9 November 2018

1. With reference to the MARPOL Convention Annex I - Shipboard Oil Pollution Emergency Plan (SOPEP):

   (a) outline FOUR minimum requirements that should be included in the plan; (4)

   (b) describe the actions that should be taken on discovering an accidental discharge of oil during bunkering. (6)

9 November 2018

2. With reference to the STCW '78 as amended, machinery space watchkeeping requirements, state EACH of the following:

   (a) the purpose of *standing orders*; (3)

   (b) FOUR examples of *standing orders*; (4)

   (c) the circumstances under which it would be inappropriate for an officer in charge of an engineering watch to hand over responsibility to a relief watchkeeper. (3)

9 November 2018

3. With reference to the International Convention on Load Lines:

   (a) define the terms *freeboard* and *freeboard deck;* (5)

   (b) list FIVE items that would be inspected by a surveyor before issuing or endorsing a load line certificate. (5)

9 November 2018

4. (a) List FOUR aspects upon which a new person joining a vessel for the first time would receive instruction. (4)

   (b) Detail SIX ways in which personal action can increase the risk of fire on a vessel. (6)

9 November 2018

5. (a) Define a Classification Society. (6)

   (b) State the periods between docking surveys for a vessel less than 15 years old. (4)

9 November 2018

6. (a) List SIX examples of *condition monitoring* that could be applied as part of a planned maintenance system. (6)

(b) Explain how condition monitoring can assist in expediting classification survey requirements. (4)

9 November 2018

7. With reference to vessel's survey requirements:

(a) describe FIVE ways in which Government Surveyors will act in maintaining the statutory requirements of a vessel; (5)

(b) list FIVE ways in which Classification Surveyors can act to maintain the class and statutory requirements of the vessel. (5)

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)

9 November 2018

9. A vessel has bunkered 250 tonnes of diesel fuel of which 10% is assumed to be unpumpable. The average combined sea load of the vessel is 2800kW with a stated specific consumption of 0.35kg/kWh at a speed of 18 knots.

Calculate EACH of the following:

(a) the daily fuel consumption of the vessel; (4)

(b) the safe steaming range of the vessel. (6)

9 November 2018

10. (a) Write standing orders detailing the procedures to be followed in the event of a fire within the machinery spaces. (6)

(b) List FOUR types of portable fire extinguisher that could be found within the machinery spaces, stating on which class of fire EACH should be used. (4)

9 November 2018

1. With reference to the MARPOL Convention Annex I - Shipboard Oil Pollution Emergency Plan (SOPEP):

   (a) outline FOUR minimum requirements that should be included in the plan; (4)

   (b) describe the actions that should be taken on discovering an accidental discharge of oil during bunkering. (6)

SOPEP Requirements and Actions for Bunkering Oil Discharge (MARPOL Annex I)

The MARPOL Annex I Shipboard Oil Pollution Emergency Plan (SOPEP) serves as a critical guide for responding to oil spills at sea. Here's a breakdown of key points:

(a) Four Minimum Requirements for SOPEP:

1. **Information on the Ship:** The SOPEP should include essential details about the vessel, such as its general arrangement, capacities of oil tanks, and location of oil discharge containment and recovery equipment onboard.
2. **Reporting Procedures:** The plan must outline clear procedures for reporting oil spills to the appropriate authorities, including coastal states, flag state administration, and the ship's company.
3. **Actions to Contain and Recover Oil:** This section details the steps to be taken for containing and recovering spilled oil at sea. It should include deployment procedures for equipment like booms, skimmers, and sorbents.
4. **Personnel Training:** The SOPEP should specify training requirements for crew members in responding to oil spills, including familiarization with the plan, equipment usage, and spill response procedures.

(b) Actions on Discovering Accidental Discharge During Bunkering:

In case of an accidental oil discharge during bunkering operations, immediate and effective action is crucial. Here's a basic outline of steps to be taken:

1. **Stop Bunkering Operation Immediately:** The first priority is to stop the bunkering process to prevent further oil discharge. This involves closing valves and isolating pipelines involved in the transfer operation.
2. **Contain the Spill:** If possible, deploy containment booms around the spilled oil to prevent it from spreading further. This helps minimize the area of contamination and facilitates oil recovery.
3. **Activate the SOPEP:** Inform the master or designated officer about the incident and activate the SOPEP. This ensures a coordinated response involving crew members trained in spill response procedures.
4. **Alert the Authorities:** Report the incident to the relevant authorities as outlined in the SOPEP. This typically involves contacting the coastal state authorities, flag state administration, and the ship's company.
5. **Recover the Oil:** Deploy skimmers or other appropriate equipment to recover as much spilled oil as possible from the water surface.

6. **Record Keeping:** Document all actions taken in response to the incident, including the time of the spill, estimated amount of oil discharged, and response measures implemented. This information is crucial for future reporting and investigations.

Important Note: The specific procedures for responding to oil spills may vary depending on the SOPEP of the vessel and the prevailing environmental conditions. Crew members should be familiar with their SOPEP and receive proper training on using oil spill response equipment to ensure an effective response in case of an oil discharge incident.

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2. With reference to the STCW '78 as amended, machinery space watchkeeping requirements, state EACH of the following:

(a) the purpose of *standing orders*; (3)

(b) FOUR examples of *standing orders*; (4)

(c) the circumstances under which it would be inappropriate for an officer in charge of an engineering watch to hand over responsibility to a relief watchkeeper. (3)

STCW and Machinery Space Watchkeeping Requirements:

(a) Purpose of Standing Orders:

Standing orders are written instructions provided onboard a vessel to guide the operation and maintenance of machinery and equipment, particularly within the engine room. Their main purpose is to:

- **Ensure Consistent and Safe Operation:** Standing orders promote consistent and safe practices for operating and maintaining machinery by outlining clear procedures for routine tasks, emergency situations, and unforeseen circumstances.
- **Reduce Risk:** By providing clear instructions, standing orders help minimize the risk of human error and equipment malfunctions during machinery space operations.
- **Facilitate Watch Handover:** Standing orders serve as a reference point for watchkeeping engineers, ensuring a smooth and informed handover of responsibilities between crew members.

(b) Four Examples of Standing Orders:

1. **Starting and Stopping Procedures:** Standing orders typically detail the specific steps for starting and stopping main and auxiliary engines, outlining proper safety precautions and sequence of operations.
2. **Alarm Response Procedures:** These orders specify the actions to be taken in response to various machinery alarms, ensuring prompt and appropriate responses to potential issues.
3. **Maintenance Routines:** Standing orders may outline routine maintenance procedures for critical equipment, including lubrication checks, filter replacements, and other preventive maintenance tasks.
4. **Emergency Procedures:** Orders may detail actions to be taken in emergency situations such as fires, flooding, or loss of propulsion, promoting a coordinated and effective response from the engine room crew.

(c) Inappropriate Circumstances for Handing Over Watchkeeping Duties:

The officer in charge of an engineering watch should not hand over responsibility to a relief watchkeeper under the following circumstances:

1. **During Critical Maneuvers:** When the vessel is engaged in critical maneuvers like entering or leaving port, navigating restricted waters, or encountering adverse weather conditions, it's crucial for the experienced officer to remain in charge.
2. **Equipment Malfunction:** If the machinery space is experiencing a significant equipment malfunction or breakdown, a qualified and experienced officer should oversee the situation until it's stabilized and corrective actions are initiated.
3. **Unfamiliar Crew Member:** In cases where the relief watchkeeper is unfamiliar with the specific vessel's machinery or lacks sufficient experience for the prevailing conditions, it might be prudent for the current officer to remain on watch until a more suitable replacement is available.
4. **Impaired Watchkeeper:** If the relief watchkeeper appears to be under the influence of alcohol, drugs, or is otherwise unfit for duty due to fatigue or illness, handing over responsibility would be inappropriate and potentially dangerous.

Ultimately, the officer in charge of the watch has the responsibility to exercise professional judgement and ensure a safe handover considering the prevailing circumstances and the competency of the relief watchkeeper.

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3. With reference to the International Convention on Load Lines:

(a) define the terms *freeboard* and *freeboard deck;* (5)

(b) list FIVE items that would be inspected by a surveyor before issuing or endorsing a load line certificate. (5)

International Load Line Convention: Freeboard and Inspections

(a) Freeboard and Freeboard Deck Definitions:

The International Load Line Convention defines two key terms related to a vessel's loading and seaworthiness:

1. **Freeboard:** The freeboard is the vertical distance measured downwards amidships from the upper edge of the deck line to the upper edge of the relevant load line mark (like the summer load line "S"). In simpler terms, it's the distance between the waterline and the deck line as specified by the regulations. A larger freeboard indicates a higher deck relative to the waterline, enhancing seaworthiness in rough seas.
2. **Freeboard Deck:** The freeboard deck is the highest complete deck exposed to weather and sea. It must have permanent means of closing all openings in the weather part thereof. All openings in the sides of the ship below the freeboard deck must be fitted with permanent means of watertight closing to maintain watertight integrity during harsh weather conditions.

(b) Items Inspected by a Surveyor for Load Line Certificate:

Before issuing or endorsing a Load Line Certificate, a qualified surveyor will conduct a thorough inspection of the vessel to ensure compliance with the International Load Line Convention. Here are five key areas a surveyor will focus on:

1. **Load Line Marks:** The surveyor will verify the correct placement, size, and legibility of all load line markings on the vessel's hull as per the assigned freeboard.
2. **Superstructure and Sheer:** The surveyor will measure the extent and arrangements of superstructures on the freeboard deck and along the length of the vessel. These superstructures can affect a vessel's stability and freeboard requirements.
3. **Permeability:** The surveyor will assess the watertight integrity of compartments above the freeboard deck. The percentage of watertight compartments affects a vessel's reserve buoyancy and freeboard assignment.
4. **Doors and Hatches:** The surveyor will examine all weathertight doors and hatches on the freeboard deck and above, ensuring they are operable and can be securely closed to maintain watertight integrity in heavy weather.
5. **Load Line Exemption Certificate (if applicable):** For vessels operating under specific conditions (like short voyages in sheltered waters), a Load Line Exemption Certificate may be granted. The surveyor will verify the validity of such a certificate and ensure the vessel complies with any restrictions mentioned therein.

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4. (a) List FOUR aspects upon which a new person joining a vessel for the first time would receive instruction. (4)

(b) Detail SIX ways in which personal action can increase the risk of fire on a vessel. (6)

Onboard Familiarisation and Fire Safety Precautions

(a) Four Aspects of Instruction for New Crew:

Joining a new vessel requires familiarization to ensure efficient work and safety. Here are four key areas where a new crew member would receive instruction:

1. **Vessel Familiarisation:** New crew will be introduced to the general arrangement of the ship, including location of their designated work areas, muster stations, emergency exits, life-saving appliances, and essential machinery spaces.
2. **Life-Saving Appliances and Drills:** Training will be provided on the operation and use of life-saving appliances like lifeboats, life rafts, and personal flotation devices (PFDs). New crew will also participate in mandatory safety drills to practice emergency procedures.
3. **Fire Safety Procedures:** Crew members will receive comprehensive instruction on fire safety procedures, including the use of fire extinguishers, activation of fire alarms, and emergency evacuation routes from accommodation and machinery spaces.
4. **Duties and Responsibilities:** New crew will be briefed on their specific duties and responsibilities onboard, including their role during emergencies, watchkeeping requirements (if applicable), and proper use of relevant equipment and machinery.

(b) Six Ways Personal Actions Can Increase Fire Risk:

Fires onboard vessels pose a serious threat. Here are six ways personal actions can increase fire risk:

1. **Smoking in Unauthorized Areas:** Smoking is strictly prohibited in most areas onboard a vessel. Ignoring designated smoking areas and smoking in accommodation spaces or around flammable materials can easily start a fire.
2. **Improper Use of Electrical Equipment:** Overloading electrical outlets, using damaged electrical cords, or leaving electrical appliances unattended while operating can lead to overheating and electrical fires.
3. **Mishandling of Flammable Liquids:** Careless handling of flammable liquids like paint thinners, cleaning solvents, or fuels can result in spills and vapor accumulation, increasing fire risk. Proper storage and use of flammable liquids are essential.
4. **Improper Waste Disposal:** Accumulation of oily rags, discarded cigarettes, or combustible waste in inappropriate locations can create fire hazards. Proper waste disposal procedures must be followed.
5. **Using Cooking Appliances Unsafely:** Leaving cooking unattended on stoves, using improper cooking methods, or not cleaning ovens regularly can lead to grease fires in galley areas. Following safe cooking practices is critical.
6. **Tampering with Fire Safety Equipment:** Disabling fire alarms, blocking fire doors, or tampering with fire extinguishers can significantly hinder firefighting efforts in the event of a fire.

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5. (a) Define a Classification Society. (6)

(b) State the periods between docking surveys for a vessel less than 15 years old. (4)

Classification Societies and Docking Surveys

(a) Classification Society Definition:

A Classification Society is an independent organization that sets standards for ship design, construction, and operation. These organizations play a vital role in ensuring the safety and structural integrity of vessels throughout their operational life.

Classification societies achieve this by:

- **Establishing and publishing class rules:** These rules comprise technical requirements for various aspects of shipbuilding and ship operation, covering structural strength, machinery suitability, stability, fire safety, and navigation equipment.
- **Verifying compliance with class rules:** Classification societies review ship designs and conduct surveys during construction and in service to ensure vessels comply with their rules.
- **Issuing class certificates:** Vessels that meet classification society standards are issued with class certificates. This recognition allows ships to operate internationally and obtain port state control clearance.

(b) Docking Survey Periods for Vessels Less Than 15 Years Old:

For vessels less than 15 years old, classification societies typically require a combination of surveys to maintain class and ensure seaworthiness. These surveys can be categorized as follows:

- **Intermediate Survey:** This survey is typically conducted every 2.5 years and focuses on maintenance records review, machinery operation checks, and general hull condition assessment.

- **Special Survey:** This more extensive survey is performed every five years and includes a thorough examination of the vessel's hull structure, watertight doors, life-saving appliances, and cargo handling gear.

It's important to note that these are general guidelines, and the specific survey requirements can vary slightly depending on the classification society, vessel type, and operational profile.

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6. (a) List SIX examples of *condition monitoring* that could be applied as part of a planned maintenance system. (6)

(b) Explain how condition monitoring can assist in expediting classification survey requirements. (4)

Condition Monitoring Techniques for Planned Maintenance

(a) Six Examples of Condition Monitoring in Planned Maintenance:

Planned maintenance systems leverage various condition monitoring techniques to proactively assess equipment health and schedule maintenance activities. Here are six common examples:

1. **Vibration Analysis:** Vibration sensors placed on machinery components like bearings and gearboxes detect changes in vibration patterns. Early detection of abnormal vibrations indicates potential problems like imbalance, misalignment, or wear, allowing corrective action before critical failure.
2. **Tribology (Oil Analysis):** Regular analysis of crankcase oil samples reveals the presence of wear metals, contaminants, and oxidation products. These indicators help determine oil suitability for further service and identify potential wear within the engine components.
3. **Thermography:** Thermal imaging cameras capture temperature variations on equipment surfaces. Unusual hot spots can indicate overheating components due to friction, blockages, or insufficient lubrication, prompting investigations and maintenance actions.
4. **Ultrasonic Testing:** This non-destructive testing technique uses high-frequency sound waves to detect cracks, voids, and other internal defects in critical components like pipelines and pressure vessels. Early detection of such defects allows for timely repairs and prevents catastrophic failures.
5. **Machine Performance Monitoring:** Modern machinery often includes built-in sensors that monitor parameters like oil pressure, fuel consumption, and engine RPM. By tracking these parameters over time, deviations from normal operating ranges can signal potential issues requiring attention.
6. **Machine Learning and Predictive Maintenance:** Advanced planned maintenance systems utilize machine learning algorithms to analyze condition monitoring data and predict equipment failures. This allows for proactive maintenance planning and optimization of resource allocation.

(b) How Condition Monitoring Expedites Classification Surveys:

Classification societies conduct regular surveys of vessels to ensure compliance with safety and operational standards. Condition monitoring data can significantly assist in expediting these surveys in several ways:

- **Reduced Scope of Inspections:** By demonstrating consistent condition monitoring practices and well-maintained equipment through documented data, classification societies may reduce the scope of physical inspections during surveys. This saves time and resources for both surveyors and the vessel operator.

- **Targeted Inspections:** Condition monitoring data highlights specific equipment with potential issues. Surveyors can direct their inspections towards these areas of concern, focusing their efforts on critical components identified as at risk.
- **Demonstrated Proactive Maintenance:** Comprehensive condition monitoring records demonstrate a proactive approach to maintenance. This can improve a vessel's classification status and potentially lead to favorable insurance rates.
- **Improved Communication and Transparency:** Sharing condition monitoring data with classification societies fosters transparency and communication regarding the vessel's overall health. This collaboration can facilitate a more streamlined survey process.

Overall, condition monitoring empowers a data-driven approach to planned maintenance, resulting in more efficient classification surveys and enhanced vessel safety.

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7. With reference to vessel's survey requirements:

(a) describe FIVE ways in which Government Surveyors will act in maintaining the statutory requirements of a vessel; (5)

(b) list FIVE ways in which Classification Surveyors can act to maintain the class and statutory requirements of the vessel. (5)

Ensuring Vessel Safety: Roles of Government and Classification Surveyors

(a) How Government Surveyors Maintain Statutory Requirements:

Government surveyors play a critical role in upholding the statutory safety and environmental regulations for vessels. Here are five key ways they achieve this:

1. **Conducting Initial Surveys and Issuing Certificates:** Government surveyors assess new vessels against national and international regulations. Upon successful inspection, they issue statutory certificates like Safety Equipment Certificates (SEC) and International Safety Management Code (ISMC) Certificates, which are mandatory for commercial operation.
2. **Performing Periodic Surveys:** Throughout a vessel's operational life, government surveyors conduct regular surveys to ensure continued compliance with statutory requirements. These surveys may focus on life-saving appliances, fire safety equipment, navigation systems, and pollution prevention measures.
3. **Investigating Accidents and Incidents:** In the event of accidents or incidents at sea, government surveyors may be called upon to investigate the cause. They analyze evidence, interview crew, and assess whether statutory non-compliance contributed to the incident.
4. **Enforcing Regulations Through Port State Control:** Government surveyors conduct port state control inspections on foreign vessels entering national ports. These inspections verify that the vessels comply with international maritime regulations, potentially detaining non-compliant vessels until corrective actions are taken.
5. **Collaborating with Classification Societies:** Government surveyors often maintain close working relationships with classification societies. They may share survey information and work cooperatively to ensure vessels meet both statutory and class requirements.

(b) How Classification Surveyors Maintain Class and Statutory Requirements:

Classification societies supplement government efforts by providing classification surveys that address both class rules and statutory requirements. Here are five ways they contribute:

1. **Plan Review and Approval:** Classification societies review ship designs to ensure compliance with their class rules, which often exceed minimum statutory requirements. This proactive approach enhances vessel safety beyond the bare minimums.
2. **Construction Oversight and Surveys:** Throughout construction, classification surveyors conduct inspections to verify adherence to approved plans and materials. This helps identify potential statutory non-compliance issues early on during construction.
3. **In-Service Surveys and Audits:** Classification societies conduct regular in-service surveys to ensure vessels maintain class and statutory compliance. These surveys can include machinery surveys, hull inspections, and safety equipment checks.
4. **Issuing Class Certificates:** Upon successful completion of surveys, classification societies issue class certificates. These certificates demonstrate a vessel's adherence to higher safety standards than just statutory regulations, potentially leading to lower insurance premiums.
5. **Continuous Improvement and Rule Updates:** Classification societies proactively update their class rules to reflect advances in technology and best practices in maritime safety. This indirectly encourages vessels to maintain a level of safety that may exceed current statutory requirements.

By working together, government surveyors and classification societies create a multi-layered system of checks and balances to ensure that vessels operate safely and in compliance with both statutory regulations and higher industry standards.

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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.

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9. A vessel has bunkered 250 tonnes of diesel fuel of which 10% is assumed to be unpumpable. The average combined sea load of the vessel is 2800kW with a stated specific consumption of 0.35kg/kWh at a speed of 18 knots.

Calculate EACH of the following:

(a) the daily fuel consumption of the vessel; (4)

(b) the safe steaming range of the vessel. (6)

Fuel Consumption and Steaming Range Calculations

We can calculate the daily fuel consumption and safe steaming range of the vessel based on the provided information.

(a) Daily Fuel Consumption:

1. **Calculate usable fuel:**
    - Unpumpable fuel = Bunkered fuel * 10% = 250 tonnes * 0.1 = 25 tonnes
    - Usable fuel = Bunkered fuel - Unpumpable fuel = 250 tonnes - 25 tonnes = 225 tonnes
2. **Convert tonnes of usable fuel to kilograms:**

Usable fuel (kg) = Usable fuel (tonnes) × 1000 kg/tonne Usable fuel = 225 tonnes × 1000 kg/tonne Usable fuel = 225,000 kg

3. **Convert kW to kWh (kilowatt-hours):** Since we're interested in daily consumption, we need to consider the total operating hours per day. A day has 24 hours, so:

   Total daily operating hours = 24 hours/day

4. **Calculate daily energy consumption:**

   Daily energy consumption (kWh) = Average combined sea power load (kW) × Daily operating hours (hours/day) Daily energy consumption = 2800 kW * 24 hours/day Daily energy consumption = 67200 kWh/day

5. **Calculate daily fuel consumption:**

   Daily fuel consumption (kg) = Daily energy consumption (kWh) × Specific consumption (kg/kWh) Daily fuel consumption = 67200 kWh/day × 0.35 kg/kWh Daily fuel consumption = 23520 kg/day

Therefore, the daily fuel consumption of the vessel is 23,520 kg/day.

(b) Safe Steaming Range:

Important Note: Calculating the exact safe steaming range is complex and depends on various factors beyond just fuel consumption, such as weather conditions, sea state, and vessel efficiency at different speeds. Here, we can estimate a theoretical maximum range based on the following assumptions:

- All 225,000 kg of usable fuel are consumed.
- There are no inefficiencies in fuel consumption.

1. **Estimate safe steaming range:**

   Safe steaming range (days) = Usable fuel (kg) / Daily fuel consumption (kg/day) Safe steaming range = 225,000 kg / 23,520 kg/day Safe steaming range ≈ 9.56 days (rounded to two decimal places)

Therefore, the safe steaming range of the vessel at a speed of 18 knots is approximately 9.56 days. This is a theoretical maximum, and the actual range may be lower in real-world conditions.

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10. (a) Write standing orders detailing the procedures to be followed in the event of a fire within the machinery spaces. (6)

    (b) List FOUR types of portable fire extinguisher that could be found within the machinery spaces, stating on which class of fire EACH should be used. (4)

(a) Standing Orders: Fire in Machinery Spaces

WARNING: Evacuate all non-essential personnel and activate the fire alarm immediately upon discovering a fire.

1. Evacuation and Alarm:

- If safe to do so, sound the fire alarm and **alert the bridge** of the fire location.
- **All non-essential personnel** must evacuate the machinery space and surrounding areas at risk.

2. Fire Extinguisher Use (if safe):

- **Only trained personnel** familiar with portable fire extinguishers should attempt to extinguish small fires.
- **Identify the fire class** (refer to section b below) and select the appropriate fire extinguisher.
- **Do not** attempt to fight large fires or fires that endanger your safety.

3. Isolation and Shutdown:

- If safe and accessible, **isolate the burning machinery or electrical equipment** from its power source.
- Shut down any **fuel or oil supply lines** feeding the fire, if possible.

4. Firefighting and Ventilation:

- **Do not** open hatches or doors unless necessary to escape. This can provide an oxygen source to the fire.
- If safe, activate the machinery space fixed fire suppression system (e.g., water mist or CO_2 flooding) as per operating instructions.
- Prepare for the arrival of the firefighting team by gathering information on the fire location, type, and any potential hazards.

5. Muster Point:

- All evacuated personnel must assemble at the designated **muster station** and report to the muster officer.

6. Re-entry:

- Re-entry into the machinery space is **strictly prohibited** until authorized by the Chief Engineer or designated officer.
- Re-entry personnel must wear appropriate personal protective equipment (PPE) including breathing apparatus.

7. Incident Reporting:

- A detailed report of the fire incident, including cause (if known), actions taken, and any injuries, must be submitted to the appropriate authorities.

(b) Portable Fire Extinguishers in Machinery Spaces:

Here are four common types of portable fire extinguishers found in machinery spaces and their suitable fire classes:

1. **Water Mist Extinguisher (Class A):** Effective against ordinary combustible materials like wood, paper, and textiles. **Not** suitable for flammable liquids or electrical fires.

2. **Foam Extinguisher (Class B):** Ideal for extinguishing flammable liquid fires such as gasoline, oil, and diesel. **Not** suitable for electrical fires.

3. **Carbon Dioxide (CO_2) Extinguisher (Class B & C):** Effective against flammable liquids and electrical fires by displacing oxygen. **Not** suitable for ordinary combustibles. **Caution:** CO_2 displacement can be hazardous to personnel. Evacuate before use.

4. **Dry Chemical Powder Extinguisher (Class A, B, & C):** Versatile extinguisher for ordinary combustibles, flammable liquids, and electrical fires. However, the powder residue can be messy and requires cleanup.