

# STCW III/2 Engineering Knowledge (EK) Syllabus

Ref: <https://www.edumaritime.net/uk-mca-exams>

Source: UK MCA

Candidates should have knowledge of current and emerging technologies, practises and operation techniques required for the operation and maintenance of machinery, equipment and ship structure usually in charge of the Chief Engineering officer.

Candidates are required to understand the legal and management responsibilities of the rank of Chief Engineer officer.

Candidates should be well acquainted with machinery and boiler causalities which may occur at sea and be able to state how these can be prevented or remedied.

The candidate to have knowledge of the following:

- I. Materials used in marine engineering and ship construction.
- II. Control, automation and alarm systems associated with marine equipment.
- III. Operation, testing and maintenance of auxiliary equipment and systems.
- IV. Operation, testing and maintenance of electrical equipment.
- V. Operation, testing and maintenance of marine propulsion plant using steam as power.
- VI. Operation, testing and maintenance of marine propulsion plant using internal combustion engines as power.
- VII. Safety and security of the crew and vessel.
- VIII. Legal powers, responsibilities and administrative duties of a Chief Engineer.
- IX. Vessel construction and maintaining seaworthiness.

The candidate will be able to:

1. Describe the use of metals, materials, liquids, gases and vapours used in marine engineering and ship construction with reference to their physical properties.
2. Identify cause of failure and describe failure mechanisms and testing of common materials used in marine engineering and ship construction.
3. Describe processes to which component parts of machinery and equipment are subjected which are relevant to their operation, explaining why these processes are required.
4. Describe the principles of operation of monitoring and measuring devices associated with marine equipment, giving examples of their use based on an analysis of their characteristics.
5. Describe the operation, testing and maintenance of automatic control systems for engineering plant.
6. Describe the operation, testing and maintenance of auxiliary systems, analysing possible faults and explaining their remedy, including:
  - 6.1. propulsion transmission systems, including thrust and shaft bearings, stern tubes and propellers;
  - 6.2. pumping systems including pollution prevention equipment and systems;
  - 6.3. steering and stabilising systems, including bow thrusters and rudders;
  - 6.4. refrigeration and air conditioning systems;
  - 6.5. fresh water production, conditioning and storage systems;
  - 6.6. deck machinery and cargo handling systems;
  - 6.7. air compressors, receivers and associated equipment;
  - 6.8. auxiliary diesel engines and associated equipment;
  - 6.9.

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7. Explain the principles of the operation, testing and maintenance of electrical equipment, including:
  - 7.1. alternators and generators, including excitation, voltage control, load sharing and protection;
  - 7.2. motors, including starting;
  - 7.3. distribution systems, their arrangement and protection of supplies;
  - 7.4. transformers;
  - 7.5. batteries.
8. Describe methods of fault finding, analyse symptoms and suggest methods of rectification of faults in electrical systems.

Items 9 and 10 will only be tested for candidates for Steam Certificate

9. Describe the configuration of marine plant using steam for propulsion.
10. Describe the operation, testing and maintenance of marine plant using steam for propulsion, analysing possible faults and explaining their remedy, including:
  - 10.1. steam boilers, their mountings, feed water and fuel, including preparation, systems;
  - 10.2. methods of boiler water testing and conditioning and action to be taken to maintain safe conditions;
  - 10.3. steam turbines, gearing and lubrication systems;
  - 10.4. steam distribution systems and associated equipment;
  - 10.5. control and alarm systems associated with automatic operation of marine steam plant;
  - 10.6. assessment of power, output and efficiency and action to be taken to maintain safe and efficient operation;
  - 10.7. internal combustion engines used for auxiliary and emergency sources of power.

Items 11 and 12 will only be tested for candidates for Motor Certificate

11. Describe the configuration of marine plant using internal combustion engines as power plant.
12. Describe the operation, testing and maintenance of marine plant using internal combustion engines as power plant, analysing possible faults and explaining their remedy, including:
  - 12.1. marine internal combustion engines (medium speed trunk and crosshead types), gearing systems and clutches;
  - 12.2. starting and reversing systems;
  - 12.3. cooling, lubrication, fuel and fuel preparation systems;
  - 12.4. methods of testing fuel oil, lubricating oil and cooling water and action to be taken to maintain safe conditions;
  - 12.5. control and alarm systems associated with automatic operation of marine internal combustion plant;
  - 12.6. methods of assessment of power output and internal combustion plant efficiency, and action to be taken to maintain safe and efficient operation of plant;
  - 12.7. auxiliary steam boilers and associated equipment.

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13. Ensure the safety and security of the crew and vessel, including:
  - 13.1. describe information issued by relevant bodies, including IMO, UK MCGA, MAIB, with respect to safety at sea;
  - 13.2. explain precautions against fires or explosions, explosive mixtures and sources of ignition;
  - 13.3. explain principles and methods of fire prevention and extinction in all areas of a ship;
  - 13.4. explain the principles of the operation, and describe the testing and maintenance of, fire detection and extinguishing systems including pumps and associated pumping systems;
  - 13.5. describe the control and organisation of fire and damage control parties;
  - 13.6. explain the principles involved with, and the operation, testing and maintenance of, plant and equipment specifically for use with dangerous substances as cargo;
  - 13.7. explain the organisation and control procedures necessary for the safe and efficient operation in the UMS mode;
  - 13.8. describe the constructional details of ships and explain the stresses that the hull is subjected to and the methods of resisting these stresses, fire protection and flood protection;
  - 13.9. the source of and problems associated with vibration and noise;
  - 13.10. describe the requirements of the International Convention on Load Lines and maintaining conditions of assignment.
  
14. Explain the legal and administrative responsibilities of a Chief Engineer, including:
  - 14.1. organisation and training of staff for normal and emergency duties;
  - 14.2. organisation of temporary and permanent repairs and surveys;
  - 14.3. ensuring ship is in seaworthy condition prior to sailing taking into account nature of voyage;
  - 14.4. compliance with international legislation, class and port state requirements, including consequences of non-compliance;
  - 14.5. ensuring sufficient consumables are available prior to sailing taking into account necessary reserves;
  - 14.6. preparing for, undertaking and securing Bunkering operations taking into account present legislation, statutory duties and protest procedures;
  - 14.7. preparing for, undertaking and leaving dry dock.

## STCW Reg. III/2 Engineering Knowledge

STCW Competence, Table A-III/2	Engineering knowledge syllabus	Other courses
Manage the operation of propulsion plant.	3, 6, 9, 10, 11, 12	
Plan and schedule operations.	1, 2, 3, 6, 9, 10, 11, 12, 13.8	Chief Eng Reg III_2 Applied Heat Chief Eng Reg III_2 Applied Mechanics Chief Eng Reg III_2 Naval Architecture
Operation, surveillance, performance and maintaining safety of propulsion plant and auxiliary machinery.	3, 4, 5, 6, 7, 8, 9, 10, 11, 12	
Manage fuel, lubrication and ballast operations.	6.2, 10.1, 10.3, 12.3, 14.5, 14.6	
Manage operation of electrical and electronic control equipment.	4, 5, 6.3, 6.6, 7, 8	High Voltage (M) Chief Eng Reg III_2 Electrotechnology
Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.	4, 5, 7, 8	
Manage safe and effective repair procedures.	1, 2, 13.1, 13.2, 13.8, 14.2,14.3, 14.4, 14.7	
Detect and identify cause of machinery malfunctions and correct faults.	2, 6, 7, 8, 10, 12, 13.9	
Ensure safe working practices.	13.1, 13.2, 13.6, 13.7, 14.1, 14.2 14.4	STCW Advanced Oil, Gas, Chemical tanker courses. Liquefied/compressed Gas Bunkering course
Control trim, stability and stress.	6.2, 6.3, 13.5, 13.8, 13.10, 14.1	Chief Eng Reg III_2 Naval Architecture
Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment.	13, 14.1, 14.3, 14.4	STCW Advanced Oil, Gas, Chemical tanker courses. Liquefied/compressed Gas Bunkering course
Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems.	13.1, 13.4, 14.1	STCW Advanced Fire Fighting STCW Advanced Oil, Gas, Chemical tanker courses. Liquefied/compressed Gas Bunkering course
Develop emergency and damage control plans and handle emergency situations.	13.1, 13.2, 13.3, 13.4, 13.8, 13.10,	STCW Advanced Oil, Gas, Chemical tanker courses. Liquefied/compressed Gas Bunkering course
Use leadership and managerial skills.		HELM(M)