МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Національний університет кораблебудування
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Л. М. БОЙКО

ENGLISH FOR SHIPBUILDERS: A TECHNICAL READER

Методичні рекомендації до самостійної роботи студентів
з дисципліни
«Англійська мова для кораблебудівників»

Рекомендовано Методичною радою НУК

ВИДАВНИЦТВО
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Рекомендації складені відповідно до робочої навчальної програми з дисципліни «Англійська мова для кораблебудівників», містять англомовні автентичні тексти професійного спрямування, вправи до них, глосарій до тем, завдання до текстів та список рекомендованої літератури для підготовки до занять та самостійної роботи.

Призначено для студентів третього курсу кораблебудівних спеціальностей, які прагнуть поглибити свої знання англійської мови з фаху.

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ЗМІСТ

ПЕРЕДМОВА

Методичні рекомендації до самостійної роботи здобувачів першого (бакалаврського) рівня вищої освіти кораблебудівних спеціальностей з дисципліни «Англійська мова для кораблебудівників» укладено відповідно до робочої навчальної програми дисципліни і спрямовано на розвиток у студентів навичок читання, розуміння та аналізу англомовних професійно-орієнтованих текстів, збагачення словникового запасу, тобто на підготовку майбутніх інженерів-кораблебудівників до використання англійської мови у професійному середовищі.

Завданнями дисципліни є формування необхідної комунікативної спроможності у сферах професійного спілкування в усній і письмовій формах; розуміння та переклад іншомовних джерел; удосконалення комунікативних умінь і навичок володіння іноземною мовою при спілкуванні з професійної тематики.

Самостійна робота студента сприяє формуванню автономності у навчанні, розвитку навичок самоконтролю, відповідальності за результати власної діяльності та здатності ефективно опрацьовувати інформацію без супроводу викладача.

Зміст рекомендацій охоплює ключові теми, що відповідають структурі фахової підготовки майбутніх кораблебудівників, зокрема питання конструктивних характеристик і остійності судна, матеріалів для суднобудування, механічних та електричних систем судна. Добір матеріалу здійснено з урахуванням його актуальності, інформативності та практичної спрямованості.

Робота з даними методичними рекомендаціями сприятиме інтенсифікації процесу вивчення професійної англійської мови та розуміння науково-технічних текстів за фахом.

ПАМ’ЯТКА ДЛЯ КОРИСТУВАЧІВ

Крок 1: Прочитайте вправи перед читанням (Pre-reading exercises). Вони підготують вас до сприйняття технічної лексики та основних ідей.

Крок 2: Уважно прочитайте текст. Зробіть нотатки щодо ключових термінів або ідей.

Крок 3: Виконайте вправи після читання (Post-reading exercises). Вони вміщують лексико-граматичні завдання, питання на розуміння тексту та вправи на вирішення певних професійних проблем.

Крок 4: Використовуйте глосарій, щоб закріпити знання фахової лексики. Спробуйте вживати нові терміни у своїх реченнях.

Unit 1
Basic Ship Construction and Naval Architecture Terms

PRE-READING EXERCISES

Exercise 1. Answer the questions before reading the text:

Why is it important to know the main dimensions of a ship?

Which ship measurements might influence safety at sea?

What parts of a ship do you think are measured from the keel?

Exercise 2. Look at the following terms and try to guess their meaning or explain them from your professional knowledge:

length overall	breadth extreme		draught
freeboard	camber	sheer	bilge

Exercise 3. Decide whether the statements are true or false before reading the text:

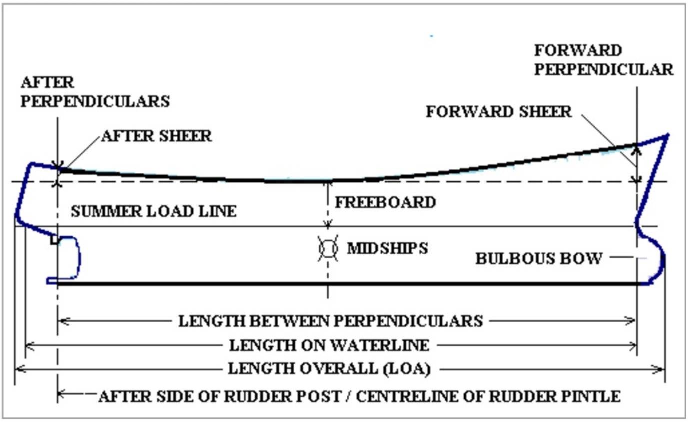
Length overall is shorter than the length between perpendiculars.

Freeboard shows how deeply a ship can be safely loaded.

Camber and sheer describe the curvature of the ship's deck.

Port and Starboard Sides: Viewing the ship from the aft, the left side of the ship is called the Port side, and the right, is called the Starboard side.

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.

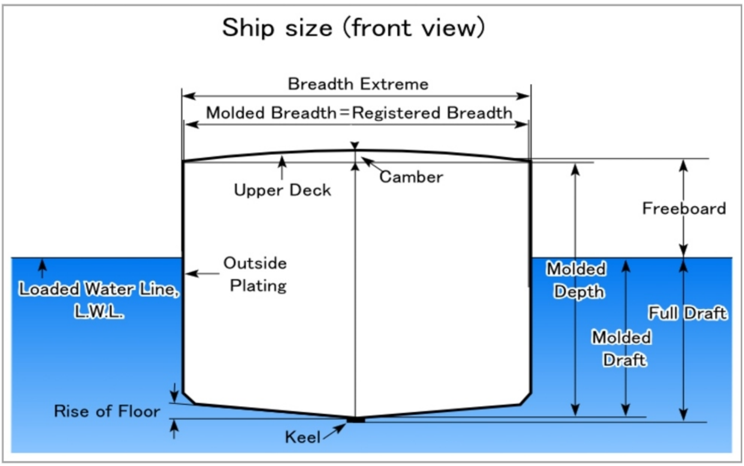


Stem: Front-most part of the boat or ship's bow is termed as stem of the ship

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 center 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.



Breadth extreme: The greatest breadth of the ship, measured to the outside of the shell plating.

Breadth moulded: The greatest breadth of the ship, measured to the inside of the inside strakes of shell plating.

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.

Depth moulded: The depth measured from the top of the keel.

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.

Draught moulded: The draught measured from the top of the keel to the waterline.

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.

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.

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.

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.

Bilge radius: The radius of the arc connecting the side of the ship to the bottom at the midship portion of the ship.

Tumble home: In some ships the midship side shell in the region of the upper deck is curved slightly towards the centreline, thus reducing the width of the upper deck and decks above. Such a tumble home improves the appearance of the ship.

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 the range of plate forming the side of the vessel, or metal plate extending the ship's hull from stem to stern.

Bilge strake: strake at the turn of the bilge called.

Sheer strake and its importance: it is the largest continuous strake at the top of the side of the vessel on the main deck. Or uppermost strakes 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 contributes to the strength of the hull.

Stringer: the stiffners used to strengthen the sides surface of the ship are called, without stringer the hull shape does not form.

Coffin plate: used to connect the stern frame to the flat plate keel.

Shoe plate: used to connect stem to the flat plate keel.

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 sets an angle of about 450 to the tank top and meets the shell almost at right angle.

Bulwark: It is a solid wall that extends above the weather deck or any other deck to be exposed to weather and fitted for the safety of the crew. At Least 1 m in height spacing of stays and is not exceed 1.2 m on the forecastle.

Source: https://www.marinesite.info/2021/04/basic-ship-construction-and-naval.html

POST-READING EXERCISES

Exercise 1. Answer the questions according to the text:

What is the difference between length overall and length between perpendiculars?

What is the function of freeboard in ship safety?

Why are camber and sheer used on exposed decks?

What is the purpose of the rise of floor in ship construction?

Why is the sheer strake thicker than other side plating?

Exercise 2. Match the shipbuilding term with its correct description:

Term

1. Length overall
2. Breadth extreme
3. Depth extreme
4. Draught extreme
5. Freeboard
6. Camber
7. Sheer

Description

a) The vertical distance from the bottom of the keel to the waterline

b) The distance from the waterline to the deck at the side of the ship

c) The greatest length of the vessel measured from the forwardmost point to the aftermost point

d) The transverse curvature of the deck from the centerline to the sides

e) The vertical distance from the keel to the deck beam at the side of the upper deck

f) The greatest width of the ship measured outside the shell plating

g) The longitudinal curvature of the deck rising toward the bow and stern

Exercise 3. Find the terms in the text that correspond to the following descriptions:

1. The curved connection between the bottom and the side of the ship.
2. A plate used to connect the stern frame to the flat plate keel.
3. A strong upper strake of side plating on the main deck.
4. A solid wall above the weather deck protecting the crew.

Exercise 4. Complete the sentence using information from the text:

1. The distance between the fore perpendicular and the after perpendicular is called __________.
2. The curvature of the deck from midships to the bow and stern is known as __________.
3. The bottom shell may rise from the keel to the bilge to improve __________.
4. A solid protective wall above the weather deck is called a __________.

Exercise 5. Problem-solving task:

A naval architect is designing a cargo vessel that will operate in rough seas. Explain which structural features described in the text (for example camber, sheer, freeboard, or bilge design) help improve seaworthiness and safety. Give at least three examples and explain their function.

Exercise 6. Find in the text words or phrases that mean the same as the following:

1. greatest length of the ship
2. curved surface of the deck
3. outside metal covering of the ship
4. vertical distance from keel to waterline
5. safety margin above water

Exercise 7. Choose the correct term to complete the sentence:

1. The distance from the keel to the waterline is called

a) breadth

b) draught

c) freeboard

2. The curved connection between the bottom and the side of the ship is called

a) bilge radius

b) camber

c) sheer

3. The upward curvature of the deck from midships to the bow and stern is called

a) camber

b) tumblehome

c) sheer

4. The strongest upper plate along the side of the ship is the

a) margin plate

b) sheer strake

c) bilge strake

5. The protective wall above the weather deck is the

a) bulwark

b) stringer

c) strake

Exercise 8. Rearrange the words to make correct sentences:

1. greatest / length / ship / the / overall / is / the / length / of / the
2. waterline / the / keel / draught / the / from / distance / the / is / to / the
3. camber / deck / the / helps / drain / water / the / from
4. sheer / the / seaworthiness / improves / ship / of / the

Exercise 9. Unscramble the shipbuilding terms:

1. RBEFADROE
2. HRESE
3. BGLIE
4. TERSMAK
5. REKSTA

Exercise 10. Match the term with its function:

Term	**Function**
Freeboard	A. helps drain water from the deck
Camber	B. indicates safe loading level
Sheer	C. improves seaworthiness
Bilge radius	D. connects the ship's bottom and side

Exercise 11. Test. Choose the correct naval architecture term:

1. The largest width of the ship measured outside the hull plating is

a) breadth moulded
b) breadth extreme
c) beam radius

2. The structural plate connecting the stern frame to the keel is

a) shoe plate
b) coffin plate
c) margin plate

3. The continuous strip of hull plating from bow to stern is called

a) frame
b) strake
c) beam

4. The inward curvature of the ship's sides near the deck is called

a) camber
b) tumblehome
c) sheer

Exercise 12. Mini problem-solving task:

A ship designer wants to improve seaworthiness and deck drainage.

Which structural features mentioned in the text would help achieve this goal?

Explain how at least three of the following features contribute to safety: camber, sheer, freeboard, rise of floor.

Unit 2
Fundamentals of Ship Stability

PRE-READING EXERCISES

Exercise 1. Look at the title *Fundamentals of Ship Stability*. What topics do you expect to read about? Choose three:

center of gravity	engine power	flooding
navigation systems	buoyancy	cargo loading

Exercise 2. Match the term with its meaning before reading the text. Try to guess:

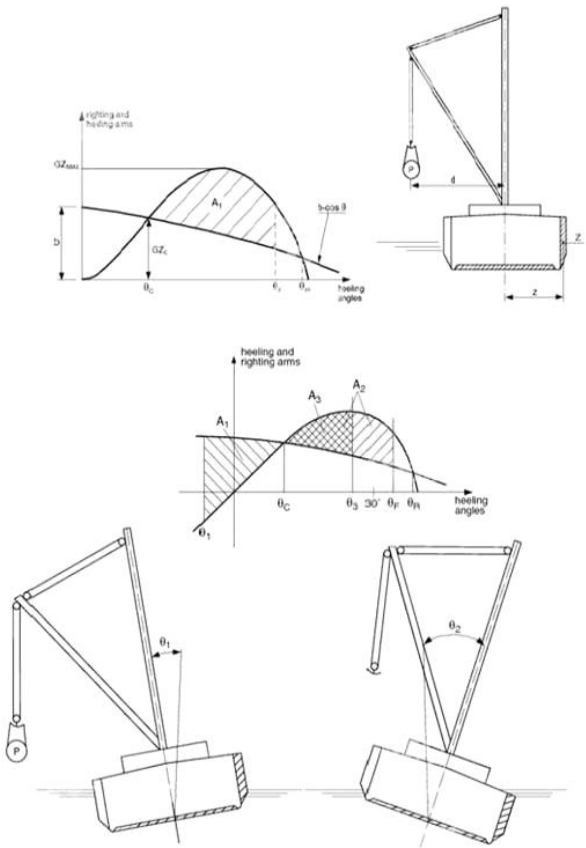
1. Buoyancy	**a)** water entering the ship
2. Center of gravity	**b)** tilting of the ship to one side
3. Flooding	**c)** force that pushes the ship upward
4. List	**d)** point where weight is concentrated

Exercise 3. Complete the sentences with your own ideas:

1. A ship returns to its original position when…
2. Stability is important because…
3. Cargo loading can affect…

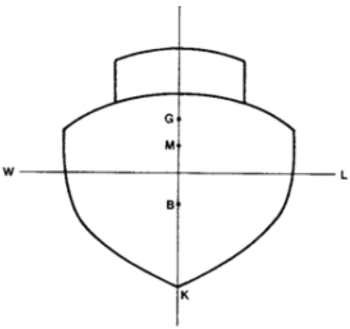
A ship's stability can be defined as its ability and tendency to return to its original state as it completes its tasks and occasionally used to extremes of its capabilities. The stability factor plays a part when a vessel interacts with external forces when they are applied and removed; making the vessel, at first sustaining the application of a certain force and returning/adjusting itself to the initial state upon removal of the force. Stability also focuses on a vessel's behavior at sea by calculations concerning its center of gravity, buoyancy and the relationships between the two factors.

There are two types of stability calculations; damage and intact stability where the main difference lies in the focus and the difficulty in generating data. Intact stability involves a straightforward calculation between all center masses of objects on the vessel as well as the vessel itself; computed and calculated to identify the center of gravity and buoyancy of the hull. Cargo arrangement+loading, crane operation and design sea is also considered.



Damage stability is more challenging due to the long time to gather the necessary variables with the latter also changing due to the situation at hand. What are the potential hazards at sea? Flooding is usually common and there lies the first threat to stability. However since a vessel consists of many interlinked parts which maintain stability with their own characteristics without which a ship will behave differently. Loss of stability during flooding may also occur due to the free surface effect; water accumulating in the hull usually drains to the bilges which lowers its center of gravity; however if a ship is inclined to any degree (e.g. a wave strike) fluids in bilges move and make the ship list.

A ship is at equilibrium when its weight acts down through a center of gravity, equal to the up-thrust force of water acting on the center of buoyancy with both forces being at a vertical line.



Stability in a flood is also lost due to seawater filling up the empty tank which takes its buoyancy resulting in that section of the ship lowering into water; creating a list unless the tank is on the center-line of the vessel. Stability calculations show that when a tank is filled the contents are assumed to be lost and replaced by seawater. However if the contents are lighter than seawater, (e.g light oil) then buoyancy is lost and a list happens.

Calculations, the challenging aspect of stability is of two approaches; deterministic and probabilistic. Deterministic approach bases the ship's subdivisions/division of the ship into smaller compartments on theoretical principles. Standard dimensions of damage used in the deterministic approach extending anywhere along the ship's length and/or between transverse bulkheads; depending on requirements. The probabilistic approach applies to cargo ships of length above 80M which in-turn evade deterministic methods. This principle works by a pattern of accidents whose consequences are used to improve ship designs. Probabilistic approach is also based on statistical evidences relating to ship design choices, situations at sea (collisions, weather conditions).

Probabilistic method is made from three probabilities that relate to subdivision and damage stability requirements; probability of occurrence/damage to the ship, probability of damage in a certain location and property of flooding and assessing the on-deck situation.

So which is the most beneficial attitude towards stability of your vessel? The best answer lies within the degree of negativity and the management of factors that go with that method as negativity persists with some factors in maritime; evaded by some methods and maximised by others. Starting from the deterministic method, the consequences of taking such approach are the creation of damage cases the number of which along with the number of compartments/sub-divisions involved depends on the ship's dimensions. Each loading condition has to be considered along with compiling all applicable criteria.

Probabilistic approach is more realistic and practical as all ideas are based on real incidents where design choices of similar vessels can easily be fixed and future casualties avoided. However, this method is considerably old (devised in 1973) and with new vessel builds being designed and produced, with emphasis on safety therefore this method is mute regarding builds that never saw accidents.

While theoretical methods composed of ideas that may share similar characteristics to newer vessel builds, (which maybe constructed on older principles) and thus be valid when considering the stability issue aboard newer vessels; the fact remains that the ideas are still theories and yet to have seen practical application. Along with this, the theories have a chance to be wrong as new technology, though tested before implementation may still respond and work differently to the theory. Whereas the probabilistic approach which was based on real-life accidents where technology was, possibly modern to the times of the incident therefore making the conclusions drawn more accurate. Regardless, this leaves the question which attitude to adopt regarding stability of a vessel.

However, in the maritime industry the stakes are always high and the margin for error is low which warrants an experienced approach of aspects that were tested and have a higher guarantee of working. Experience is key to avoiding errors in maritime where errors and mishaps are easier to detect prior to conducting operations at sea.

Source: https://www.hendersongroup.org/approaching-naval-stability/

POST-READING EXERCISES

Exercise 1. Check your understanding. Answer the questions:

1. What is ship stability?
2. What two main forces affect stability?
3. What is the difference between intact and damage stability?
4. Why is flooding dangerous for stability?
5. What is the free surface effect?

Exercise 2. Find the key terms in the text that mean:

1. ability to return to original position
2. upward force of water
3. water entering the ship
4. division of the ship into compartments
5. based on real accidents

Exercise 3. Choose the correct answer:

1. A ship is stable when

a) it moves quickly
b) it returns to its original position
c) it carries more cargo

2. The center of gravity is

a) where buoyancy acts
b) where weight acts
c) where water enters

3. Free surface effect happens when

a) cargo shifts
b) water moves inside the ship
c) the engine stops

4. Deterministic method is based on

a) real accidents
b) theoretical models
c) weather forecasts

5. Probabilistic method is based on
a) statistics and past incidents
b) ship speed
c) fuel consumption

Exercise 4. Rearrange the words to make sentences:

1. ship / returns / stable / a / position / its / original / to
2. buoyancy / upward / force / is / an
3. flooding / stability / reduces / ship / of / the
4. gravity / center / acts / weight / through / the / of

Exercise 5. Unscramble the terms:

1. YTOBANCUY
2. GYTRAVI
3. DOOFLING
4. LISET
5. TYBILSTA

Exercise 6. Match the concept with explanation:

Free surface effect	A. water movement inside tanks causing instability
Intact stability	B. stability of an undamaged ship
Damage stability	C. stability after flooding
Center of buoyancy	D. point where upward force acts

Exercise 7. Each sentence has one mistake. Correct it:

1. Buoyancy pulls the ship downward.
2. Flooding improves ship stability.
3. The center of gravity is where buoyancy acts.
4. Probabilistic method is purely theoretical.

Exercise 8. Problem-solving task. Situation:

A ship starts listing after taking water into one compartment. Answer the questions:

1. What is the main reason for the list?
2. Which effect is responsible for increasing instability?
3. What can engineers do to reduce the problem?

Unit 3
Role of Ship Machinery Systems in Vessel Operations

PRE-READING EXERCISES

Exercise 1. Key idea activation. Complete the sentences using your own ideas:

1. Ship machinery systems are important because __________
2. The main engine is responsible for ___________
3. Auxiliary systems help the ship to ___________
4. A failure in machinery can lead to ___________

Exercise 2. Tick the topics you expect to read about:

propulsion systems	crew management	auxiliary machinery
navigation charts	system failures	maintenance

Exercise 3. Complete the sentences with suitable words:

1. A ship must operate ________ (continuously / rarely) at sea.
2. Machinery systems work as an ___________ (isolated / integrated) network.
3. Equipment failure can affect the ship's ___________ (operation / decoration).

Ship machinery systems play a decisive role in the safe, efficient, and continuous operation of commercial vessels. Beyond propulsion, these systems directly support navigation, cargo handling, onboard safety functions, and compliance with international regulations.

From a practical engine room perspective, machinery systems are not isolated units. Propulsion plants, auxiliary machinery, fuel systems, electrical power generation, automation, and safety systems operate as an integrated network. The performance or failure of one system has immediate consequences on the vessel's overall operational capability.

During normal sea passage, machinery systems ensure speed control, maneuverability, redundancy, and operational reliability. In port, they support cargo operations, ballast management, peak electrical loads, and critical safety systems. Any weakness in machinery readiness can result in delays, off-hire situations, or increased exposure during inspections and audits.

For engine room personnel, understanding the operational role of machinery systems goes beyond knowing individual pieces of equipment. It requires a system-based approach, where interactions between systems, load conditions, redundancy philosophy, and operational limits are clearly understood.

This is especially critical on tankers and other specialized vessels, where machinery performance is directly linked to cargo safety, environmental protection, and regulatory compliance. Small deviations in operation or maintenance can have significant operational and commercial consequences.

In real operations, many incidents do not originate from major failures, but from degraded performance, incorrect operation, or lack of situational awareness between interconnected systems. Effective machinery management therefore relies on continuous monitoring, preventive maintenance, proper operating procedures, and sound engineering judgment by the engine department.

Main Propulsion Systems on Commercial Vessels. Main propulsion systems are the primary element of vessel mobility and operational capability. Their performance directly affects voyage planning, fuel consumption, schedule reliability and, most importantly, safety at sea. On board commercial vessels, propulsion systems are designed to operate continuously under varying loads and sea conditions, which places high demands on both machinery design and operational management.

From an operational engineering perspective, the main engine is not an isolated unit. Its reliability depends on the correct interaction between combustion processes, lubrication systems, cooling systems, fuel treatment, control systems and the propeller arrangement. Any imbalance or degradation in one of these supporting elements can quickly translate into reduced efficiency, increased wear or unplanned downtime.

In daily operations, propulsion-related issues rarely arise from sudden catastrophic failures. More commonly, they develop progressively through factors such as improper load management, inadequate maintenance planning, poor fuel quality control or deviations from recommended operating parameters. Early recognition of abnormal trends-such as increases or deviations in exhaust temperatures, fuel index deviations, abnormal lube oil consumption, or unusual vibration patterns – is a critical responsibility of the engine room team.

Effective management of main propulsion systems requires a combination of technical knowledge, operational discipline and situational awareness. Chief Engineers must balance engine load, fuel efficiency and machinery protection while adapting to commercial pressures, weather conditions and voyage requirements. Sound decision-making in propulsion management is essential to safe, economical and reliable vessel operations.

Auxiliary Machinery Systems in Ship Engine Rooms. Auxiliary machinery systems provide the essential support functions that allow the main propulsion plant and the vessel as a whole to operate safely, efficiently, and continuously. Although they often receive less attention than the main engine, auxiliary systems are frequently the source of operational limitations, delays, and incidents when they are not properly managed.

These systems include, among others, cooling water systems, lubrication oil systems, compressed air systems, boilers, freshwater generation, bilge and ballast systems, steering gear hydraulics, and cargo-related auxiliary equipment. Each of these systems plays a critical role in maintaining machinery availability and overall ship readiness.

From an operational point of view, auxiliary machinery systems are highly interdependent. A failure in a cooling pump, air compressor, or fuel transfer system can quickly escalate into propulsion limitations, partial or total blackout situations, or even loss of maneuverability. For this reason, auxiliary systems must be treated as mission-critical equipment, not as secondary machinery.

In practice, auxiliary machinery failures are often linked to inadequate preventive maintenance, poor housekeeping, contamination issues, or non-compliance with standard operating procedures. Blocked heat exchangers, leaking valves, degraded seals, moisture in air systems, and incorrect system line-ups are common situations encountered during daily operations and port stays.

Effective management of auxiliary machinery systems relies on structured maintenance planning, clear operational procedures and continuous monitoring. Chief Engineers must ensure redundancy is preserved, standby equipment is functional and crew members clearly understand system line-ups and operational limitations. A well-maintained auxiliary plant is a key factor in reducing operational risk and maintaining compliance with class, flag state and charterer requirements.

Source: https://oceum.com.br/ship-machinery-systems/

POST-READING EXERCISES

Exercise 4. Answer the questions:

1. Why are machinery systems important for vessel operations?
2. Why are machinery systems considered an integrated network?
3. What happens if one system fails?
4. What is the role of auxiliary machinery?
5. Why is preventive maintenance important?

Exercise 5. Find words/phrases in the text that mean:

1. continuous operation of the ship
2. supporting equipment for the main engine
3. ability to continue working in case of failure
4. gradual worsening of performance
5. careful observation of system condition

Exercise 6. Choose the correct answer:

1. Machinery systems are

a) independent units
b) interconnected systems
c) optional equipment

2. Auxiliary systems are

a) unimportant
b) only used in emergencies
c) essential for ship operation

3. Most failures occur due to

a) sudden explosions
b) gradual problems and poor operation
c) design errors only

4. Preventive maintenance helps to

a) increase failures
b) avoid breakdowns
c) reduce speed

5. Redundancy means
a) having backup systems
b) removing equipment
c) reducing maintenance

Exercise 7. Rearrange the words to make sentences:
1. systems / machinery / operate / integrated / as / network / an
2. auxiliary / support / systems / main / engine / the
3. failures / caused / often / are / maintenance / poor / by
4. monitoring / helps / problems / detect / early

Exercise 8. Unscramble the terms:
1. NOISRLOPUP
2. YIRALIXUA
3. TNEENIAMATNC
4. YTILIBAILER
5. GNIROTINOM

Exercise 9. Match the system with its function:

Propulsion system	A. reduces friction
Cooling system	B. supplies power
Lubrication system	C. removes excess heat
Electrical system	D. provides movement of the vessel

Exercise 10. Find and correct the mistake:
1. Machinery systems work independently.
2. Auxiliary systems are not important.
3. Most failures are sudden and unpredictable.
4. Preventive maintenance increases risk.

Exercise 11. Complete the summary. Use the words:
(propulsion, auxiliary, maintenance, monitoring, failures)
1 Ship machinery systems include ___________ and ___________ systems.

2 Their reliability depends on proper ___________ and continuous ___________.

3 Most ___________ occur due to gradual problems rather than sudden breakdowns.

Exercise 12. Problem-solving task. Situation:

A ship experiences a loss of maneuverability due to a failure in a cooling system.

Answer the questions in writing:

1. How can a cooling system failure affect propulsion?
2. What could be the possible cause of this failure?
3. What actions should the engineer take?

Unit 4
Materials in Shipbuilding

PRE-READING EXERCISES

Exercise 1. Complete the sentences:

1. Ships are built from different materials because ___________
2. Steel is commonly used in shipbuilding because ___________
3. Lightweight materials are important because ___________

Exercise 2. Predict the content. Tick the materials you expect to read about:

Steel plastic aluminium copper alloys wood

Exercise 3. Match the term with its meaning:

1. Hull	**a.** damage caused by chemical reaction (e.g. rust)
2. Alloy	**b.** ability to resist forces
3. Corrosion	**c.** mixture of metals
4. Strength	**d.** outer body of a ship

Exercise 4. Choose the correct option:

1. Ship materials must be:
a) weak
b) durable
2. Corrosion is caused by:
a) saltwater
b) air only

3. Aluminium is:
a) heavier than steel
b) lighter than steel

MOST COMMONLY USED MATERIALS FOR SHIPBUILDING

Steel: This is a highly versatile ship construction material and is used extensively on ships for the making of its integral structure and parts.

Steel has been in use for over 150 years in the shipbuilding industry, thanks to its excellent mechanical properties and low cost. One major drawback of employing steel in ship constructions is the weight of steel. For the construction of the hull of a ship, mild steel containing 0.15 % to 0.23 % carbon, and reasonably high manganese content is used. Sulphur and phosphorus contents in the mild steel are kept to a minimum (less than 0.05 %) as higher contents of each hamper the welding properties of the steel. Furthermore, cracks and such can develop easily during the rolling process if the sulphur content is high.

High Tensile Steels: Steels which have higher strength than that of mild steel are employed in the more stressed regions of large tankers, container ships and bulk carriers. They are often used for the deck and bottom regions of larger tankers as well. As this leads to a reduction in the scantlings of these structural items, it proves advantageous both for the shipbuilder and owner.

Some integral parts of the ship that are made of steel include; the thickness stringer plate, rounded gunwales, sheerstrake, Bilge strake, deck strake in the way of the longitudinal bulkheads, main deck plating, bottom plating, keel, and the upper strake of longitudinal bulkheads. Mast tables, crosstrees, etc., may be fabricated from welded steel plates and sections. Derrick booms, as a rule, are welded lengths of seamless tubular steel.

Aluminium Alloys: There are three main advantages which Aluminium alloys have over mild steel in the construction of ships.

1. Aluminium is lighter than mild steel and studies suggest that up to 60 percent of the weight of a steel structure can be saved by using Al alloys. For merchant vessels, this is a key advantage for increasing the cargo carrying capacity of ships.
2. Aluminium is highly resistant to corrosion
3. Its non-magnetic properties and low-cost maintenance

The most often used Al-alloys used in shipbuilding are the 5083 type for plates and 6082 for extrusions. These alloys are reliable in marine service as well as during manufacture. It has estimated that the selection of Al-Mg (Aluminium-Magnesium) type alloys brings a potential for at least 10 % lower costs in respect of the heat-treatable, and appears favourable after a total estimation for applicability in shipbuilding

Excellent corrosion properties of aluminium can be used easily, but correct maintenance procedures and careful insulation from the adjoining steel structures are necessary when using this material.

A major disadvantage of the use of aluminium alloys is their high initial cost (They are estimated to cost 8 to 10 times the price of steel per tonnage). This high initial cost must be absorbed by an increase in the earning capacity of the vessel or a major increase in passenger accommodation on the same draft. Aluminium alloys can replace carbon steels of normal strength. The weight saved by using Al alloys improves the ship stability – and allows the design of narrower ships, which in turn enhances fuel efficiency.

Materials Used on Different Parts of a Ship.

The Shell Plating: This forms the watertight skin of the ship contributes to the longitudinal strength of the structure and resists vertical shear forces. The bottom and side shell plating consist of several flat and curved steel plates are butt welded together. They are of greater length than breadth.

Insulation: A steel hull structure is an excellent conductor of heat. Some form of insulation must be provided at the boundaries where there is a requirement to maintain desired temperatures, such as the refrigeration compartments.

Cork, glass fibre, and different kinds of foam plastics in sheet or granulated form may be used for insulating purposes. Air spaces, which are less efficient, may be provided. Glass fibre is widely used in modern ships as it has several advantages over the other materials. It is light in weight, tends to be vermin-proof, does not absorb moisture and is fire-resistant.

Superstructures: The introduction of aluminium alloy superstructures has provided increased passenger accommodation on the same draft, and/or a lowering of the lightweight centre of gravity with improved stability. These are hence used on passenger ships and **cruise ships**. It is possible to accept more significant deformation in these superstructures than would be possible with steel. This is brought about by the lighter weight of the aluminium structure.

Watertight Doors: In some instances, it is necessary to provide access between compartments on either side of a watertight bulkhead. Hence watertight doors are fitted for this purpose. For example, in a cargo ship, direct means of access is required between the engine room and the shaft tunnel. In passenger ships, watertight doors are found where passengers are allowed to pass between one point of the accommodation and another. Mild steel or cast steel watertight doors are fitted below the water line, which prevents flooding of the compartments when shut while providing adequate strength in the case of emergencies.

Propellers: As they have to withstand the corrosive effects of saltwater, ship propellers are constructed from copper alloys such as brass. These are designed to minimize cavitation, which happens when a propeller working under heavy load creates a region of low pressure. Bubbles of water vapour form suddenly and then burst next to the propeller blades, blasting little pits into the surface and wearing it away.

The fitting of zinc plates in the way of bronze propellers and other immersed fittings being used as sacrificial anodes is common practice in shipbuilding. These anodes are metals or alloys attached to the hull, which have more anodic potential than steel when immersed in sea water.

Hence these anodes supply cathodic protection current and get consumed in doing so. Regular maintenance and replacement are hence required in such systems for protection.

Modern anodes are based on alloys of zinc, aluminium, or magnesium which have undergone many tests to examine their suitability; high purity zinc anodes are also used. Sacrificial anodes are fitted with the hull and also often in ballast tanks as well.

Should any part of the anode fall and strike the tank structure where gaseous conditions exist, an explosion could result and hence magnesium anodes are not used in the cargo-ballast tanks of oil carriers owing to spark hazards. Aluminium anode system is employed in tankers, and they are only fitted in locations where the potential energy is less than 28 kg.m.

Source: https://www.marineinsight.com/guidelines/what-materials-are-used-for-building-ships/

POST-READING EXERCISES

Exercise 5. Answer the questions:

1. Why is steel widely used in shipbuilding?
2. What are the disadvantages of steel?
3. Where are high tensile steels used?
4. What are the advantages of aluminium alloys?
5. Why are copper alloys used for propellers?

Exercise 6. Find key terms in the text that mean:

1. resistance to rust and damage
2. outer watertight structure of the ship
3. materials used to reduce heat transfer
4. protective metals that corrode instead of steel
5. bubbles forming due to low pressure

Exercise 7. Choose the correct answer:

1. Mild steel contains

a) high carbon
b) low carbon
c) no carbon

2. Aluminium is preferred because it is

a) heavier
b) lighter
c) weaker

3. High tensile steel is used in

a) low-stress areas
b) highly stressed regions
c) decorative parts

4. Propellers are made from

a) steel only
b) copper alloys
c) plastic

5. Sacrificial anodes are used for

a) decoration
b) corrosion protection
c) insulation

Exercise 8. Match the material with its function:

Steel	A. lightweight structures
Aluminium	B. main structural material
Copper alloys	C. temperature control
Insulation	D. propellers

Exercise 9. Rearrange the words to make sentences:

1. steel / widely / used / shipbuilding / is / in
2. aluminium / lighter / is / than / steel
3. propellers / made / copper / alloys / are / of
4. anodes / protect / corrosion / from / the / hull

Exercise 10. Unscramble the terms:

1. LESTE
2. MUNIULMA
3. NOISORROC
4. NOITALUSNI
5. REPLELORP

Exercise 11. Find and correct the mistake:

1. Aluminium is heavier than steel.
2. Steel is resistant to corrosion without protection.
3. Propellers are made from plastic.
4. Sacrificial anodes protect themselves, not the ship.

Exercise 12. Complete the summary:

Use the words: (*propellers, steel, corrosion, aluminium, insulation*)

1. ________ is the main shipbuilding material.
2. ________ is used to reduce weight.
3. Ships must be protected from __________.
4. ________ are made from copper alloys.
5. ________ helps maintain temperature.

Exercise 13. Problem-solving task. Situation:

A ship operates in a highly corrosive marine environment. Answer the questions:

1. Which materials should be used for protection?
2. What role do sacrificial anodes play?
3. What maintenance actions are necessary?

GLOSSARY

UNIT 1

Term	Definition	Translation
Length overall (LOA)	The maximum length of the ship measured from the foremost point of the bow to the aftermost point of the stern.	найбільша довжина судна (габаритна довжина)
Stem	The front structural part forming the bow of the ship.	форштевень
Length between perpendiculars (LBP)	The distance between the fore perpendicular and the aft perpendicular used in ship design calculations.	довжина між перпендикулярами
Fore perpendicular	The vertical line where the summer load waterline meets the stem.	носовий перпендикуляр
After perpendicular	The vertical line at the after side of the rudder post or rudder stock.	кормовий перпендикуляр
Breadth extreme	The greatest width of the ship measured outside the shell plating.	найбільша ширина судна (габаритна)
Breadth moulded	The greatest width of the ship measured inside the shell plating.	теоретична ширина судна

Term	Definition	Translation
Depth extreme	The vertical distance from the underside of the keel to the deck beam at the side of the upper deck.	габаритна висота борту
Depth moulded	The depth measured from the top of the keel to the deck.	теоретична висота борту
Draught extreme	The vertical distance from the bottom of the keel to the waterline.	осадка судна
Draught moulded	The draught measured from the top of the keel to the waterline.	теоретична осадка
Freeboard	The vertical distance between the waterline and the deck at the side of the ship; indicates loading safety margin.	надводний борт
Camber (round of beam)	The transverse curvature of the deck from the centreline to the sides to help drain water.	поперечна кривизна палуби (камбер)
Sheer	The longitudinal upward curvature of the deck toward the bow and stern.	поздовжня кривизна палуби (шір)
Rise of floor	The upward slope of the ship's bottom from the keel to the bilge that helps drainage.	підйом днища
Bilge radius	The curved section connecting the ship's bottom and side at midship.	радіус скули
Tumblehome	Inward curvature of the ship's sides above the waterline.	завал бортів всередину
Strake	A continuous strip of plating forming part of the hull structure.	пояс обшивки

Term	Definition	Translation
Bilge strake	The plating strip located at the bilge where the bottom meets the side.	скуловий пояс обшивки
Sheer strake	The uppermost and strongest side plating along the main deck contributing to hull strength.	ширстрек
Stringer	A longitudinal stiffening member that strengthens the hull structure.	стрингер
Coffin plate	A plate used to connect the stern frame to the flat plate keel.	з'єднувальна кормова плита
Shoe plate	A plate connecting the stem to the keel.	носова опорна плита
Margin plate	A watertight plate connecting the tank top with the shell plating near the bilge.	крайова (маргінальна) плита
Bulwark	A solid protective wall above the deck designed for crew safety.	фальшборт

UNIT 2

Term	Definition	Translation
Stability	The ability of a ship to return to its original position after being disturbed	остійність судна
Center of gravity	The point through which the total weight of the ship acts downward	центр ваги
Buoyancy	The upward force exerted by water that keeps the ship afloat	виштовхувальна сила (плавучість)
Center of buoyancy	The point through which the buoyant force acts upward	центр плавучості

Term	Definition	Translation
Intact stability	Stability of a ship in normal, undamaged condition	остійність непошкодженого судна
Damage stability	Stability of a ship after flooding or structural damage	остійність пошкодженого судна
Flooding	The entry of water into the ship's compartments	затоплення
Free surface effect	The movement of liquid inside tanks or spaces that reduces stability	ефект вільної поверхні
List	Permanent tilting of a ship to one side	крен
Equilibrium	A state where opposing forces (weight and buoyancy) are balanced	рівновага
Cargo loading	The arrangement and distribution of cargo on board	завантаження вантажу
Compartment	A separate enclosed space within the ship	відсік
Subdivision	Division of the ship into compartments for safety	поділ на відсіки
Deterministic method	A method based on theoretical damage scenarios	детерміністичний метод
Probabilistic method	A method based on statistical data and real accidents	імовірнісний метод
Bilge	The lowest part of the ship where water collects	трюм
External forces	Forces acting on the ship from outside (waves, wind, etc.)	зовнішні сили
Up-thrust	Another term for buoyancy (upward force of water)	виштовхувальна сила

UNIT 3

Term	Definition	Translation
Ship machinery systems	All mechanical and technical systems ensuring vessel operation	суднові машинні системи
Propulsion system	System that moves the ship (main engine + propeller)	рушійна установка
Main engine	Primary engine providing propulsion power	головний двигун
Auxiliary machinery	Supporting equipment for ship operation	допоміжні механізми
Fuel system	System supplying and treating fuel	паливна система
Electrical power generation	Production of electricity onboard	виробництво електроенергії
Automation system	System controlling machinery automatically	система автоматизації
Safety systems	Systems ensuring safe operation of the ship	системи безпеки
Redundancy	Availability of backup systems/components	резервування
Operational reliability	Ability to function without failure	експлуатаційна надійність
Maneuverability	Ability to control ship movement	маневреність
Load conditions	Different operating loads on machinery	навантажувальні режими
Engine room	Area where ship machinery is located	машинне відділення
System-based approach	Understanding systems as interconnected units	системний підхід
Operational limits	Safe working limits of machinery	експлуатаційні межі
Tanker	Ship designed for transporting liquids	танкер

Term	Definition	Translation
Environmental protection	Measures to prevent pollution	захист довкілля
Regulatory compliance	Following international rules and standards	відповідність нормативам
Situational awareness	Understanding current operational conditions	ситуаційна обізнаність
Preventive maintenance	Regular maintenance to avoid failures	профілактичне обслуговування
Engineering judgment	Professional decision-making by engineers	інженерне мислення
Fuel consumption	Amount of fuel used	витрата палива
Downtime	Period when machinery is not operating	простій
Wear	Gradual damage due to use	зношування
Combustion process	Process of burning fuel in engine	процес згоряння
Lubrication system	System supplying oil to reduce friction	система змащування
Cooling system	System removing excess heat	система охолодження
Fuel treatment	Cleaning and preparation of fuel	очищення палива
Control system	System regulating engine operation	система керування
Propeller arrangement	Configuration of propeller system	гвинтова установка
Load management	Control of engine load	керування навантаженням
Fuel quality control	Ensuring proper fuel condition	контроль якості палива
Operating parameters	Measurable working conditions (temp, pressure)	робочі параметри
Exhaust temperature	Temperature of exhaust gases	температура вихлопних газів

Term	Definition	Translation
Fuel index	Indicator of fuel supply to engine	паливний індекс
Lube oil consumption	Amount of lubricating oil used	витрата мастила
Vibration	Mechanical oscillation of machinery	вібрація
Chief Engineer	Head of engine department	старший механік
Operational discipline	Strict adherence to procedures	виробнича дисципліна
Commercial pressure	Business-related operational demands	комерційний тиск
Auxiliary systems	Supporting systems for main engine	допоміжні системи
Cooling water system	System circulating cooling water	система охолоджувальної води
Compressed air system	System supplying compressed air	система стисненого повітря
Boiler	Equipment producing steam	котел
Freshwater generation	Production of fresh water onboard	опріснення води
Bilge system	System removing water from bilges	осушувальна система
Ballast system	System controlling ship stability with water	баластна система
Steering gear	System controlling rudder movement	рульова машина
Hydraulics	System using fluid power	гідравліка
Cargo equipment	Machinery used for cargo operations	вантажне обладнання
Interdependent systems	Systems depending on each other	взаємозалежні системи
Blackout	Total loss of electrical power	повне знеструмлення

Term	Definition	Translation
Loss of maneuverability	Inability to control ship movement	втрата керованості
Maintenance planning	Scheduling maintenance activities	планування техобслуговування
Housekeeping	Cleanliness and order in machinery spaces	технічна чистота
Contamination	Presence of unwanted substances	забруднення
Heat exchanger	Device transferring heat between fluids	теплообмінник
Valve	Device controlling fluid flow	клапан
Standby equipment	Backup machinery ready for use	резервне обладнання

UNIT 4

Term	Definition	Translation
Steel	Strong metal used for ship structures	сталь
Mild steel	Low-carbon steel used in shipbuilding	м’яка сталь
High tensile steel	Steel with higher strength for stressed areas	високоміцна сталь
Aluminium alloy	Lightweight metal mixture used in ships	алюмінієвий сплав
Alloy	Mixture of two or more metals	сплав
Hull	Main body of the ship	корпус судна
Corrosion	Damage caused by chemical reactions (rust)	корозія
Shell plating	Outer steel skin of the ship	обшивка корпусу
Insulation	Material used to reduce heat transfer	ізоляція
Superstructure	Upper part of the ship above the main deck	надбудова

Term	Definition	Translation
Watertight door	Door preventing water from passing between compartments	водонепроникні двері
Propeller	Device that moves the ship through water	гребний гвинт
Cavitation	Formation and collapse of vapor bubbles	кавітація
Sacrificial anode	Metal that corrodes to protect the hull	протектор (жертовний анод)
Copper alloy	Metal mixture used for propellers	мідний сплав
Strength	Ability to withstand forces	міцність
Maintenance	Regular care and repair	технічне обслуговування

РЕКОМЕНДОВАНА ЛІТЕРАТУРА ТА ІНФОРМАЦІЙНІ РЕСУРСИ В ІНТЕРНЕТ

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Навчальне видання

БОЙКО Любов Михайлівна

ENGLISH FOR SHIPBUILDERS: A TECHNICAL READER

Методичні рекомендації до самостійної роботи студентів
з дисципліни
«Англійська мова для кораблебудівників»

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