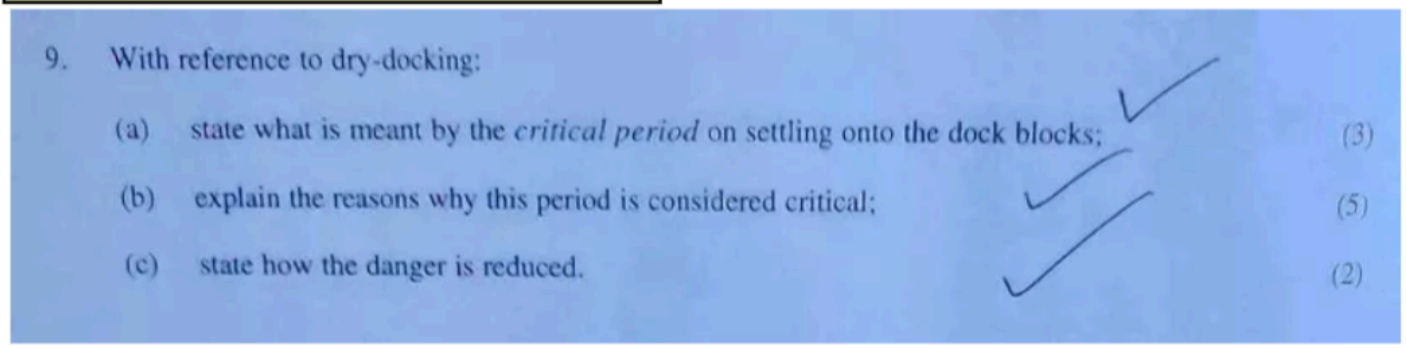
Jan 2024



9. With reference to dry-docking:

(a) state what is meant by the *critical period* on settling onto the dock blocks; (3)

(b) explain the reasons why this period is considered critical; (5)

(c) state how the danger is reduced. (2)

Dry-Docking and the Critical Period on Settling

(a) Critical Period on Settling onto Dock Blocks:

In dry-docking, the critical period on settling refers to the **brief moment when a vessel first makes contact with the dock blocks** after being lifted out of the water. During this transition, the entire weight of the vessel rests on a relatively small contact area between the hull and the dock blocks.

(b) Reasons for Criticality:

This period is considered critical for several reasons:

- **Uneven Load Distribution:** Initially, the weight of the vessel is not uniformly distributed across all dock blocks. The areas making first contact bear a disproportionately high load, which can exceed the designed strength of the blocks or the hull structure.
- **Hull Stresses:** The uneven load distribution can cause significant bending stresses in the hull structure, particularly at the areas making first contact with the blocks. These stresses can lead to permanent deformations or even cracks if not managed properly.
- **Block Movement and Instability:** If the initial load on individual blocks exceeds their capacity, they may crack, crumble, or shift out of position. This can destabilize the vessel and cause catastrophic accidents.

(c) Reducing the Danger:

Several measures are taken to minimize the dangers associated with the critical period:

- **Detailed Calculations and Planning:** Naval architects perform extensive calculations to determine the vessel's weight distribution, center of gravity, and optimal placement of dock blocks to ensure even load sharing upon initial contact.
- **Staged Lowering and Ballast Control:** The vessel is lowered onto the dock blocks in a controlled manner, ensuring multiple contact points before the full weight rests on the blocks. Ballast water distribution within the vessel may be adjusted to further optimize load distribution.
- **Shoring and Dunnage:** Temporary supports like shoring and dunnage (wedges made of wood or other materials) are used to provide additional support for the hull during the critical period and throughout the dry-docking process.
- **Experienced Crew and Monitoring:** Highly trained personnel oversee the entire dry-docking operation, continuously monitoring the vessel's stability and the condition of the dock blocks throughout the critical period and beyond.

By implementing these precautions, dry-docking facilities can significantly reduce the risks associated with the critical period on settling and ensure the safe and stable support of vessels during maintenance and repair work.

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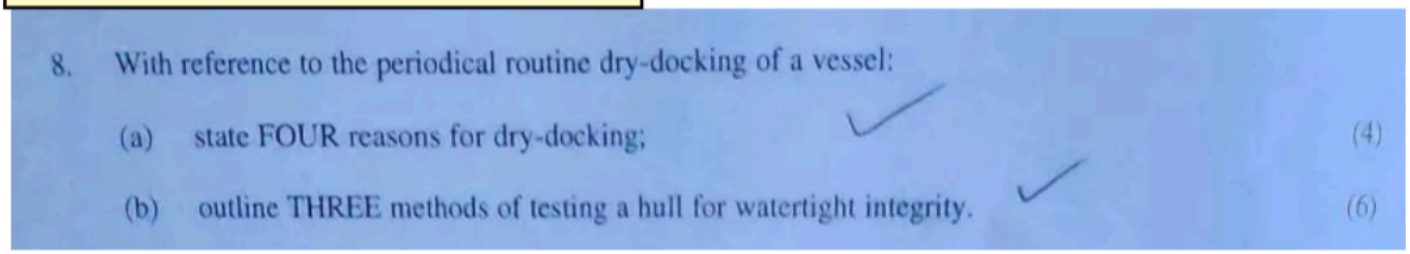

8. With reference to the periodical routine dry-docking of a vessel:

(a) state FOUR reasons for dry-docking; (4)

(b) outline THREE methods of testing a hull for watertight integrity. (6)

Dry-Docking: Essential Maintenance for Vessels

(a) Reasons for Periodical Dry-Docking:

Dry-docking, where a vessel is taken out of the water and placed on blocks in a dry dock, is a crucial process for maintaining a vessel's seaworthiness. Here are four key reasons for routine dry-docking:

1. **Hull Cleaning and Inspection:** Marine growth like barnacles and algae attach themselves to a vessel's hull over time, increasing frictional resistance and reducing fuel efficiency. Dry-docking allows for thorough cleaning of the hull to restore smoothness and performance. Additionally, surveyors can closely inspect the hull for corrosion, cracks, or other damage while it's out of the water.
2. **Underwater Repairs and Maintenance:** With the hull exposed, divers and maintenance crews can perform repairs on propellers, rudders, shafts, seawater intakes, and other underwater components that are inaccessible when the vessel is afloat. Routine dry-docking allows for preventive maintenance on these critical systems to avoid potential failures at sea.
3. **Classification Society Surveys:** Classification societies conduct regular surveys to ensure vessels meet safety and regulatory standards. Dry-docking facilitates thorough inspections of the underwater hull structure, internal compartments, and machinery spaces required by classification societies to maintain class status.
4. **Painting and Anti-fouling Applications:** Dry-docking provides an opportunity to apply fresh coats of anti-corrosive paint to the hull to protect the steel from deterioration. Additionally, anti-fouling coatings are applied to the hull to deter marine growth and maintain fuel efficiency for the upcoming operational period.

(b) Testing Methods for Hull Watertight Integrity:

Watertight integrity of a vessel's hull compartments is critical for safety and stability. Here are three methods used to test for watertight integrity during dry-docking:

1. **Visual Inspection:** Surveyors conduct a thorough visual examination of all watertight doors, hatches, and seals looking for signs of damage, deformation, or deterioration of gaskets and sealing surfaces. This initial assessment identifies areas that may need further testing.
2. **Hose Testing:** Watertight doors and hatches are subjected to a controlled spray of water from a high-pressure hose to simulate heavy seas or damage scenarios. Surveyors observe for any water leakage through the closure, indicating a potential breach in watertight integrity.
3. **Ultrasonic Testing:** In some cases, advanced ultrasonic testing equipment may be used to non-destructively assess the integrity of watertight bulkheads and decks. This technique sends sound

waves through the steel structure and analyzes the reflections to detect cracks or voids that could compromise watertightness.

By combining these testing methods during dry-docking, classification societies and ship owners can ensure that a vessel's watertight integrity meets safety regulations and the vessel is prepared to safely navigate even in harsh weather conditions.

28 may 2021

28 May 2021

8. (a) State the procedures and safety checks that should be undertaken prior to flooding a dry dock. (9)

(b) State who is responsible for signing the authority for a Flood Certificate. (1)

Dry Dock Flooding Procedures and Safety Checks:

(a) Prior to Flooding the Dry Dock:

Before flooding a dry dock and refloating a vessel, a series of crucial procedures and safety checks must be rigorously followed to ensure a smooth and safe operation. Here are some key steps:

- **Completion of Repairs and Maintenance:** All planned repairs, maintenance tasks, and painting work on the vessel must be demonstrably finished. No personnel or equipment should be left on board that could interfere with the flooding process.
- **Double-Bottom Tanks and Valves:** Double-bottom tanks (compartments at the bottom of the hull for ballast water) must be checked to ensure all valves are closed properly to prevent water ingress into the vessel as the dock is flooded.
- **Sea Chest Openings and Blanks:** All sea chests (openings in the hull for water intake and outflow) should be confirmed closed and secured with blanks (solid plates) to prevent unintended water flow into the vessel.
- **Bilge System and Pumps:** The bilge system (compartment for collecting drainage water) must be operational, and bilge pumps should be tested to ensure they can effectively remove any accumulated water once the vessel is afloat.
- **Mooring Lines and Fenders:** Mooring lines used to secure the vessel within the dry dock need to be slackened to allow for rising water levels and vessel movement during refloating. Fenders (protective cushions) between the hull and the dock wall may be adjusted or removed as needed.
- **Final Safety Checks:** A designated responsible person should conduct a final walkthrough of the dry dock and the vessel to verify all procedures have been completed and no personnel or equipment pose a hazard during flooding.

(b) Signing the Flood Certificate:

The authority for a Flood Certificate, which authorizes the flooding of the dry dock, is typically signed by a joint decision between two parties:

1. **Docking Master/Harbor Master:** This individual represents the dry dock facility and holds responsibility for the safe operation of the flooding process and ensuring the dock is prepared to receive water.

2. **Ship's Master/Chief Engineer:** The captain of the vessel (Ship's Master) or the chief engineer (responsible for machinery and vessel systems) represents the ship's ownership and certifies that the vessel is ready for refloating from a safety and operational standpoint.

Both parties share accountability for ensuring a safe and successful flooding operation. Their joint signatures on the Flood Certificate acknowledge completion of all necessary checks and grant final approval to proceed with flooding the dry dock.

26 feb 2021

26 February 2021

8. With reference to the periodical dry-docking of a vessel:

(a) state FIVE items of information that may be obtained from a *docking plan*; (5)

(b) state FIVE services that must be made available in order to maintain the safety of the vessel. (5)

Information Gleaned from a Docking Plan:

(a) Five Key Details from a Docking Plan:

A well-prepared docking plan provides valuable information for a successful dry-docking operation. Here are five key details you can typically find:

1. **Vessel Characteristics:** The plan will include basic vessel information like dimensions (length, breadth, draft), weight, and center of gravity. This data is crucial for calculating block placement and ensuring proper support during dry-docking.
2. **Docking Block Arrangement:** The plan details the specific type, size, and placement of docking blocks used to support the vessel in the dry dock. This ensures even weight distribution and minimizes stress on the hull structure.
3. **Sea Chest and Valve Locations:** The plan identifies the location of all sea chests (openings for water intake/outflow) and associated valves. This information is essential for divers to blank off these openings and prevent water ingress during flooding.
4. **Planned Maintenance and Repairs:** The docking plan outlines the specific maintenance and repair tasks scheduled for the dry-docking period. This helps coordinate workforces and allocate resources efficiently.
5. **Stability Calculations and Ballast Distribution:** The plan may include stability calculations to determine optimal ballast water distribution within the vessel during dry-docking. This maintains vessel stability and prevents tipping while out of the water.

(b) Five Essential Services for Vessel Safety During Dry-Docking:

(b) Five Essential Services for Vessel Safety During Dry-Docking:

Several crucial services are required to maintain vessel safety throughout the dry-docking process:

1. **Mooring and Shoring:** Skilled personnel secure the vessel within the dry dock using mooring lines and provide additional support with shoring (temporary structures) as needed. This prevents the vessel from shifting or tipping during flooding and dry-docking.

2. **Firefighting and Safety Equipment:** The dry dock facility must have readily available firefighting equipment and emergency response procedures in place to address any potential fire hazards during hot work (welding, cutting) performed on the vessel.
3. **Waste Management:** A plan for handling and disposing of waste generated during maintenance activities, such as paint scrapings, sandblasting debris, and oily wastes, is essential to comply with environmental regulations and maintain a safe work environment.
4. **Scaffolding and Access Platforms:** For repairs conducted on elevated sections of the hull, properly constructed scaffolding and access platforms are needed to ensure safe working conditions for maintenance personnel.
5. **Marine Growth Removal and Hull Cleaning:** Specialized services are required to remove marine growth like barnacles and algae from the hull. This improves fuel efficiency and reduces frictional resistance once the vessel returns to service.

By ensuring the availability of these essential services, dry dock facilities can contribute significantly to safe and efficient vessel maintenance during periodical dry-docking operations.

3 nov 2020

3 November 2020

8. With reference to the periodical dry-docking of a vessel:

(a) list FIVE precautions that should be undertaken before the vessel enters the dock; (5)

(b) list FIVE inspections/precautions that should be undertaken before re-flooding the dock. (5)

9 nov 2018

9 November 2018

8. With reference to the periodical dry-docking of a vessel:

(a) list SIX items of information that could be obtained from a docking plan; (6)

(b) list FOUR conditions to be met prior to dry-docking a vessel. (4)

Dry-Docking Precautions: Before Entering and Before Re-Flooding

(a) Pre-Docking Precautions:

To ensure a safe and smooth dry-docking operation, several precautions should be undertaken before the vessel enters the dock:

1. **Stability Calculations and Ballast Management:** Naval architects perform stability calculations to determine optimal ballast water distribution within the vessel. This ensures stability during the tricky transition from water to blocks and prevents excessive stress on the hull structure.
2. **Removal of Loose Items and Hazardous Materials:** All loose equipment, stores, and hazardous materials are removed from the vessel to minimize the risk of damage or accidents during lifting and dry-docking operations.
3. **Double-Bottom Tank Sounding and Valve Checks:** Double-bottom tanks (compartments in the bottom of the hull used for ballast water) are sounded to verify water levels and ensure all valves are closed properly. This prevents water ingress into the vessel during dry-docking.

4. **Sea Chest Blanking and Valve Closure:** All sea chests (openings in the hull for water intake and outflow) are closed and secured with blanks (solid plates) to prevent unintended water flow into the vessel during flooding of the dock.
5. **Pre-Docking Meeting and Communication:** A pre-docking meeting is held between ship's personnel, dry dock representatives, and relevant contractors to discuss the docking plan, safety procedures, and communication protocols throughout the operation.

(b) Pre-Re-Flooding Inspections and Precautions:

Before refloating the vessel by flooding the dry dock, a series of crucial inspections and precautions are essential:

1. **Completion of Repairs and Maintenance:** All planned repairs, maintenance tasks, and painting work on the vessel must be demonstrably finished. No personnel or equipment should be left onboard that could interfere with the flooding process.
2. **Bilge System and Pump Testing:** The bilge system (compartment for collecting drainage water) must be operational, and bilge pumps should be tested to ensure they can effectively remove any accumulated water once the vessel is afloat.
3. **Mooring Lines and Fender Adjustment:** Mooring lines used to secure the vessel within the dry dock need to be adjusted to accommodate rising water levels and eventual departure. Fenders (protective cushions) between the hull and the dock wall may be adjusted or removed as needed.
4. **Final Safety Checks:** A designated responsible person should conduct a final walkthrough of the dry dock and the vessel to verify all procedures have been completed and no personnel or equipment pose a hazard during flooding.
5. **Flood Certificate Authorization:** A Flood Certificate, authorizing the flooding of the dry dock, requires joint signatures from the Docking Master (representing the dry dock facility) and the Ship's Master (or Chief Engineer) certifying the vessel's readiness for refloating.

16 nov 2018

16 November 2018

7. With reference to the classification survey of a vessel in dry dock:

   (a) list EIGHT separate items of the hull and associated equipment that would be examined by the surveyor; (4)

   (b) describe TWO ways in which the thickness of a steel hull may be determined. (6)

Dry Docking Plans and Pre-Docking Conditions

(a) Six Items of Information from a Docking Plan:

A well-prepared docking plan provides crucial details for a successful dry-docking operation. Here are six key pieces of information you can typically find:

1. **Vessel Characteristics:** Dimensions (length, breadth, draft), weight, and center of gravity of the vessel. This data is vital for calculating block placement and ensuring proper support during dry-docking.
2. **Docking Block Arrangement:** The specific type, size, and precise placement of docking blocks used to support the vessel in the dry dock. This ensures even weight distribution and minimizes stress on the hull structure.

3. **Sea Chest and Valve Locations:** The location of all sea chests (openings for water intake/outflow) and associated valves is identified. This information is essential for divers to blank off these openings and prevent water ingress during flooding.
4. **Planned Maintenance and Repairs:** The docking plan outlines the specific maintenance and repair tasks scheduled for the dry-docking period. This helps coordinate workforces and allocate resources efficiently.
5. **Stability Calculations and Ballast Distribution:** The plan may include stability calculations to determine optimal ballast water distribution within the vessel during dry-docking. This maintains vessel stability and prevents tipping while out of the water.
6. **Waste Management Plan:** The plan may outline procedures for handling and disposing of waste generated during maintenance activities, such as paint scrapings, sandblasting debris, and oily wastes. This ensures compliance with environmental regulations.

(b) Four Conditions to be Met Before Dry-Docking:

Several crucial conditions must be met before a vessel can be safely dry-docked:

1. **Classification Society Approval:** Classification societies conduct surveys to ensure vessels meet safety and regulatory standards. Their approval is often required before dry-docking, particularly for extensive repairs or modifications.
2. **Docking Facility Suitability:** The chosen dry dock facility must be suitable for the size and weight of the vessel. Factors like dock dimensions, lifting capacity, and available services (e.g., cranes, waste disposal) need to be considered.
3. **Weather Conditions:** Favorable weather conditions are essential for safe dry-docking operations. High winds, waves, or storms can pose significant risks during the lifting and positioning of the vessel.
4. **Pre-Docking Preparations:** The vessel itself needs to be prepared for dry-docking. This includes removing loose equipment, hazardous materials, double-bottom tank sounding and valve checks, sea chest blanking, and a pre-docking meeting for clear communication between all parties involved.

16 nov 2018

16 November 2018

8. (a) Describe the basic construction and operation of a Vertical Ship Lift. (6)

(b) List TWO advantages and TWO disadvantages of a Vertical Ship Lift. (4)

Vertical Ship Lifts: Elevating Vessels Efficiently

(a) Construction and Operation:

A Vertical Ship Lift is a massive mechanical device used to raise and lower vessels between bodies of water with different elevations. Here's a breakdown of its construction and operation:

- **Structure:** A vertical ship lift consists of a large platform strong enough to support the weight of a vessel. The platform is suspended from a sturdy gantry frame equipped with powerful winch systems. These winches utilize wire ropes or hydraulic rams for precise vertical movement of the platform.
- **Operation:** The process of raising or lowering a vessel involves several steps:
    1. **Vessel Positioning:** The vessel carefully navigates into a receiving basin located at the lower end of the lift. Guides and mooring lines ensure proper alignment with the platform.

2. **Platform Submersion:** The platform descends until it is completely submerged, allowing the vessel to sail onto it. Water tightness between the basin and the platform is maintained during this stage.
3. **Lifting and Lowering:** Once the vessel is secured on the platform, the winches are activated, raising the platform with the vessel to the desired upper water level. The reverse process is used for lowering a vessel.
4. **Exiting the Lift:** Upon reaching the upper level, the platform is positioned over the exit canal. The vessel sails off the platform and continues its journey on the higher water body.

(b) Advantages and Disadvantages of Vertical Ship Lifts:

Vertical ship lifts offer some distinct advantages:

- **Faster Transit:** Compared to traditional canal locks, vertical ship lifts can raise or lower vessels much faster, reducing transit time and increasing efficiency on waterways with significant elevation differences.
- **Overcoming Large Elevation Changes:** Vertical ship lifts can effectively handle larger elevation changes between water bodies compared to multi-stage canal lock systems.

However, there are also some limitations to consider:

- **High Construction and Maintenance Costs:** Building and maintaining a large and powerful vertical ship lift can be significantly more expensive than canal lock systems.
- **Limited Vessel Capacity:** The platform size of a vertical ship lift restricts the maximum size of vessels it can accommodate, whereas canals can theoretically handle a wider range of vessel sizes.