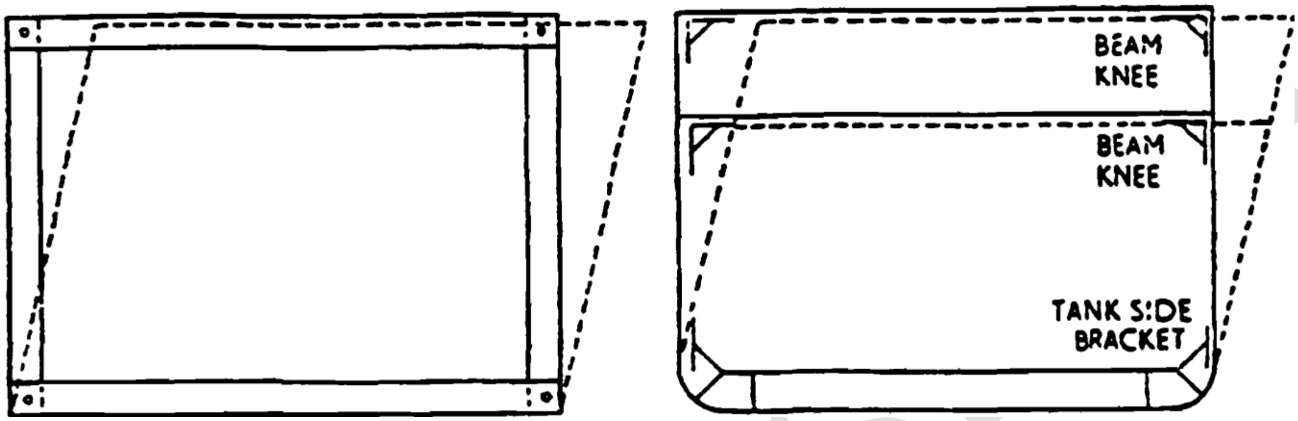
RACKING EFFECT:



- **When a ship is rolling, the deck tends to move laterally relative to the bottom structure, and the shell on one side to move vertically relative to the other side. This type of deformation is referred to as 'racking'.**
- **When a ship rolls there is a tendency for the ship to distort transversely in a similar way to that in which a picture frame may collapse. This is known as *racking.***
- It is reduced or prevented by the beam knee and tank side bracket connections together with the transverse bulkheads, the latter having the greatest effect.
- Transverse bulkheads primarily resist such transverse deformation, the side frames contribution being insignificant provided the transverse bulkheads are at their usual regular spacings.

THEORY:

- **TORSION**: When anybody is subject to a twisting moment which is commonly referred to as torque, that body is said to be in 'torsion'.
- A ship heading obliquely (45°) to a wave will be subjected to righting moments of opposite direction at its ends twisting the hull and putting it in 'torsion'.
- In most ships these torsional moments and stresses are negligible but in ships with extremely wide and long deck openings they are significant.
- A particular example is the larger container ship where at the topsides a heavy torsion box girder structure including the upper deck is provided to accommodate the torsional stresses.

- ***OIL TANKER** has many transverse bulkheads which act as a main stiffening member as a racking and twisting along with we have the uppermost continue deck which doesn't have many opening hatch compare to dry cargo ship. So OIL TANKER didn't have additional stiffening member like Torsion box.*
- ***IN BULK CARRIER** have small hatch opening and it has sufficient deck space or deck stiffening member which are sufficient to counteract the twisting moment.*

===

Q 58: What is Standard Fire test? Explain Class of Bulkhead also called Thermal Bulkhead?

A 58 :

STANDARD FIRE TEST

- A standard fire test is a test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the test method specified in the Fire Test Procedures.
- **Specimen shall have an expose surface not less than 4.65 m^2 and height 2.44 m including atleast one joint.**

CLASS "A" BULKHEAD:

- "A" class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:
  - **they are constructed of steel or other equivalent material;**
  - **they are suitably stiffened;**
  - **they are insulated with approved non-combustible materials such that the average**
- **Temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180ºC above the original temperature, within the time listed below:**

Class	A-60	60min
Class	A-30	30Min
Class	A-15	15Min
Class	A-0	0Min

- **They are constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test.**

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CLASS "B" BULKHEAD:

- "B" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:
  - They are constructed of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible.
- **They have an insulation value such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225ºC above the original temperature, within the time listed below**:

Class	B-15	15 min
Class	B-0	0 min

- **They are constructed as to be capable of preventing the passage of smoke and flame to the end of the first half hour standard fire test.**

CLASS "C" BULKHEAD:

- "C" class divisions are divisions constructed of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise.

He can ask you some definition from this:

- **Non-combustible material:** is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750^0 C, this being determined in accordance with the Fire Test Procedures.
- **Flashpoint** is the temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapour to be ignited.

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Q 59: Explain Anti heeling system? How it will work?

A 59 :

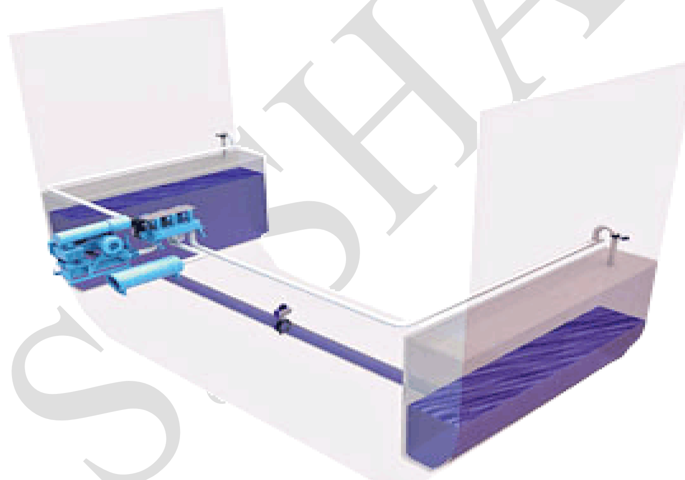
ANTI-HEELING SYSTEM

- **When the ship tilts on any of its sides i.e. port or starboard and doesn't return back to its upright position, it is known as heeling of the vessel.**
- Heeling is unsafe for ship, its machineries and people onboard.
- The main reasons of ship's heeling are strong winds, hard and speedy turns and uneven cargo loading.

- Out of the three reasons, the most common cause is uneven cargo loading and unloading.

Anti-heeling System

- The anti heeling system of a ship automatically detects the heeling angle of the ship and compensates the same.
- This allows the vessels to have continues loading and unloading cargo operation without stopping in between for list correction.
- This saves considerable amount time on the port.



- In this system, ballast tanks are internally connected to each other by means of pipe lines, automatic valves and control systems.
- When the ship heels to any of the sides, the heeling sensor sends the signal for change of ships angle with respect to the ship's upright position to the master control panel.
- This change in heeling angle is compensated by methods of auto transferring the water from the heeled side to the other side of the ship, making the vessel upright.
- Level control switches are also installed in the ballast tank involved with the anti-heeling system to avoid low level or over filling and hence over pressurizing of the tanks.

Types of Anti Heeling System

There are two widely used anti heeling system on board ships:

1) **Pneumatic system:**

- This system comprises of air purging arrangement and regulating valve system to force the air on the top of ballast tank.
- The air is forced on one tank and purged from the other, making the water rapidly flow from pressurised to purged tank.
- This transfer of water is used to upright the vessel in quick time.

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2) Water pump system:

- The pump system consists of electrical motor driven water pump, which can be a reversible or non reversible pump, connected with remote controlled valves that can direct ballast water flow in between the tanks.

Advantages of Anti Heeling System:

- Allows safer and rapid cargo loading and unloading.
- Shortens harbor time and saves port dues.
- Reduces damage to ramp, rolling cargo and containers.
- Ensures safety of the ship and personals

Safety of the system :

- Limit switch only

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Q 60: How you will enter in ENCLOSED SPACE with safety?

A 60:

ENCLOSED SPACE ENTRY

- Risk assessment carried out by 2/E or C/O.
- Meeting discussing the possible of hazards situation.
- A list of work, which is should be done is made for easy and fast work.
- Risk assessment includes rescue operation work done etc. etc….
- Assuming about Toxic gas present.
- Opening and securing the enclosed space cover with precaution.
  (CHECK IF SPACE IS PRESSURISED OR NOT)
- All fire hazards risk should minimize if hot work is carried out.
  (THIS CAN BE DONE BY EMPTY FUEL OR CHEMICAL TANK NEARBY HOTWORK)
- The space should be well ventilated
- Space should be check for sufficient O_2 level and check for other gas
- O_2 level should 21% by volume Percentage less than that is not acceptable and more time for ventilation should be given in such circumstances.
- Enough lighting and illumination should be present in the enclosed space before entering.
- A proper permit to work has to be filled out and checklist to be checked so as to prevent any accident which can endanger life.

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- Permit to work is to be valid only for a certain time period. If time period expires then again new permit is to be issued and checklist is to be filled out.
- Permit to work has to be checked and permitted by the Master of the ship in order to work in confined space.
- Proper signs and Men at work sign boards should be provided at required places so that person should not start any equipment, machinery or any operation in the confined space endangering life of the people working.
- Duty officer has to be informed before entering the enclosed space.
- The checklist has to be signed by the person involved in entry and also by a competent officer.
- One person always has to be kept standby to communicate with the person inside the space.
- The person may also carry a life line with him inside.
- The person should carry oxygen analyzer with him inside the enclosed space and it should be on all the time to monitor the oxygen content.
- As soon as level drops, the analyzer should sound alarm and the space should be evacuated quickly without any delay.
- No source of ignition has to be taken inside unless the Master or competent officer is satisfied.
- The number of persons entering should be constrained to the adequate number of persons who are actually needed inside for work.
- The rescue and resuscitation equipment are to be present outside the confined space. Rescue equipment includes breathing air apparatus and spare charge bottles.
- Means of hoisting an incapacitated person should be available.
- After finishing the work and when the person is out of the enclosed space, the after work checklist has to be filled.
- The permit to work has to be closed after this

The above mentioned procedure is extremely important to entering an enclosed space. These points are imperative to risk any crew member's life while entering a confined space.

==

Q 61: How you will clean Bilge Holding tank with following safety ? and what are they ?

A 61:

BILGE HOLDING TANK CLEANING WITH SAFETY

- **First you make sounding of the tank.**
- **Now inform to bridge for discharging water from the tank via OWS, and note down your position of the ship, if should be outside of the special area.**
- **Discharge as much as possible bilge water to overboard.**

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- **Via 15 ppm alarm testing**
- **If not possible than transfer into SLOP tank**
- **Or send it to SHORE facility.**

- **Note down entry into ORB.**
- **Now before you went for cleaning the tank after transfer, filled Enclosed space entry first.**
- The space should be well ventilated
- Space should be check for sufficient O_2 level and check for other gas
- O_2 level should 21% by volume Percentage less than that is not acceptable and more time for ventilation should be given in such circumstances.
- Enough lighting and illumination should be present in the enclosed space before entering.
- A proper permit to work has to be filled out and checklist to be checked so as to prevent any accident which can endanger life.
- Permit to work is to be valid only for a certain time period. If time period expires then again new permit is to be issued and checklist is to be filled out.
- Permit to work has to be checked and permitted by the Master of the ship in order to work in confined space.
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- After finishing the work and when the person is out of the enclosed space, the after work checklist has to be filled.
- The permit to work has to be closed after this

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Q 62: How is propeller fitting done? Explain procedure? How is it secured?

A 62:

1. Check propeller shaft:

- After removing the old propeller check that the shaft taper, key and thread are undamaged.
- Try the propeller shaft nut on the shaft thread.
- The shaft taper should be clean and dry.
- Five minutes with a dial indicator while the shaft is still installed can save a lot of agony and expense later.
- Even a slightly bent shaft can ruin your boating pleasure. If you don't have a dial indicator, you can use the following method.
- Rest a pointed stick on the rudder, aligning the pointed end with the machined centre of the shaft, than rotate the shaft.
- Any deviation will be apparent indicating the tapered end of the shaft may be bent.

2. Bearing check:

- Before installing your new prop ensure that the shaft bearing is not worn.
- A worn bearing or shaft will not be suitable for any propeller, so if it is worn, replace it. If there is too much play of the shaft in the bearing, the bearing must be replaced or vibration and damage to the shaft can occur.
- Please note that certain types of bearings require some clearance.
- If not sure contact the manufacturer and ask them what the maximum allowable clearance is.

3. Check key and keyway:

- Check that the key fits the keyway. Ensure the key slides through the new prop's keyway without jamming at any point or with no apparent slop.
- It will be helpful to mark the direction of the key in the keyway.

4. Propeller fit:

- Dry fit the propeller to the shaft, without the key in place first. Check that the propeller does not rock on the taper.
- Mark the shaft at the forward end of the propeller hub.

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- This is most is important - to first fit the new prop onto the shaft withoutthe key in place and to mark the shaft at the forward edge of the prop hub. Remove the prop and place the key into the shaft keyway.
- Slide the prop back onto the shaft and check that the forward edge of the hub comes to your shaft mark.
- If not then it is likely that the key is too large, and the propeller is not seated to the shaft taper correctly.
- Remove the prop and file the top of the key down until the prop will slide on to the shaft and reach the mark.
- This will ensure that the prop is now correctly seated on the shaft taper.

5. Fit propeller to shaft:

- It is good practice to "lap" the propeller to the shaft. I
- t only takes a few minutes and will improve the fit. Purchase some coarse valve grinding compound from an automotive supply store.
- Liberally coat the tapered end of the shaft and the bore of the propeller with the grinding paste. Slide the propeller onto the shaft.
- Apply gentle pressure and rotate the propeller on the shaft 90° to the right , then 90° to the left and repeat this several times.
- Occasionally remove the propeller from the shaft and wipe out the valve grinding compound and visually inspect the bore.
- Continue this until a minimum fit of 75% is achieved. Most valve grinding compounds are water soluble and wash off easily with soap and water.

6. Check propeller position:

- Carefully clean the propeller and the shaft and check the "dry fit" once more. You will probably notice that the propeller goes to a different position on the shaft than before.
- Mark this new position.

7. Install propeller:

- Install the propeller with the key fitted to the shaft. Some people prefer to use a lubricant on the shaft, we do not recommend this.
- Check that the propeller goes up to the mark on the propeller shaft. If it doesn't, the propeller is sitting on the key and you must reduce the height of the key to overcome this problem.

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- Draw the propeller up the taper using the propeller locking nut, then lock this nut with the second nut.
- Don't forget to fit a new cotter pin.

8. Painting propellers:

- Painting your propeller will degrade the performance. Barnacles, on the other hand will degrade the performance more than properly applied paint.
- If you use the boat often painting is not necessary. If you have the bottom regularly cleaned then painting is also not required.
- On the other hand, if you are like most of us and use the boat not as often as you would like, then painting may be helpful. A good alternative is the specialized silicon propeller coatings e.g.PROPSPEED which works because they are slick;- any marine growth slides off the metal surface when moving through the water.
- Here is one procedure for painting propellers:
  A. The propellers will be clean when you receive them apart from a light coat of oil. Remove this oil film using alcohol or acetone.
  B. Choose a good quality Zinc Chromate primer and lightly coat the propellers.
  C. The anti-fouling paint to use on the propellers is sold under various trade names as 'Outdrive Anti-fouling Paint' in spray cans. Spray 2-3 light even coats of paint on the propellers taking care not to get any paint into the bore of the hub.
  D. Allow at least 48 hours drying time before putting the propellers into service.
  E. It is best not to apply standard anti foul paint with a brush as it tends to "spin off" the propellers quickly and cannot be applied as evenly as spray paint.

9. Alignment check:

- After the boat has been in the water for 24 hrs, the engine alignment should be checked.

10. Shaft zinc anode:

- Shaft anodes should be fitted as far forward on the shaft as possible, or as near to the cutlass bearing as practical so it does not disturb the water flow to the propeller.

11. Vessel performance

- Record your vessels performance after the hull is cleaned and while the propeller is in good condition. Note of the top RPM and speeds achieved.
- This data will be very useful when fine tuning your propellers etc.

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Q 63: Type of Crude? What is Sweet and Sour crude?

A 63:

Crude: Natural or Raw state which is not yet processed or Refine.

Sweet Crude:

- **Crude which has Hydrogen Sulphate (H_2S) less than 25 ppm**
- **Crude which has sulphur is between 0.42-0.50 % .**
- Crude contain small amount of H_2S and CO_2 and is commonly used in process into Gasoline, kerosene and High quality diesel.

Sour Crude:

- **Crude which has Hydrogen Sulphate (H_2S) more than 25 ppm**
- **Crude which has sulphur is more than 0.50 % .**
- Crude contain small amount of H_2S and CO_2 but impurities are more and to remove impurities more processing charge. and is commonly used in process into heavy fuel oil.

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Q 64: Regulation of SOUNDING PIPE?

Q 64 a: Safety provided on sounding pipe?

A 64, 64 a:

SOLAS Regulation for SOUNDING PIPE:

- Sounding pipe for Bilges, Coffer dams, and Double bottom tanks situated in the machinery space.
- **All sounding pipe shall extend to position above ship's bulkhead deck which shall at all time accessible.**
- Sounding pipe diameter should not be less than 32 mm is it general required.
- **But where they pass through refrigerated spaces to allow for icing, a minimum diameter is 65 mm where temp at 0^0 C or less.**
- Sounding pipe for the bilges of insulated holds shall be insulated and not less than 65 mm in Diameter.

Safety on Sounding pipe:

- **A thick steel doubling or Striking plate shall be securely fixed below each sounding pipe for the sounding rod to strike upon.**

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- It is fitted with the parallel plug with an arrangement which gets open on being loaded and gets automatically closed when released to avoid the damage in case a person forget to close the sounding cap.
- It is always located close to the suction pipe to get the correct sounding for the pump to take the suction.

===

Q 65: Tell me about dimension of International Shore coupling, Sewage Coupling, and Bilge line coupling?

A 65 :

Dimension	International Shore Coupling *(500 GT and above have at least one)*	Bilge Coupling	Sewage Coupling
O.D	178 mm	215 mm	210 mm
I.D	64 mm	According to O.D of pipe	According to O.D of pipe
Bolt Circle Dia	132 mm	183 mm	170 mm
Flange Thick	14.5 mm	20 mm	16 mm
Slot in Flange	4	6	4
Dia of Slot	19 mm	22 mm	18 mm
Bolt & Nuts	4 / 4	6 / 6	4 / 4
Dia of Bolt	16 mm	20 mm	16 mm
Length of Bolt	50 mm	Suitable length	Suitable length
Pipe inner dia	------------------------	---------------------	100 mm

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So Friend these are all about "SHIP CONSTRUCTION AND NAVAL ARCHITECTURE", I hope you will understand easily and if you have any doubt just go through the REED'S, PURSEY, etc etc book, or any reference if you have. I just share what I know from my side.

"Correction Accepted"

PREPARED BY:
KUNJAL S. SHAH

In next page you have THE MOST IMPORTANT PART OF THIS SAFETY ORAL "SOLAS & MARPOL", and surveyor most most most important topic also this. I will try to explain each and everything, also about RULES AND REGULATION .

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