Sept 2020

1. With reference to the SOLAS requirements for conducting regular emergency musters and drills:

   (a) state the accepted emergency signal for calling crew and passengers to lifeboat muster stations; (2)

   (b) state when emergency drills must be carried out; (4)

   (c) list FOUR types of emergency drill that must be conducted on a regular basis. (4)

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2. (a) State, with reasons, where the watch should be handed over on a vessel fitted with a UMS system, where the period of duty is 24 hours. (2)

   (b) Outline the responsibility of the duty engineer with respect to EACH of the following:

   (i) the Systems Status Board; (3)

   (ii) the Oil Record Book; (3)

   (iii) the main and auxiliary Machinery Maintenance Record Book. (2)

Sept 2020

3. With reference to the use of Oily Water Bilge Separators, explain the meaning of EACH of the following terms:

   (a) turbulent flow; (2)

   (b) emulsion; (2)

   (c) maximum flow rate; (2)

   (d) coalescence; (2)

   (e) interface. (2)

Sept 2020

4. With reference to the safe bunkering of marine gas oil fuel:

   (a) list SIX actions that should be taken prior to and during the loading; (6)

   (b) state FOUR tests to be carried out on the fuel to ensure that it is uncontaminated. (4)

Sept 2020

5. (a) State the IMO regulations for the disposal of sewage. (4)

   (b) With reference to aerobic sewage treatment plants, explain EACH of the following:

   (i) why air is bubbled through the effluent in the aeration tank; (2)

   (ii) why care must be taken over the choice of toilet cleansers used; (2)

   (iii) why calcium hypochlorite is added to the treated sewage before discharge overboard. (2)

Sept 2020

6. With reference to refrigeration plant;

   (a) state THREE indications of a loss in refrigerant charge; (3)

   (b) state THREE methods of detecting the location of the source of leakage; (3)

   (c) describe a safe method of bringing the gas charge back to its normal working level. (4)

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7. Explain, with the aid of sketches, the principles of reverse osmosis as a method of producing fresh water. (10)

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8. Describe, with the aid of a sketch, an active tank stabilisation system. (10)

Sept 2020

9. List the important operations that should be included when organising fire drills. (10)

Sept 2020

10. With reference to the construction of a vessel, state the meaning of EACH of the following terms:

(a) sheer; (2)

(b) freeboard; (2)

(c) moulded depth; (2)

(d) moulded draft; (2)

(e) flare. (2)

Sept 2020

1. With reference to the SOLAS requirements for conducting regular emergency musters and drills:

(a) state the accepted emergency signal for calling crew and passengers to lifeboat muster stations; (2)

(b) state when emergency drills must be carried out; (4)

(c) list FOUR types of emergency drill that must be conducted on a regular basis. (4)

SOLAS Requirements for Emergency Drills:

(a) Emergency Signal for Muster Stations:

The SOLAS-approved international signal for calling crew and passengers to lifeboat muster stations is a series of short blasts on the ship's whistle followed by one long blast. This is universally recognized as the signal for emergencies requiring muster at lifeboat stations.

(b) Frequency of Emergency Drills:

SOLAS mandates that emergency drills must be carried out at regular intervals to ensure crew familiarity with procedures and equipment in case of an actual emergency. The specific frequency depends on the type of drill:

- **At least once a week:** Abandon ship drills and fire drills for passenger ships carrying 24 or more passengers for more than 24 hours.
- **At least once a month:** Abandon ship drills and fire drills for all crew members on all passenger ships and cargo ships.
- **At least once every three months:** Drills for other emergencies, such as lifeboat operation, firefighting techniques, and emergency steering.

(c) Four Types of Regular Emergency Drills:

1. **Abandon Ship Drill:** This drill simulates the process of abandoning the ship in an emergency situation. Crew members practice their roles in assisting passengers and operating lifeboats and liferafts.

2. **Fire Drill:** This drill simulates a fire onboard. Crew members practice using firefighting equipment, search and rescue techniques, and evacuation procedures.

3. **Lifeboat Operation Drill:** This drill focuses on the proper operation of lifeboats and liferafts, including launching, lowering, boarding, and operating the emergency equipment onboard.

4. **Emergency Steering Drill:** This drill ensures the crew can maintain control of the ship in case of a failure in the main steering gear. It involves practicing alternative steering methods from the bridge or directly from the steering gear compartment.

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2. (a) State, with reasons, where the watch should be handed over on a vessel fitted with a UMS system, where the period of duty is 24 hours. (2)

(b) Outline the responsibility of the duty engineer with respect to EACH of the following:

(i) the Systems Status Board; (3)

(ii) the Oil Record Book; (3)

(iii) the main and auxiliary Machinery Maintenance Record Book. (2)

Handover and Engineer Responsibilities on a UMS Vessel:

(a) Handover Location on a UMS Vessel (24-Hour Duty):

On a vessel equipped with an Unattended Machinery Space (UMS) system and a 24-hour duty period, the ideal handover location **should be at the central control room**. Here's why:

- **Centralized Monitoring:** The central control room provides a centralized overview of all critical engine room parameters and alarms. This allows the oncoming duty engineer to quickly assess the current status of the machinery and identify any potential issues.

- **Information Sharing:** During handover, the outgoing engineer can efficiently communicate important information about recent events, equipment operation, and any ongoing maintenance tasks directly at the central control room. This ensures seamless continuity of watchkeeping duties.
- **Emergency Response:** Familiarity with the central control room layout and alarm systems is crucial. Handovering in this location ensures the oncoming engineer is immediately prepared to respond to any emergencies that might arise during their watch.

While the central control room is preferred, some vessels might have designated handover stations within the engine room itself. However, the key principle remains ensuring the oncoming engineer has full access to necessary information and equipment for effective watchkeeping.

(b) Duty Engineer Responsibilities:

The duty engineer on a UMS vessel has several key responsibilities:

(i) Systems Status Board:

- **Maintaining Accuracy:** The duty engineer is responsible for ensuring the Systems Status Board displays accurate and up-to-date information about the operational status of all critical machinery and auxiliary systems. This typically involves monitoring alarms, parameter readings, and equipment indications and reflecting them on the board.
- **Identifying Issues:** By monitoring the Systems Status Board, the engineer can identify any abnormal readings or developing problems that require further investigation or corrective action.

(ii) Oil Record Book (ORB):

- **Recording Operations:** The duty engineer is responsible for meticulously recording all oil-related operations in the ORB. This includes entries for:
    - Fuel oil bunkering (quantity, type, supplier)
    - Lubricating oil additions and changes
    - Bilge oil and waste oil discharges (with port and authorization details)
    - Any accidental oil spills or leakages
- **Maintaining Compliance:** Accurate and complete ORB records are crucial for demonstrating compliance with MARPOL (International Convention for the Prevention of Pollution from Ships) regulations concerning oil discharges and oily waste management.

(iii) Main and Auxiliary Machinery Maintenance Record Book:

- **Recording Maintenance:** The duty engineer is responsible for recording all maintenance activities performed on the main and auxiliary machinery in the designated record book.
- **Data Recording:** Entries should include details like:
    - Date and time of maintenance
    - Equipment or system worked on
    - Specific task performed (replacement of parts, adjustments, etc.)
    - Spare parts used (if applicable)
    - Initials of the engineer performing the maintenance
- **Future Reference:** These records provide a history of maintenance performed on the machinery, which can be valuable for future reference, troubleshooting issues, and planning preventive maintenance schedules.

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3. With reference to the use of Oily Water Bilge Separators, explain the meaning of EACH of the following terms:

   (a) turbulent flow; (2)

   (b) emulsion; (2)

   (c) maximum flow rate; (2)

   (d) coalescence; (2)

   (e) interface. (2)

In the context of oily water separators (OWS) used on ships, here's a breakdown of the terminology:

(a) **Turbulent Flow:** Turbulent flow refers to a chaotic and irregular fluid motion within the separator. This can occur during the initial influx of oily bilge water and can hinder effective oil-water separation. OWS designs often incorporate features to minimize turbulence and promote laminar flow (smooth, ordered flow) for optimal separation.

(b) **Emulsion:** An emulsion is a mixture of two immiscible (non-mixing) liquids. In an OWS, the emulsion refers to the bilge water, which is a mixture of oil and water. Oil and water don't naturally form a stable solution and tend to separate. However, in bilge water, wave action and other factors can create a stable emulsion where the oil particles are dispersed throughout the water in tiny droplets. This emulsion makes separation more difficult.

(c) **Maximum Flow Rate:** The maximum flow rate of an OWS refers to the highest rate of oily bilge water that the separator can process effectively and still meet regulatory discharge limits for oil content. Exceeding the maximum flow rate can compromise the separation efficiency and result in oily water discharge exceeding regulations.

(d) **Coalescence:** Coalescence refers to the process of small oil droplets in an emulsion coming together to form larger oil droplets. This process is crucial for effective oil-water separation in OWS. OWS often employ coalescing media or plates that promote coalescence by providing surfaces for oil droplets to collide and merge. Larger oil droplets are easier to separate from the water due to the difference in density.

(e) **Interface:** The interface refers to the boundary between the two separated liquids within the OWS - the treated water (bottom layer) and the oil (top layer). OWS designs aim for a clear and distinct interface to facilitate efficient separation and removal of the oil layer. Sensors within the OWS often monitor the interface level to ensure proper operation and prevent oil carryover in the discharged water.

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4. With reference to the safe bunkering of marine gas oil fuel:

(a) list SIX actions that should be taken prior to and during the loading; (6)

(b) state FOUR tests to be carried out on the fuel to ensure that it is uncontaminated. (4)

(a) Actions Before and During Bunkering:

1. **Pre-Bunkering Preparations:**
    - **Review Bunker Delivery Note (BDN):** Ensure the fuel specifications (grade, sulfur content, viscosity) match the order and meet vessel requirements.
    - **Analyze Fuel Certificate:** Verify the fuel meets international standards for quality and compatibility with the vessel's engine.
    - **Inspect Bunkering Manifolds and Hoses:** Visually check for leaks, damage, or wear and tear on bunkering hoses and connections.
2. **During Bunkering:**
    - **Double-Check Tank Capacity and Ullage:** Confirm sufficient tank capacity to accommodate the planned bunker quantity to prevent overfilling.
    - **Establish Clear Communication:** Maintain clear communication between vessel crew and bunkering personnel regarding agreed flow rates, hose connections, and emergency shutdown procedures.
    - **Monitor Bunkering Operation:** Assign dedicated personnel to continuously monitor the bunkering process, observing flow rates, tank levels, and any signs of leaks or spills.

(b) Tests to Ensure Uncontaminated Fuel:

1. **Visual Inspection:** Check for any discoloration, cloudiness, or presence of a "diesel bug" layer at the fuel-oil interface during bunkering, which might indicate microbial contamination.
2. **Spot Test:** A simple test using a commercially available kit can provide an initial indication of water content in the fuel. However, this might not be as precise as laboratory testing.
3. **Laboratory Analysis:** Sending fuel samples to a laboratory for detailed analysis provides a more accurate picture of fuel quality. This can include tests for water content, sediment levels, sulfur content, and presence of microbial growth.
4. **Flash Point Test:** This test determines the minimum temperature at which the fuel vapors ignite, ensuring the fuel meets safety specifications and has not been contaminated with lighter, more volatile hydrocarbons.

By implementing these precautions and tests, the risk of receiving contaminated fuel and potential problems during bunkering can be significantly reduced. It's important to follow established bunkering procedures, maintain clear communication, and prioritize safety throughout the operation.

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5. (a) State the IMO regulations for the disposal of sewage. (4)

(b) With reference to aerobic sewage treatment plants, explain EACH of the following:

(i) why air is bubbled through the effluent in the aeration tank; (2)

(ii) why care must be taken over the choice of toilet cleansers used; (2)

(iii) why calcium hypochlorite is added to the treated sewage before discharge overboard. (2)

Sewage Disposal and Aerobic Treatment Plants

(a) IMO Regulations for Sewage Disposal:

The International Maritime Organization (IMO) regulates sewage disposal from ships through Annex IV of the MARPOL Convention - **"Regulations for the Prevention of Pollution by Sewage from Ships"**. Here's a summary of the key points:

- **Discharge Prohibition:** Generally, the discharge of **untreated sewage** from ships is **prohibited**. Exceptions are allowed only in specific circumstances, with strict distance requirements from land.
- **Treatment Requirements:** Ships can discharge **comminuted and disinfected sewage** or **treated sewage** from approved sewage treatment plants when meeting specific conditions and at greater distances from land compared to untreated sewage.
- **Discharge Records:** MARPOL requires ships to maintain an **Oil Record Book (ORB)**, which also includes a section for recording sewage discharges, including date, time, location, quantity, and operational conditions.

(b) Aerobic Sewage Treatment Processes:

(i) Air Bubbling in Aeration Tank:

Air is continuously bubbled through the effluent in the aeration tank of a sewage treatment plant for several reasons:

- **Supplies Oxygen:** The bubbles provide **dissolved oxygen** necessary for the survival and activity of **aerobic microorganisms**. These bacteria are crucial for breaking down organic matter present in the sewage.
- **Mixing:** The air bubbles promote efficient **mixing** of the effluent. This ensures all parts of the wastewater come into contact with the microorganisms for optimal biological treatment.
- **Floc Formation:** The air bubbles can also aid in the formation of **flocs**. These are clumps of organic matter and microorganisms that settle more readily for separation during later stages in the treatment process.

(ii) Choosing Toilet Cleansers:

Care must be taken over the choice of toilet cleansers used on ships with aerobic sewage treatment plants because:

- **Harmful Chemicals:** Some conventional toilet cleansers contain harsh chemicals that can be toxic to aerobic bacteria. These chemicals can hinder the bacteria's ability to break down organic matter, compromising the efficiency of the treatment process.
- **Biodegradable Options:** Using **biodegradable toilet cleansers** specifically formulated for marine sanitation systems is recommended. These cleansers are effective while being less harmful to the beneficial bacteria in the treatment plant.

(iii) Adding Calcium Hypochlorite:

Calcium hypochlorite (Ca(OCl)2), also known as bleaching powder, is often added to the treated sewage before discharge overboard for disinfection purposes:

- **Disinfection:** Calcium hypochlorite releases chlorine when added to water. Chlorine is a powerful disinfectant that inactivates harmful bacteria and viruses present in the treated sewage effluent. This helps minimize the risk of spreading pathogens in the marine environment and protects public health.
- **Controlled Dosage:** The amount of calcium hypochlorite added is carefully controlled to ensure effective disinfection while minimizing the environmental impact of chlorine.
- **Alternative Methods:** Some treatment plants may utilize other disinfection methods like ultraviolet (UV) radiation instead of chlorine, depending on regulations and specific considerations.

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6. With reference to refrigeration plant;

(a) state THREE indications of a loss in refrigerant charge; (3)

(b) state THREE methods of detecting the location of the source of leakage; (3)

(c) describe a safe method of bringing the gas charge back to its normal working level. (4)

Refrigeration Plant: Refrigerant Loss, Leak Detection, and Recharge

(a) Indications of Refrigerant Loss:

Several signs can indicate a loss of refrigerant charge in a refrigeration plant:

1. **Reduced Cooling Capacity:** One of the most noticeable signs is a decrease in the system's ability to achieve and maintain the desired cooling temperature. The chilled space may not reach the set point, or it may take longer to reach the desired temperature.

2. **Increased Compressor Workload and Run Time:** With less refrigerant circulating, the compressor has to work harder to maintain the required cooling effect. This can lead to longer compressor run times, higher energy consumption, and potential overheating of the compressor.

3. **Changes in System Pressures and Temperatures:** Refrigerant loss typically results in changes to the system's pressure and temperature readings. The suction pressure (low pressure side) may be lower than usual, while the discharge pressure (high pressure side) could also be affected. Additionally, frost patterns on the evaporator coil might become erratic or uneven.

(b) Methods for Leak Detection:

Here are three methods for detecting the location of a refrigerant leak in a refrigeration plant:

1. **Electronic Leak Detectors:** Specialized electronic leak detectors can be used to pinpoint leaks. These devices are sensitive to specific refrigerants and emit an audible or visual signal when they detect a concentration of refrigerant gas above a certain threshold.

2. **Ultrasonic Leak Detection:** This method uses ultrasonic sound waves. Leaks create turbulence in the escaping gas, which can be detected by the ultrasonic equipment. This method can be effective for pinpointing leaks in areas that may be difficult to visually inspect.

3. **Bubble Testing:** A safer method involves applying a soapy water solution to suspected leak areas. If a leak is present, bubbles will form around the leak point due to the escaping gas creating pressure against the soapy water film. This method is relatively simple but may not be effective for all types of leaks or in areas that are difficult to access.

(c) Safe Refrigerant Recharge:

Recharging a refrigeration system with refrigerant should only be done by a qualified technician who is properly trained and equipped to handle refrigerants safely. Here's a breakdown of a safe method for refrigerant recharge:

1. **System Leak Repair:** The first and most important step is to identify and repair the source of the leak. Leaking refrigerant poses environmental and safety risks. Recharging without fixing the leak will only lead to further refrigerant loss.

2. **System Evacuation:** A qualified technician will use a vacuum pump to evacuate the system. This removes any non-condensable gases (like air or moisture) that may have entered the system during the leak or repairs.

3. **Refrigerant Recovery (if applicable):** If any residual refrigerant remains in the system, a technician will use a recovery unit to capture and store it for proper disposal or recycling.

4. **Refrigerant Charging:** Using specialized equipment and following the manufacturer's specifications, the technician will carefully measure and introduce the correct amount and type of refrigerant into the system. Overcharging can be just as detrimental to the system as undercharging.

5. **Leak Monitoring:** After recharging, the technician will monitor the system for leaks and ensure proper system pressures and temperatures are achieved.

Following these steps ensures a safe and effective refrigerant recharge process that minimizes environmental impact and optimizes system performance.

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7. Explain, with the aid of sketches, the principles of reverse osmosis as a method of producing fresh water. (10)

Reverse osmosis (RO) is a water purification technique that utilizes a semi-permeable membrane to separate dissolved contaminants from water. Here's a breakdown of the principles behind it:

Natural Osmosis:

Imagine a container divided by a semi-permeable membrane separating salty water (high solute concentration) from pure water (low solute concentration). Osmosis, a natural process, will cause the pure water to flow through the membrane towards the saltier side. This happens because water molecules are constantly moving, and the semi-permeable membrane only allows them to pass through, not the salt ions. This movement of water molecules tries to balance the concentration of solutes on both sides.

Reverse Osmosis:

In RO, we apply pressure to the salty water side, overcoming the natural osmotic pressure. This applied pressure forces the pure water molecules from the salty water solution to pass through the membrane in the opposite direction of natural osmosis, hence the term "reverse." The filtered water, devoid of most salts and impurities, is collected on the other side of the membrane as permeate. The remaining concentrated brine solution (reject water), containing the filtered-out contaminants, is discharged from the system.

Key Components:

- **Semi-permeable membrane:** This is the heart of RO, allowing only water molecules to pass through while rejecting most dissolved ions and larger molecules.
- **High-pressure pump:** This pump pressurizes the feed water (salty water) to overcome the osmotic pressure and drive the process.
- **Pre-treatment (optional):** Depending on the feed water quality, pre-treatment steps like filtration or chlorination might be necessary to protect the RO membrane from damage.

Applications:

Reverse osmosis is a versatile and efficient method for desalination, turning seawater or brackish water into fresh water for various purposes:

- **Drinking water:** RO is widely used to produce clean drinking water from saline sources, especially in regions with limited freshwater resources.
- **Industrial processes:** RO purified water is used in various industries where high-purity water is required, such as electronics manufacturing and pharmaceutical production.
- **Irrigation:** RO can help reduce salinity in water used for agriculture, protecting crops from salt damage.

Limitations:

- **Energy consumption:** The high-pressure pump requires significant energy to operate.
- **Membrane maintenance:** RO membranes are susceptible to fouling and require periodic cleaning or replacement.
- **Wastewater disposal:** The concentrated brine solution from RO needs proper disposal to avoid environmental impacts.

Overall, reverse osmosis is a powerful technology for producing fresh water from various saline sources, playing a crucial role in water security and sustainable water management.

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8. Describe, with the aid of a sketch, an active tank stabilisation system. (10)

An active tank stabilization system is a method for reducing a ship's rolling motion using onboard tanks filled with water and a control system. Unlike passive anti-rolling tanks, which rely on the natural movement of water within the tanks, active systems utilize pumps and sensors to actively control the water movement, counteracting the roll of the ship.

Here's a breakdown of how an active tank stabilization system works:

Components:

- **Stabilization Tanks:** Two symmetrical tanks are located on either side of the ship, typically positioned low in the bilge area for optimal roll reduction.
- **Pumps:** Variable-speed pumps are installed within each tank. These pumps can be axial flow pumps or other suitable types designed for efficient water movement.
- **Control System:** This system plays a crucial role in the active stabilization process. It includes:
  - **Roll Sensors:** Gyroscopes or accelerometers are used to detect the ship's rolling motion and its direction.
  - **Control Unit:** This unit processes the sensor data and calculates the required pump operation to counteract the roll.

Operation:

1. **Roll Detection:** The roll sensors continuously monitor the ship's rolling motion, measuring the angle and direction of the roll.
2. **Control System Response:** The control unit receives the sensor data and determines the necessary action to counter the roll. It calculates the direction and speed at which each pump needs to operate.
3. **Pump Activation:** Based on the control unit's output, the pumps in the tanks are activated.

- **Starboard Roll:** If the ship rolls to starboard (right), the control unit activates the pump in the port (left) tank to move water towards the starboard side. This creates a counteracting force that pushes the starboard side upwards and the port side downwards, bringing the ship back to a level position.
- **Portside Roll:** Conversely, if the ship rolls to port, the pump in the starboard tank is activated to move water towards the port side, countering the roll in the opposite direction.

Advantages:

- **Highly Effective:** Active tank stabilization systems are very effective in reducing a ship's rolling motion, often achieving reductions of 80% or more. This provides significant improvements in passenger comfort, crew safety, and cargo handling efficiency in rough seas.
- **Fast Response:** The system can react quickly to changes in roll angle due to the real-time sensor data and rapid adjustments in pump operation.
- **Scalability:** The system can be scaled to accommodate different vessel sizes and roll reduction requirements.

Disadvantages:

- **Complexity:** Active tank stabilization systems are more complex than passive systems due to the additional pumps, sensors, and control units. This complexity increases installation and maintenance costs.
- **Power Consumption:** The pumps require power to operate, which adds to the overall energy consumption of the vessel.
- **Limited Effectiveness at High Speeds:** The effectiveness of the system might be reduced at very high ship speeds due to limitations in pump capacity and water movement capabilities.

Overall, active tank stabilization systems offer a powerful solution for significantly reducing a ship's rolling motion, enhancing passenger comfort, and improving overall operational efficiency. However, their complexity and energy consumption need to be considered when compared to simpler passive tank stabilization methods pt 2020

Sept 2020

9. List the important operations that should be included when organising fire drills. (10)

Fire drills are essential for ensuring the safety of crew and passengers on marine vessels. Here's a list of important operations that should be included when organizing fire drills for marine applications:

1. Alarm Activation and Response:

- Simulate a fire alarm by activating the fire alarm system in the designated drill area.
- Crew members should practice their immediate response to the alarm, including:
  - Reporting to their assigned muster stations.
  - Donning personal protective equipment (PPE), including breathing apparatus if applicable.
  - Taking headcount to ensure everyone is accounted for.

2. Fire Reporting and Communication:

- Simulate the discovery of a fire by a crew member.
- Practice proper procedures for reporting the fire location and size to the designated personnel (bridge, control room).
- Test communication protocols between different teams (e.g., bridge team informing firefighting teams).

3. Firefighting Operations:

- Depending on the scenario, practice various firefighting techniques:
  - Using fire hoses to extinguish flames with simulated fire sources (following safety precautions).
  - Operating portable fire extinguishers on designated training fires.
  - Utilizing fire blankets to smother small fires.
  - Sealing watertight doors to isolate the fire zone.

4. Evacuation Procedures:

- Practice emergency evacuation procedures for the designated area:
  - Following designated escape routes according to muster station assignments.
  - Using emergency exits and life-saving equipment (lifeboats, liferafts) if applicable to the drill scenario.
  - Conducting headcount at the designated assembly stations after evacuation.

5. Search and Rescue:

- In some drills, simulate search and rescue operations for missing crew members within the designated area.
- Practice utilizing search equipment (thermal imaging cameras) and proper rescue techniques.

6. Abandon Ship Procedures:

- In specific scenarios, practice complete abandonment ship procedures:
  - Boarding lifeboats and liferafts following assigned stations.

- ○ Launching lifeboats and deploying liferafts.
- ○ Signaling for help using distress flares or radios.
- ○ Performing emergency first aid and survival techniques while awaiting rescue.

Additional Considerations:

- **Different Scenarios:** Conduct drills for various fire scenarios, including engine room fires, galley fires, and cabin fires.
- **Realistic Environment:** As far as practical, create a realistic environment during the drill to simulate the stress and confusion of a real fire.
- **Debriefing:** After each drill, conduct a debriefing session to discuss performance, identify areas for improvement, and answer any questions from crew members.
- **Record Keeping:** Maintain accurate records of fire drills, including date, time, scenario, participants, and any observations or lessons learned.

By incorporating these essential operations and considering these additional factors, you can ensure that your marine fire drills are effective in preparing crew members for real-world emergencies. Remember, the goal is to instill a sense of urgency, practice teamwork, and ensure everyone onboard knows their roles and responsibilities in case of fire.

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Sept 2020

10. With reference to the construction of a vessel, state the meaning of EACH of the following terms:

(a)	sheer;	(2)
(b)	freeboard;	(2)
(c)	moulded depth;	(2)
(d)	moulded draft;	(2)
(e)	flare.	(2)

Here's a breakdown of the terms related to a vessel's construction and shape:

(a) **Sheer:** Sheer refers to the longitudinal curvature of a vessel's deck from bow to stern. The deck is typically higher at the bow and stern compared to the midships section. This curvature provides several benefits:

- **Improved Buoyancy:** The higher sheer at the bow helps to shed water and prevent excessive wave washing over the deck in rough seas.
- **Enhanced Drainage:** The slope of the sheer helps to drain water overboard more effectively.
- **Strength Considerations:** In some cases, a slight sheer can improve the longitudinal strength of the hull.

(b) **Freeboard:** Freeboard is the vertical distance between the waterline and a specific deck on the vessel's side, typically the uppermost continuous deck exposed to weather. It's a safety measure that ensures sufficient buoyancy and prevents excessive wave washing over the deck. Regulations specify minimum freeboard requirements based on factors like vessel type, size, and operating area.

(c) **Moulded Depth:** Moulded depth refers to the vertical distance between the keel (lowest point of the hull) and the uppermost deck (typically the main deck) measured at the vessel's side amidships. It's a measurement of the hull's depth excluding any external appendages like bulwarks or fenders. Moulded depth is a fixed dimension specific to a vessel design.

(d) **Moulded Draft:** Moulded draft is the vertical distance between the keel (lowest point of the hull) and the waterline measured amidships. It's a measurement of the vessel's depth underwater excluding external appendages. Unlike moulded depth, moulded draft is not fixed and changes based on the vessel's weight and cargo load (resulting in a deeper draft).

(e) **Flare:** Flare refers to the outward inclination of a ship's side shell plating above the waterline, particularly towards the bow. This outward angle serves several purposes:

- **Improved Buoyancy:** The flare helps to increase buoyancy at the bow, preventing excessive water ingress during head-on seas.
- **Reduced Wave Impact:** The angle deflects waves outwards, minimizing water washing over the deck and improving weather handling.
- **Stability Enhancement:** The wider beam at the waterline created by the flare improves initial stability, helping the vessel resist rolling motions.