



MIN 654 – Amendment 1 (M)

Engineering and Electro-technical Officer Oral Exam Syllabus

Notice to all Owners, Masters, Officers, Ratings and those concerned with maritime training.

*This notice should be read with MSN 1857, MSN 1859, MSN 1860 and replaces MGN 69.
This MIN expires 01 May 2024*

Summary

This Marine Information Note (MIN) provides information and outlines the updated Oral exam syllabus, for Merchant Navy engineer officers and Electro-Technical Officers, leading to the issue of a UK Certificate of Competency. Following the initial one-year roll-out period of this syllabus, no feedback has been provided and as such the guidance has been extended for a further two years. Any feedback in this period should be sent to exams@mcga.gov.uk.

This MIN Covers:

1. Introduction
2. Further Information
3. Engineer Officer of the Watch (EOOW) Certificate of Competency Oral Exam Syllabus
4. Chief Engineer and Second Engineer Certificate of Competency Oral Exam Syllabus
5. Electro-Technical Officers (ETO) Certificate of Competency Oral Exam Syllabus

Annex

The Annexes of this MIN cover:

- A. The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW), Part 4 – 2 – Principles to be observed in keeping an engineering watch

1. Introduction

- 1.1 The STCW Convention requires all officers to complete an approved education and training programme and meet the standards of competence specified in the STCW Code. All education and training programmes leading to a Certificate of Competency (CoC) must be



mapped to the Code and approved by the MCA. The MCA Engineer oral examination syllabus is mapped to the applicable STCW Code table. The oral examination forms part of the assessment for the attainment of all MCA Certificates of Competency, and all candidates must demonstrate an adequate knowledge of the English language.

- 1.2 The Examiner is expected to base the assessment on the competence and relate them to tasks, responsibilities and duties considered necessary for ship operations, safety of life at sea and the protection of the marine environment.
- 1.3 The oral exam can draw on any part of the syllabus. It is recommended that candidates complete the associated qualification that delivers the underpinning knowledge¹ for each oral exam prior to undertaking the oral assessment.

2. Further Information

- 2.1 Further information on the current process for Oral Examinations is available in MIN 620, as amended.
- 2.2 Further information on the requirements and application for a Notice of Eligibility (NOE) for an Oral Examination and how to obtain the associated CoC is available here:

Quick Reference	Application Form (including link)	M-Notice Number (including link)
Engineer Officers	MSF 4275	MSN 1857

¹ Underpinning knowledge is the appropriate Higher Education academic qualification such as a Foundation Degree or HND and the applicable ancillary training courses listed in MSN 1857 (Amendment 1), section 6.



3. Engineer Officer of the Watch (EOOW) Certificate of Competency Oral Exam Syllabus

3.1 Oral Exam Aim:

The MCA oral examination is aimed at ensuring the candidate's ability to undertake the duties appropriate to the engineer officer of the watch (EOOW). Candidates should demonstrate the ability to apply the knowledge required for competencies outlined in this oral examination syllabus by appropriate responses, anticipations and reactions to a range of routine, non-routine and contingency scenarios as presented by the examiner, from the perspective of EOOW of Ships of 750kW or more.

3.2 Standard of competence – EOOW Certificate of Competency

1. Every candidate for certification as *officer in charge of an engineering watch* in a manned engine-room or as designated duty engineer in a periodically unmanned engine-room shall be required to demonstrate ability to undertake, at the operational level, the tasks, duties and responsibilities listed in the 'Competence' column of this oral exam syllabus.
2. The minimum knowledge, understanding and proficiency required for an EOOW CoC is listed in the 'Knowledge, understanding and proficiency' column of this oral exam syllabus.
3. The level of knowledge of the material listed in the 'Knowledge, understanding and proficiency' column of this oral exam syllabus shall be such that in the examiners professional judgement it would be enough for engineer officers to carry out their watchkeeping duties.
4. Theoretical knowledge, understanding and proficiency should take into account STCW Code, Part A, Section A-VIII/2, part 4-2 – Principles to be observed in keeping an engineering watch, and shall take into account the relevant requirements of this part of the STCW code.²
5. Candidates for CoC for service on ships in which steam boilers do not form part of their machinery may omit the relevant part of this oral exam syllabus. The CoC awarded on such a basis shall not be valid for service on ships in which steam boilers form part of a ship's machinery until the engineer officer meets the standard of competence and seagoing service requirements set out in Marine Shipping Notice (MSN) 1857. Any such limitation shall be stated on the CoC.
6. Candidates and Examiners should refer to the 'Criteria for evaluating competence' and 'Further guidance for evaluating competence' columns for further details.

² See **Annex A** for the STCW Code Part A, Chapter VIII, Section A-VIII/2, Part 4 – 2 – Principles to be observed in keeping an engineering watch.



EOOW Oral Exam Syllabus

Function: Marine engineering at the operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
<p>Maintain a safe engineering watch</p>	<p>Thorough knowledge of Principles to be observed in keeping an engineering watch, including:</p> <ol style="list-style-type: none"> 1. duties associated with taking over and accepting a watch 2. routine duties undertaken during a watch 3. maintenance of the machinery space logs and the significance of the readings taken 4. duties associated with handing over a watch <p>Safety and emergency procedures; change-over of remote/automatic to local control of all systems</p> <p>Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems</p>	<p>The conduct, handover and relief of the watch conforms with accepted principles and procedures</p> <p>The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers' recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch</p> <p>A proper record is maintained of the movements and activities relating to the ship's engineering systems</p>	<p>Similar to job interview looking at technical abilities and candidates response to probing questions, body language and other physical response are observed</p> <p>Questions open ended starting with a basic question and allowing the candidate to express themselves in the quality and quantity of answer</p> <p>As the candidate gives up information elements of the answer are further probed for more detailed explanation</p> <p>E.g. – the candidate has been asked a broad based question regarding “taking over the watch.” During the questioning as the candidate develops their answers to the question they will refer to technical, safety and operational aspects of the answer</p> <p>As these aspects are mentioned the examiner will take the opportunity to further question on</p>



	<p><i>Engine-room resource management</i></p> <p>Knowledge of engine-room resource management principles, including:</p> <ol style="list-style-type: none"> 1. allocation, assignment, and prioritization of resources 2. effective communication 3. assertiveness and leadership 4. obtaining and maintaining situational awareness 5. consideration of team experience 	<p>Resources are allocated and assigned as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously given and received</p> <p>Questionable decisions and/or actions result in appropriate challenge and response</p> <p>Effective leadership behaviours are identified</p> <p>Team member(s) share accurate understanding of current and predicted engine-room and</p>	<p>specific detailed elements relating to these aspects</p> <p>This will allow the examiner to develop typical working scenarios including safety critical operations. The examiner will monitor body language as the candidate responds and also observe candidates overall response as scenario escalates</p> <p>The examiner judges the candidate competent in this area if the candidate consistently displays a working knowledge at the professional level. This will involve clear descriptions and annunciation, technical knowledge, ref to recognised documents such as ISM, COSWP etc. Display confidence in their value of decisions. The examiner uses their experiences and practical knowledge as CEO to aid the assessment process. The questioning is repeated for the other elements of competency required by STCW (as shown in the 'Competence' column) by placing the candidate in various other practical scenarios covering breadth and depth of syllabus</p>
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		associated systems state, and of external environment	<p>When the Candidate has satisfied the examiner in these areas the Oral is brought to a close The candidate is judged to have passed when they have demonstrated consistently that the level of confidence and ability listed in the STCW syllabus has been achieved</p> <p>Failure when the candidate cannot show a consistent approach in dealing with onboard operations and emergency situations in relation to scenarios the candidate has been placed. The candidate will be given feedback on their performance regarding pass or fail. Also this will help in strengthening those areas where they lack STCW Competency, knowledge and understanding</p>
Use English in written and oral form	Adequate knowledge of the English language to enable the officer to use engineering publications and to perform engineering duties	<p>English language publications relevant to engineering duties are correctly interpreted</p> <p>Communications are clear and understood</p>	Relevant aspects of candidates knowledge and experience in these areas are assessed in the oral examination
Use internal communication systems	Operation of all internal communication systems on board	Transmission and reception of messages are consistently successful	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination



		Communication records are complete, accurate and comply with statutory requirements	
Operate main and auxiliary machinery and associated control systems	<p>Basic construction and operation principles of machinery systems, including:</p> <ol style="list-style-type: none"> 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine boiler 5. shafting installations, including propeller 6. other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems 7. steering gear 8. automatic control systems 9. fluid flow and characteristics of lubricating oil, fuel oil and cooling systems 10. deck machinery 	Construction and operating mechanisms can be understood and explained with drawings/instructions	<p>All safety and emergency procedures for safe and efficient operation of main and aux propulsion plant and associated machinery inclusive of control systems</p> <p>The candidate should have knowledge of preparation, operation, fault finding and necessary measures to prevent damage for the above-mentioned machineries and associated equipment</p> <p>Candidates are evaluated on their basic understanding on Planned Maintenance Systems</p>



	<p>Safety and emergency procedures for operation of propulsion plant machinery, including control systems</p> <p>Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:</p> <ol style="list-style-type: none"> 1. main engine and associated auxiliaries 2. steam boiler and associated auxiliaries and steam systems 3. auxiliary prime movers and associated systems 4. other auxiliaries, including refrigeration, air- conditioning and ventilation systems 	<p>Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations and avoid pollution of the marine environment</p> <p>Deviations from the norm are promptly identified</p> <p>The output of plant and engineering systems consistently meets requirements, including bridge orders relating to changes in speed and direction</p> <p>The causes of machinery malfunctions are promptly identified and actions are designed to ensure the overall safety of the ship and the plant, having regard to the prevailing circumstances and conditions</p>	<p>Consequences of failure to follow correct checks prior to starting equipment. Lock out and Tag Out system is followed correctly</p> <p>Boiler safety, various alarms Trips, mountings, Boiler water treatment and importance</p>
<p>Operate fuel, lubrication, ballast and other pumping systems and associated control systems</p>	<p>Operational characteristics of pumps and piping systems, including control systems</p> <p>Operation of pumping systems:</p> <ol style="list-style-type: none"> 1. routine pumping operations 	<p>Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations and avoid pollution of the marine environment</p> <p>Deviations from the norm are</p>	<p>Understanding of Oil Record Book (ORB), importance and Entries are evaluated</p> <p>Daily pumping operations and recording in ORB</p>



	<p>2. operation of bilge, ballast and cargo pumping systems</p> <p>Oily-water separators (or-similar equipment) requirements and operation</p>	<p>promptly identified and appropriate action is taken</p>	<p>Cargo plant preparation, dangers associated with steam hammering etc.</p> <p>PPM requirements, types of Oily water Separator, ORB entries</p>
<p>Operate electrical, electronic and control systems</p>	<p>Basic configuration and operation principles of the following electrical, electronic and control equipment:</p> <p>1. electrical equipment:</p> <p>a. generator and distribution systems</p> <p>b. preparing, starting, paralleling and changing over generators</p> <p>c. electrical motors including starting methodologies</p> <p>d. high-voltage installations operational</p> <p>e. sequential control circuits and associated system devices</p> <p>2. electronic equipment:</p> <p>a. characteristics of basic electronic circuit elements</p> <p>b. flowchart for automatic and control systems</p> <p>c. functions, characteristics and features of control systems for machinery items, including</p>	<p>Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations</p> <p>Electrical, electronic and control systems can be understood and explained with drawings/instructions</p>	<p>Generator and distribution systems including emergency generator and ESB</p> <p>Preparation checks, starting, paralleling and changing over of generators</p> <p>Dead ship revival procedure</p> <p>Electrical motors including starting methodologies like DOL, star and delta etc.</p> <p>HV installations and dangers associated, permit to work systems etc.</p> <p>Preferential trips, associated systems, voltage segregation</p> <p>Emergency battery room and associated hazards</p> <p>Characteristics of basic electronic circuit elements, Zener barriers and application</p>



	<p>main propulsion plant operation control and steam boiler automatic controls</p> <p>3. control systems</p> <p>a. various automatic control methodologies and characteristics</p> <p>b. Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control</p>		<p>Automatic and control systems flow diagrams</p> <p>Control systems for machinery items, including main propulsion plant operation and control including steam boiler auto controls</p> <p>PID characteristics including system controls including pneumatic and electro pneumatic types for process control</p> <p>Human machine interface systems used in modern intelligent engines for main propulsion</p>
<p>Maintenance and repair of electrical and electronic equipment</p>	<p>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment</p> <p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment</p> <p>Detection of electric malfunction, location of faults and measures to prevent damage</p>	<p>Safety measures for working are appropriate</p> <p>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate</p> <p>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice</p> <p>Reassembling and performance testing is in accordance with manuals and good practice</p>	<p>Candidate is evaluated on construction and operation of electrical testing and measuring equipment like multimeter, megger etc.</p> <p>Knowledge and understanding of monitoring systems, auto control</p>



	<p>Construction and operation of electrical testing and measuring equipment</p> <p>Function and performance tests of the following equipment and their configuration:</p> <ol style="list-style-type: none"> 1. monitoring systems 2. automatic control devices 3. protective devices <p>The interpretation of electrical and simple electronic diagrams</p>		<p>Battery maintenance and dangers and precautions</p> <p>Candidates understanding of Earthing systems, Earth monitoring equipment, Earth fault finding and rectification are evaluated as per STCW Competency requirements listed in the 'Competence' column</p> <p>Candidates understanding in various protective devices associated with electrical distribution system are evaluated as per STCW Competency listed in the 'Competence' column</p>
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Function: Maintenance and repair at the operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board	<p>Characteristics and limitations of materials used in construction and repair of ships and equipment</p> <p>Characteristics and limitations of processes used for fabrication and repair</p>	<p>Identification of important parameters for fabrication of typical ship-related components is appropriate</p> <p>Selection of materials is appropriate</p>	Chapter 18 - Provision, Care and Use of Work Equipment from CoSWP, candidates understanding is evaluated



	<p>Properties and parameters considered in the fabrication and repair of systems and components</p> <p>Methods for carrying out safe emergency/temporary repairs</p> <p>Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments</p> <p>Use of hand tools, machine tools and measuring instruments</p> <p>Use of various types of sealants and packings</p>	<p>Fabrication is to designated tolerances</p> <p>Use of equipment and hand tools, machine tools and measuring instruments is appropriate and safe</p>	<p>Evaluation of candidate for the Use of appropriate specialized tools and measuring equipment (megger, hydraulic jacks etc)</p>
<p>Maintenance and repair of shipboard machinery and equipment</p>	<p>Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment</p> <p>Appropriate basic mechanical knowledge and skills</p> <p>Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment</p>	<p>Safety procedures followed are appropriate</p> <p>Selection of tools and spare gear is appropriate</p> <p>Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practice</p> <p>Re-commissioning and performance testing is in accordance with manuals and good practice</p>	<p>Chapter 20 - Work on Machinery and Power Systems from CoSWP, candidates understanding is evaluated</p>



	<p>The use of appropriate specialized tools and measuring instruments</p> <p>Design characteristics and selection of materials in construction of equipment</p> <p>Interpretation of machinery drawings and handbooks</p> <p>The interpretation of piping, hydraulic and pneumatic diagrams</p>	<p>Selection of materials and parts is appropriate</p>	
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Function: Controlling the operation of the ship and care for persons on board at the operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
<p>Ensure compliance with pollution- prevention requirements</p>	<p><i>Prevention of pollution of the marine environment</i></p> <p>Knowledge of the precautions to be taken to prevent pollution of the marine environment</p> <p>Anti-pollution procedures and all associated equipment</p> <p>Importance of proactive measures to protect the marine environment</p>	<p>Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed</p> <p>Actions to ensure that a positive environmental reputation is maintained</p>	<p>Awareness of SOPEP manual, equipment's on board and drills IAPP certificate, Sox, NOx, latest Sulphur content norms regarding bunkers</p> <p>Engine technical file-significance</p>
<p>Maintain seaworthiness of the ship</p>	<p><i>Ship stability</i></p>	<p>The stability conditions comply with the IMO intact stability criteria</p>	<p>Day to day onboard operations effecting stability, e.g. Bunkering,</p>



	<p>Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment</p> <p>Understanding of the fundamentals of watertight integrity</p> <p>Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy</p> <p><i>Ship construction</i></p> <p>General knowledge of the principal structural members of a ship and the proper names for the various parts</p>	<p>under all conditions of loading</p> <p>Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice</p>	<p>Bunker tanks getting empty, Fresh water tanks</p> <p>Basic understanding of free surface effect</p>
Prevent, control and fight fires on board	<p><i>Fire prevention and fire-fighting appliances</i></p> <p>Ability to organize fire drills</p> <p>Knowledge of classes and chemistry of fire</p> <p>Knowledge of fixed fire-fighting systems</p> <p>Action to be taken in the event of fire, including fires involving oil systems</p>	<p>The type and scale of the problem is promptly identified and initial actions conform with the emergency procedure and contingency plans for the ship</p> <p>Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly</p> <p>The order of priority, and the levels and time-scales of making reports and informing personnel</p>	<p>Candidates are questioned further on the classification of different bulk heads, ship specific Fixed fire fighting systems, procedures for releasing CO2 and precautions to be observed before Re-entry</p> <p>High and Low form systems</p> <p>High Fog system</p> <p>Fire plan and locations</p>



		on board, are relevant to the nature of the emergency and reflect the urgency of the problem	Knowledge of classes and chemistry of fire
Operate life-saving appliances	<p><i>Life-saving</i></p> <p>Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids</p>	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards	Understanding of Emergency Escape Breathing Device (EEBD's)
Apply medical first aid on board ship	<p><i>Medical aid</i></p> <p>Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship</p>	Identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimizes immediate threat to life	<p>Identify the immediate measures to be taken when accidents, medical emergencies or illnesses occur, including prioritising actions to be taken and minimising risk of harm to self and casualty</p> <p>Knowledge of medical equipment as listed in the Annex 1 of MSN 1768 (M+F) or subsequent amendments</p>
Monitor compliance with legislative requirements	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment	Legislative requirements relating to safety of life at sea, security and protection of the marine environment are correctly identified	SOLAS, BWM and MARPOL: understanding and adherence is evaluated for the candidates



<p>Application of leadership and teamworking skills</p>	<p>Working knowledge of shipboard personnel management and training</p> <p>A knowledge of related international maritime conventions and recommendations, and national legislation</p> <p>Ability to apply task and workload management, including:</p> <ol style="list-style-type: none"> 1. planning and co- ordination 2. personnel assignment 3. time and resource constraints 4. prioritization <p>Knowledge and ability to apply effective resource management:</p> <ol style="list-style-type: none"> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experiences 4. assertiveness and leadership, including motivation 	<p>The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned</p> <p>Training objectives and activities are based on assessment of current competence and capabilities and operational requirements</p> <p>Operations are demonstrated to be in accordance with applicable rules</p> <p>Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously given and received</p> <p>Effective leadership behaviours are demonstrated</p> <p>Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>
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	<p>5. obtaining and maintaining situational awareness</p> <p>Knowledge and ability to apply decision-making techniques:</p> <ol style="list-style-type: none"> 1. situation and risk assessment 2. identify and consider generated options 3. selecting course of action 4. evaluation of outcome effectiveness 	<p>Decisions are most effective for the situation</p>	<p>Chapter 15 – Entering Dangerous (Enclosed) Spaces from CoSWP, candidates understanding is evaluated</p>
<p>Contribute to the safety of personnel and ship</p>	<p>Knowledge of personal survival techniques</p> <p>Knowledge of fire prevention and ability to fight and extinguish fires</p> <p>Knowledge of elementary first aid</p> <p>Knowledge of personal safety and social responsibilities</p>	<p>Appropriate safety and protective equipment is correctly used</p> <p>Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times</p> <p>Procedures designed to safeguard the environment are observed at all times</p> <p>Initial and follow-up actions on becoming aware of an emergency conform with established emergency response procedures</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>



4. Chief Engineer and Second Engineer Certificate of Competency Oral Exam Syllabus

The following is a common syllabus in which Chief Engineers and Second Engineers are required to demonstrate the specific competence detailed in the appropriate paragraph below.

All candidates should demonstrate a thorough knowledge of the syllabus for Engineer Officer of the Watch.

STCW Reg III/3 - Second Engineer - ships less than 3000 kW

As candidates at this level will also be granted certificates under Regulation III/2 to sail as Second Engineer on vessels of less than 6000 kW on near-coastal voyages, the oral examination will concentrate on marine systems and equipment associated with ships up to this limited registered power.

It will be concerned with the constructional details, working principles and safe and efficient operation of plant, the correct use of equipment provided for the safety of the ship and the protection of the environment, and the legal and management responsibilities of a certificated engineer officer.

In addition, candidates are required to demonstrate sufficient knowledge to enable them to assume the responsibilities of the Chief Engineer should this officer become incapacitated during a voyage, and thus enable the vessel to safely make the next port.

STCW Reg III/3 - Chief Engineer - ships less than 3,000 kW

As candidates at this level may also be granted certificates under Regulation III/2 to sail as Chief Engineer on vessels of less than 6,000 kW on near-coastal voyages, the oral examination will be based on the operation, maintenance and management of marine machinery appropriate to ships of this limited registered power, particularly the recognition of irregularity in the performance of that machinery and the analysis and interpretation of information gained from monitoring equipment.

It will also cover emergency procedures directly related to the safety of ships and the protection of the environment, advanced operational engineering knowledge and the legal and administrative duties of a Chief Engineer Officer.

STCW Reg III/2 - Second Engineer

The oral examination will be concerned with the constructional details and working principles of marine systems and equipment, the safe and efficient operation of plant, the correct use of equipment provided for the safety of the ship and the protection of the environment, and the legal and management responsibilities of a certificated engineer officer.



In addition, candidates are required to demonstrate sufficient knowledge to enable them to assume the responsibilities of the Chief Engineer should this officer become incapacitated during a voyage, and thus enable the vessel to safely make the next port.

STCW Reg III/2 - Chief Engineer

The oral examination will be based on the operation, maintenance and management of marine machinery, particularly the recognition of irregularity in the performance of that machinery and the analysis and interpretation of information gained from monitoring equipment. It will also cover emergency procedures directly related to the safety of ships and the protection of the environment, advanced operational engineering knowledge and the legal and administrative duties of a Chief Engineer Officer.

Second Engineer and Chief Engineer Unlimited, Oral Exam

Standard of competence

1. Every candidate for certification as chief engineer officer and second engineer officer of seagoing ships powered by main propulsion machinery of 3,000 kW power or more shall be required to demonstrate ability to undertake, at the management level, the tasks, duties and responsibilities listed in the 'Competence' column of table A-III/2.
2. The minimum knowledge, understanding and proficiency required for certification is listed in the 'Knowledge, understanding and proficiency' column of table A-III/2.
3. Bearing in mind that a second engineer officer shall be in a position to assume the responsibilities of the chief engineer officer at any time, assessment in these subjects shall be designed to test the candidate's ability to assimilate all available information that affects the safe operation of the ship's machinery and the protection of the marine environment.
4. The level of knowledge of the subjects listed in the 'Knowledge, understanding and proficiency' column of table A-III/2 shall be sufficient to enable the candidate to serve in the capacity of chief engineer officer or second engineer officer.
5. The Examiner may omit knowledge requirements for types of propulsion machinery other than those machinery installations for which the certificate to be awarded shall be valid. A certificate awarded on such a basis shall not be valid for any category of machinery installation which has been omitted until the engineer officer proves to be competent in these knowledge requirements. Any such limitation shall be stated on the certificate and in the endorsement.
6. Candidates and Examiners should refer to the 'Criteria for evaluating competence' and 'Further guidance for evaluating competence' columns for further details.



Near-coastal voyages

7. The level of knowledge, understanding and proficiency required under the different sections listed in the 'Knowledge, understanding and proficiency' column of table A-III/2 may be varied for engineer officers of ships powered by main propulsion machinery with limited propulsion power engaged on near-coastal voyages, as considered necessary, bearing in mind the effect on the safety of all ships which may be operating in the same waters. Any such limitation will be stated on the certificate and in the endorsement.

Calculations will be covered in separate dedicated theoretical examinations.

Function: Marine engineering at the management level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
Manage the operation of propulsion plant machinery	Design features, and operative mechanism of the following machinery and associated auxiliaries: <ol style="list-style-type: none"> 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler 	Explanation and understanding of design features and operating mechanisms are appropriate	Candidates understanding on Operational manuals and equipment's are evaluated as per Table A-III/2 STCW Code, chapter III
Plan and schedule operations	<i>Theoretical knowledge</i>	The planning and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage	Assessment of power output and efficiency of propulsion plant and actions to maintain safe and efficient operation



	<p>Thermodynamics and heat transmission</p> <p>Mechanics and hydromechanics</p> <p>Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption</p> <p>Heat cycle, thermal efficiency and heat balance of the following:</p> <ol style="list-style-type: none"> 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler <p>Refrigerators and refrigeration cycle</p> <p>Physical and chemical properties of fuels and lubricants</p> <p>Technology of materials</p> <p>Naval architecture and ship construction, including damage control</p> <p><i>Practical knowledge</i></p>		<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p> <p>Candidates understanding on fuel oil systems, Bunkering, fuel changing over, minimising the negative effect of poor quality fuel, adjustment of fuel quality setting understanding the importance of the CCAI number, power requirements are evaluated</p> <p>Emergency replacement of stern tube seals, and checking the alignment of shafting system</p> <p>Operate, Test and Maintain Marine Engineering Systems</p>
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	<p>Start up and shut down main propulsion and auxiliary machinery, including associated systems</p> <p>Operating limits of propulsion plant</p> <p>The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery</p> <p>Functions and mechanism of automatic control for main engine</p> <p>Functions and mechanism of automatic control for auxiliary machinery including but not limited to:</p> <ol style="list-style-type: none"> 1. generator distribution systems 2. steam boilers 3. oil purifier 4. refrigeration system 5. pumping and piping systems 6. steering gear system 		<p>Marine diesel propulsion machinery, including: trunk and cross-head diesel, dual fuel, electronic engines, starting and reversing systems, gearing systems and clutches, cooling and lubrication systems, fuel oil preparation systems; steam turbine propulsion machinery, including: steam boilers and mountings, steam distribution systems, steam turbines, gearing and lubrication systems, feed water systems</p> <p>Candidates understanding on refrigeration and air-conditioning systems, Ozone depleting substances and proper handling is evaluated</p> <p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>
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	7. cargo-handling equipment and deck machinery		Candidates understanding on Main propulsion plant power requirements, load limits and load diagrams, Auxiliary power requirements, operating procedures, Local and Emergency controls and change over procedure, Emergency stop and crash astern, Safe working practices are evaluated
Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery		<p>The methods of preparing for the start-up and of making available fuels, lubricants, cooling water and air are the most appropriate</p> <p>Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with technical specifications and agreed work plans</p> <p>Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions</p> <p>The methods of preparing the shutdown, and of supervising the cooling down of the engine are the most appropriate</p> <p>The methods of measuring the load capacity of the engines are in</p>	<p>Candidates knowledge and understanding of automatic control systems regarding boilers, main propulsion plant are evaluated</p> <p>Machinery plant preparation (Main engine, Cargo plant including boiler preparation from cold), warming up procedure, safe securing of plant post operation</p>



		<p>accordance with technical specifications</p> <p>Performance is checked against bridge orders</p> <p>Performance levels are in accordance with technical specifications</p>	<p>Understanding of Power cards, draw cards, Light spring diagram and significance and correct interpretation for safe operation of Main engine and also for trouble shooting</p>
<p>Manage fuel, lubrication and ballast operations</p>	<p>Operation and maintenance of machinery, including pumps and piping systems</p>	<p>Fuel and ballast operations meet operational requirements and are carried out so as to prevent pollution of the marine environment</p>	<p>MARPOL regulations, OWS and sewage system operation and requirements</p> <p>OIL Record Book correct filling and requirements</p> <p>Lube oil different grades, TBN, understanding of procedures to take oil sample, importance of Lube oil testing and correct interpretation of test results</p>

Function: Electrical, electronic and control engineering at the management level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
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<p>Manage operation of electrical and electronic control equipment</p>	<p><i>Theoretical knowledge</i></p> <p>Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices</p> <p>Design features and system configurations of automatic control equipment and safety devices for the following:</p> <ol style="list-style-type: none"> 1. main engine 2. generator and distribution system 3. steam boiler <p>Design features and system configurations of operational control equipment for electrical motors</p> <p>Design features of high-voltage installations</p> <p>Features of hydraulic and pneumatic control equipment</p>	<p>Operation of equipment and system is in accordance with operating manuals</p> <p>Performance levels are in accordance with technical specifications</p>	<p>Electrical Isolation, understanding of pneumatic and electro pneumatic controllers and functions</p> <p>Understanding of Technical specifications and limitations of performance under special circumstances</p>
<p>Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition</p>	<p><i>Practical knowledge</i></p> <p>Troubleshooting of electrical and electronic control equipment</p>	<p>Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications</p>	<p>Understanding of trouble shooting of machinery under various circumstances</p>



	<p>Function test of electrical, electronic control equipment and safety devices</p> <p>Troubleshooting of monitoring systems</p> <p>Software version control</p>	<p>Inspection, testing and troubleshooting of equipment are appropriate</p>	<p>Decision making and correct judgement of actions to be taken under Emergency situations</p> <p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>
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Function: Maintenance and repair at the management level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
<p>Manage safe and effective maintenance and repair procedures</p>	<p><i>Theoretical knowledge</i></p> <p>Marine engineering practice</p> <p><i>Practical knowledge</i></p> <p>Manage safe and effective maintenance and repair procedures</p> <p>Planning maintenance, including statutory and class verifications</p> <p>Planning repairs</p>	<p>Maintenance activities are correctly planned and carried out in accordance with technical, legislative, safety and procedural specifications</p> <p>Appropriate plans, specifications, materials and equipment are available for maintenance and repair</p> <p>Action taken leads to the restoration of plant by the most suitable method</p>	<p>Plan, Schedule and Organise Maintenance and Repairs</p> <p>Code of Safe Working Practices for Merchant Seamen;</p> <p>Permit-to-work systems;</p> <p>Dangers of entering enclosed spaces;</p> <p>Dry dock procedures;</p> <p>Planned maintenance systems;</p>



			Temporary and permanent repairs in emergency and normal conditions
Detect and identify the cause of machinery malfunctions and correct faults	<p><i>Practical knowledge</i></p> <p>Detection of machinery malfunction, location of faults and action to prevent damage</p> <p>Inspection and adjustment of equipment</p> <p>Non-destructive examination</p>	<p>The methods of comparing actual operating conditions are in accordance with recommended practices and procedures</p> <p>Actions and decisions are in accordance with recommended operating specifications and limitations</p>	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination
Ensure safe working practices	<p><i>Practical knowledge</i></p> <p>Safe working practices</p>	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns	<p>Legislative Requirements</p> <p>International convention certificates and documents required to be on board;</p> <p>Knowledge of the international conventions on Marine Pollution, Load Lines, the Safety of Life, at Sea, the Prevention of Pollution from Ships, Standards of Training, Certification and Watchkeeping and the International Health Regulations;</p> <p>Legal powers and responsibilities under national legislation implementing international agreements and conventions;</p>



			<p>Information and guidance notices issued by the MCA with respect to safety at sea and pollution of the marine environment under STCW Convention and Code</p> <p>Knowledge of the Codes associated with the carriage of dangerous goods;</p> <p>A working knowledge of merchant shipping Health and Safety at Work Regulations;</p> <p>Full knowledge of the ISM Code;</p> <p>Port State Control</p> <p>Management of Personnel</p> <p>Effective management, organisation and training of engine department personnel</p>
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Function: Controlling the operation of the ship and care for persons on board at the management level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
Control trim, stability and stress	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures	Stability and stress conditions are maintained within safety limits at all times	Trim, Stability and Stress Factors affecting trim and stability, fuel and water ballast



	<p>necessary to preserve trim and stability</p> <p>Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken</p> <p>Knowledge of IMO recommendations concerning ship stability</p>		<p>Effects of damage to and consequent flooding of a compartment on the trim and stability of the ship and appropriate countermeasures</p> <p>Effect on Ship's hull fouling on propeller loading and analysis and interpretation of propeller curve and load diagram</p> <p>Legislative Requirements</p> <p>International convention certificates and documents required to be on board</p> <p>Knowledge of the international conventions on Marine Pollution, Load Lines, the Safety of Life, at Sea, the Prevention of Pollution from Ships, Standards of Training, Certification and Watchkeeping and the International Health Regulations</p> <p>Information and guidance notices issued by the MCA with respect to safety at sea and pollution of the marine environment</p> <p>Maintain Safety and Security of the Vessel, Crew and Passengers</p>
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			<p>Knowledge of life-saving appliance regulations</p> <p>Ensuring ship is in seaworthy condition prior to sailing, taking into account the nature of the voyage</p> <p>Preparation for heavy weather, maintenance of watertight integrity of the hull</p> <p>Procedures for the safe and efficient operation in the UMS mode</p> <p>Emergency Situations and Damage Control</p> <p>Actions to protect and safeguard all persons on board in emergencies</p> <p>A thorough knowledge of ship construction</p> <p>Damage control plans</p> <p>Organisation, training and control of fire, abandon ship and damage control parties</p> <p>Actions to limit damage following fire, explosion, collision or grounding</p> <p>Functions and use of life-saving appliances</p>
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			Pollution prevention – action in response to a pollution incident – SOPEP manual
Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment	<p>Knowledge of relevant international maritime law embodied in international agreements and conventions</p> <p>Regard shall be paid especially to the following subjects:</p> <ol style="list-style-type: none"> 1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and the period of their legal validity 2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended 3. responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea, 1974, as amended 4. responsibilities under the International Convention for the 	<p>Procedures for monitoring operations and maintenance comply with legislative requirements</p> <p>Potential non-compliance is promptly and fully identified</p> <p>Requirements for renewal and extension of certificates ensure continued validity of survey items and equipment</p>	<p>Legislative Requirements</p> <p>Knowledge of the international conventions on Marine Pollution, Load Lines, the Safety of Life, at Sea, the Prevention of Pollution from Ships, BWM, Standards of Training, Certification and Watchkeeping and the International Health Regulations;</p> <p>Clear understanding of ISM</p> <p>Purpose and application of the Maritime Labour Convention 2006 (MLC)</p>



	<p>Prevention of Pollution from Ships, as amended</p> <p>5. maritime declarations of health and the requirements of the International Health Regulations</p> <p>6. responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo</p> <p>7. methods and aids to prevent pollution of the environment by ships</p> <p>8. knowledge of national legislation for implementing international agreements and conventions</p>		
<p>Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems</p>	<p>A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea)</p> <p>Organization of fire and abandon ship drills</p> <p>Maintenance of operational condition of life-saving, fire-fighting and other safety systems</p> <p>Actions to be taken to protect and</p>	<p>Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures</p>	<p>Precautions against fires or explosions, explosive mixtures and sources of ignition</p> <p>Maintenance of fire-fighting, detection and extinguishing systems</p> <p>Maintenance of life-saving appliances and equipment including launching appliances</p>



	<p>safeguard all persons on board in emergencies</p> <p>Actions to limit damage and salve the ship following fire, explosion, collision or grounding</p>		<p>Knowledge of life-saving appliance and regulations</p> <p>Ensuring ship is in seaworthy condition prior to sailing, taking into account the nature of the voyage</p> <p>Preparation for heavy weather, maintenance of watertight integrity of the hull</p> <p>Procedures for the safe and efficient operation in the UMS mode</p>
<p>Develop emergency and damage control plans and handle emergency situations</p>	<p>Ship construction, including damage control</p> <p>Methods and aids for fire prevention, detection and extinction</p> <p>Functions and use of life-saving appliances</p>	<p>Emergency procedures are in accordance with the established plans for emergency situations</p>	<p>Actions to limit damage following fire, explosion, collision or grounding</p> <p>Emergency bilge suction valve, its usage, limitations, and related MARPOL regulation</p> <p>Pollution prevention – action in response to a pollution incident – SOPEP manual</p> <p>Procedures for operating main machinery under emergency conditions</p>
<p>Use leadership and managerial skills</p>	<p>Knowledge of shipboard personnel management and training</p> <p>A knowledge of international maritime conventions and</p>	<p>The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned</p>	<p>Effective management, organisation and training of engine department personnel</p>



	<p>recommendations, and related national legislation</p> <p>Ability to apply task and workload management, including:</p> <ol style="list-style-type: none"> 1. planning and coordination 2. personnel assignment 3. time and resource constraints 4. prioritization <p>Knowledge and ability to apply effective resource management:</p> <ol style="list-style-type: none"> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experience 4. assertiveness and leadership, including motivation 5. obtaining and maintaining situation awareness <p>Knowledge and ability to apply decision-making techniques:</p>	<p>Training objectives and activities are based on assessment of current competence and capabilities and operational requirements</p> <p>Operations are demonstrated to be in accordance with applicable rules</p> <p>Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously given and received</p> <p>Effective leadership behaviours are demonstrated</p> <p>Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment</p> <p>Decisions are most effective for the situation</p> <p>Operations are demonstrated to be effective and in accordance with applicable rules</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>
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	<ol style="list-style-type: none">1. situation and risk assessment2. identify and generate options3. select course of action4. evaluation of outcome effectiveness <p>Development, implementation, and oversight of standard operating procedures</p>		
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5. Electro-Technical Officers (ETO) Certificate of Competency Oral Exam Syllabus

Table A-III/6

Specification of minimum standard of competence for electro-technical officers

1. Every candidate for certification as *Electro-Technical Officer* shall be required to demonstrate the ability to undertake the tasks, duties and responsibilities listed in the 'competence column A-III/6 table.
2. The minimum knowledge, understanding and proficiency required for certification is listed in the 'Knowledge, understanding and proficiency' column of table A-III/6.
3. Every candidate for certification shall be required to provide evidence of having achieved the required standard of competency tabulated in the 'Criteria for evaluating competence' and 'Further guidance for evaluating competence' columns of table A-III/6.

Function: Electrical, electronic and control engineering at the operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
Monitor the operation of electrical, electronic and control systems	<p>Basic understanding of the operation of mechanical engineering systems, including:</p> <ol style="list-style-type: none"> 1. prime movers, including main propulsion plant 2. engine-room auxiliary machinery 3. steering systems 4. cargo handling systems 	<p>Operation of equipment and system is in accordance with operating manuals</p> <p>Performance levels are in accordance with technical specifications</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p> <p>Candidates Knowledge, understanding and proficiency of Electrical and electronic devices, electrical motors and generators, Control systems and Transducers, Power Electronics, Pneumatics and Hydraulics, Transformers are evaluated</p>



	<p>5. deck machinery</p> <p>6. hotel systems</p> <p>Basic knowledge of heat transmission, mechanics and hydromechanics</p> <p><i>Knowledge of:</i></p> <p>Electro-technology and electrical machines theory</p> <p>Fundamentals of electronics and power electronics</p> <p>Electrical power distribution boards and electrical equipment</p> <p>Fundamentals of automation, automatic control systems and technology</p> <p>Instrumentation, alarm and monitoring systems</p> <p>Electrical drives</p> <p>Technology of electrical materials</p> <p>Electro-hydraulic and electro-pneumatic control systems</p> <p>Appreciation of the hazards and</p>		<p><i>Understanding of Switchgear and protection of high voltage systems</i></p> <p><i>Excitation Methods</i></p> <p><i>Thyristor controls etc.</i></p> <p><i>Candidates knowledge, understanding and proficiency regarding:</i> Switchboard safety devices and breaker types</p> <p><i>Understanding of Earth faults, MEGGER readings, Dangers of Electric arc flash</i></p>
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	precautions required for the operation of power systems above 1,000 volts		
Monitor the operation of automatic control systems of propulsion and auxiliary machinery	Preparation of control systems of propulsion and auxiliary machinery for operation/td>	Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operation condition	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination
Operate generators and distribution systems	Coupling, load sharing and changing over generators Coupling and breaking connection between switchboards and distribution panels	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations Electrical distribution systems can be understood and explained with drawings/instructions	Understanding of paralleling and load sharing of generators Earth lamps
Operate and maintain power systems in excess of 1,000 volts	<i>Theoretical knowledge</i> High-voltage technology Safety precautions and procedures Electrical propulsion of the ships, electrical motors and control systems <i>Practical knowledge</i> Safe operation and maintenance of high-voltage systems, including knowledge of the special technical	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination Understanding of Switchgear and protection of high voltage systems.



	type of high-voltage systems and the danger resulting from operational voltage of more than 1,000 volts		
Operate computers and computer networks on ships	Understanding of: 1. main features of data processing 2. construction and use of computer networks on ships 3. bridge-based, engine-room-based and commercial computer use	Computer networks and computers are correctly checked and handled	Basic understanding of Local area Networking Lighting and control systems
Use English in written and oral form	Adequate knowledge of the English language to enable the officer to use engineering publications and to perform the officer's duties	English language publications relevant to the officer's duties are correctly interpreted Communications are clear and understood	Basic entry level requirements Oral exam
Use internal communication systems	Operation of all internal communication systems on board	Transmission and reception of messages are consistently successful Communication records are complete, accurate and comply with statutory requirements	Basic understanding of different Marine vessel communication systems including Emergency networks ones Communication battery and back up checks, records



Function: Maintenance and repair at the operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
<p>Maintenance and repair of electrical and electronic equipment</p>	<p><i>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment</i></p> <p><i>Maintenance and repair of electrical system equipment, switchboards, electric motors, generators and DC electrical systems and equipment</i></p> <p><i>Detection of electric malfunction, location of faults and measures to prevent damage</i></p> <p><i>Construction and operation of electrical testing and measuring equipment</i></p> <p><i>Function and performance tests of the following equipment and their configuration:</i></p> <ol style="list-style-type: none"> <i>1. monitoring systems</i> <i>2. automatic control devices</i> <i>3. protective devices</i> 	<p><i>Safety measures for working are appropriate</i></p> <p><i>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate</i></p> <p><i>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice</i></p> <p><i>Reassembling and performance testing is in accordance with manuals and good practice</i></p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p> <p>Maintenance of electrical equipment and systems</p> <p>Control systems, transducers</p> <p>Understanding of Electrical Safety</p> <p>Candidates Knowledge, understanding and proficiency of Electrical Safety</p> <p><i>Understanding of Switchgear and protection of high voltage systems</i></p>



	<i>The interpretation of electrical and electronic diagrams</i>		Basic fault finding Electrical motors, Alternators Understanding
Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery	<p>Appropriate electrical and mechanical knowledge and skills</p> <p><i>Safety and emergency procedures</i></p> <p>Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment</p> <p>Practical knowledge for the testing, maintenance, fault finding and repair</p> <p>Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition</p>	<p>The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified</p> <p>Isolation, dismantling and reassembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions and legislative and safety specifications. Action taken leads to the restoration of automation and control systems by the method most suitable and appropriate to the prevailing circumstances and conditions</p>	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination
Maintenance and repair of bridge navigation equipment and ship communication systems	<p>Knowledge of the principles and maintenance procedures of navigation equipment, internal and external communication systems</p> <p><i>Theoretical knowledge:</i></p>	The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken	



	<p>Electrical and electronic systems operating in flammable areas</p> <p><i>Practical knowledge:</i></p> <p>Carrying out safe maintenance and repair procedures</p> <p>Detection of machinery malfunction, location of faults and action to prevent damage</p>	<p>are justified</p> <p>Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of bridge navigation equipment and ship communication systems by the method most suitable and appropriate to the prevailing circumstances and conditions</p>	<p>Electrical systems in Potentially Explosive and Gas Hazardous areas</p>
<p>Maintenance and repair of electrical, electronic and control systems of deck machinery and cargo-handling equipment</p>	<p>Appropriate electrical and mechanical knowledge and skills</p> <p><i>Safety and emergency procedures</i></p> <p>Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment</p> <p>Practical knowledge for the testing, maintenance, fault finding and repair</p> <p>Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition</p>	<p>The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified</p> <p>Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of deck machinery and cargo-handling equipment by the method most</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p> <p>Fault finding</p> <p>Electrical systems in potentially explosive and gas hazardous environment</p>



		suitable and appropriate to the prevailing circumstances and conditions	
Maintenance and repair of control and safety systems of hotel equipment	<p><i>Theoretical knowledge:</i></p> <p>Electrical and electronic systems operating in flammable areas</p> <p><i>Practical knowledge:</i></p> <p>Carrying out safe maintenance and repair procedures</p> <p>Detection of machinery malfunction, location of faults and action to prevent damage</p>	<p>The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified</p> <p>Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of control and safety systems of hotel equipment by the method most suitable and appropriate to the prevailing circumstances and conditions</p>	Maintaining electrical equipment/systems, electrical motors and generators, Electrical Safety



Function: Controlling the operation of the ship and care for persons on board at operational level

Competence	Knowledge, understanding and proficiency	Criteria for evaluating competence	Further guidance for evaluating competence
Ensure compliance with pollution-prevention requirements	<p><i>Prevention of pollution of the marine environment</i></p> <p>Knowledge of the precautions to be taken to prevent pollution of the marine environment</p> <p>Anti-pollution procedures and all associated equipment</p> <p>Importance of proactive measures to protect the marine environment</p>	<p>Procedures for monitoring shipboard operations and ensuring compliance with pollution-prevention requirements are fully observed</p> <p>Actions to ensure that a positive environmental reputation is maintained</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p> <p>IMO legislation including MARPOL and BWM Conventions.</p>
Prevent, control and fight fire on board	<p><i>Fire prevention and fire-fighting appliances</i></p> <p>Ability to organize fire drills</p> <p>Knowledge of classes and chemistry of fire</p> <p>Knowledge of fire-fighting systems</p> <p>Action to be taken in the event of fire, including fires involving oil systems</p>	<p>The type and scale of the problem is promptly identified and initial actions conform with the emergency procedure and contingency plans for the ship</p> <p>Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly</p> <p>The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>



		emergency and reflect the urgency of the problem	
Operate life-saving appliances	<p><i>Life-saving</i></p> <p>Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids</p>	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination
Apply medical first aid on board ship	<p><i>Medical aid</i></p> <p>Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship</p>	Identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimizes immediate threat to life	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination
Application of leadership and teamworking skills	<p>Working knowledge of shipboard personnel management and training</p> <p>Ability to apply task and workload management, including:</p> <ol style="list-style-type: none"> 1. planning and co-ordination 2. personnel assignment 3. time and resource constraints 	<p>The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned</p> <p>Training objectives and activities are based on assessment of current competence and</p>	Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination



	<p>4. prioritization</p> <p>Knowledge and ability to apply effective resource management:</p> <ol style="list-style-type: none"> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experiences 4. assertiveness and leadership, including motivation 5. obtaining and maintaining situational awareness <p>Knowledge and ability to apply decision-making techniques:</p> <ol style="list-style-type: none"> 1. Situation and risk assessment 2. Identify and consider generated options 3. Selecting course of action 4. Evaluation of outcome effectiveness 	<p>capabilities and operational requirements</p> <p>Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously given and received</p> <p>Effective leadership behaviours are demonstrated</p> <p>Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment</p> <p>Decisions are most effective for the situation</p>	
<p>Contribute to the safety of personnel and ship</p>	<p>Knowledge of personal survival techniques</p> <p>Knowledge of fire prevention and ability to fight and extinguish fires</p> <p>Knowledge of elementary first aid</p>	<p>Appropriate safety and protective equipment is correctly used</p> <p>Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times</p>	<p>Relevant aspects of candidates knowledge and experience in these areas is assessed in the oral examination</p>



	Knowledge of personal safety and social responsibilities	Procedures designed to safeguard the environment are observed at all times Initial and follow-up actions on becoming aware of an emergency conform with established emergency response procedures	
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More Information

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Published: February 2021
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The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW) Code, Part A, Chapter VIII, Section A-VIII/2, Part 4 – 2 – Principles to be observed in keeping a engineering watch

Part 4-2 – Principles to be observed in keeping an engineering watch

52. The term engineering watch as used in parts 4-2, 5-2 and 5-4 of this section means either a person or a group of personnel comprising the watch or a period of responsibility for an officer during which the physical presence in machinery spaces of that officer may or may not be required.

53. The officer in charge of the engineering watch is the chief engineer officer's representative and is primarily responsible, at all times, for the safe and efficient operation and upkeep of machinery affecting the safety of the ship and is responsible for the inspection, operation and testing, as required, of all machinery and equipment under the responsibility of the engineering watch.

Watch arrangements

54. The composition of the engineering watch shall, at all times, be adequate to ensure the safe operation of all machinery affecting the operation of the ship, in either automated or manual mode, and be appropriate to the prevailing circumstances and conditions.

55. When deciding the composition of the engineering watch, which may include appropriately qualified ratings, the following criteria, inter alia, shall be taken into account:

- .1 the type of ship and the type and condition of the machinery;
- .2 the adequate supervision, at all times, of machinery affecting the safe operation of the ship;
- .3 any special modes of operation dictated by conditions such as weather, ice, contaminated water, shallow water, emergency conditions, damage containment or pollution abatement;
- .4 the qualifications and experience of the engineering watch;
- .5 the safety of life, ship, cargo and port, and protection of the environment;
- .6 . the observance of international, national and local regulations; and
- .7 maintaining the normal operations of the ship.
- .8 safe entry to Engine room before taking over daily watch/ during UMS.

Taking over the watch

56. The officer in charge of the engineering watch shall not hand over the watch to the relieving officer if there is reason to believe that the latter is obviously not capable of carrying out the watchkeeping duties effectively, in which case the chief engineer officer shall be notified.

57. The relieving officer of the engineering watch shall ensure that the members of the



relieving engineering watch are apparently fully capable of performing their duties effectively.

58. Prior to taking over the engineering watch, relieving officers shall satisfy themselves regarding at least the following:

- .1 the standing orders and special instructions of the chief engineer officer relating to the operation of the ship's systems and machinery;
- .2 the nature of all work being performed on machinery and systems, the personnel involved and potential hazards;
- .3 the level and, where applicable, the condition of water or residues in bilges, ballast tanks, slop tanks, reserve tanks, fresh water tanks, sewage tanks and any special requirements for use or disposal of the contents thereof;
- .4 the condition and level of fuel in the reserve tanks, settling tank, day tank and other fuel storage facilities;
- .5 any special requirements relating to sanitary system disposals;
- .6 condition and mode of operation of the various main and auxiliary systems, including the electrical power distribution system;
- .7 where applicable, the condition of monitoring and control console equipment, and which equipment is being operated manually;
- .8 where applicable, the condition and mode of operation of automatic boiler controls such as flame safeguard control systems, limit control systems, combustion control systems, fuel-supply control systems and other equipment related to the operation of steam boilers;
- .9 any potentially adverse conditions resulting from bad weather, ice, or contaminated or shallow water;
- .10 any special modes of operation dictated by equipment failure or adverse ship conditions;
- .11 the reports of engine-room ratings relating to their assigned duties;
- .12 the availability of fire-fighting appliances; and
- .13 the state of completion of the engine-room log.

Performing the engineering watch

59. The officer in charge of the engineering watch shall ensure that the established watchkeeping arrangements are maintained and that, under direction, engine-room ratings, if forming part of the engineering watch, assist in the safe and efficient operation of the propulsion machinery and auxiliary equipment.

60. The officer in charge of the engineering watch shall continue to be responsible for machinery-space operations, despite the presence of the chief engineer officer in the machinery spaces, until specifically informed that the chief engineer officer has assumed that responsibility and this is mutually understood.

61. All members of the engineering watch shall be familiar with their assigned watchkeeping duties. In addition, every member shall, with respect to the ship they are serving in, have



knowledge of:

- .1 the use of appropriate internal communication systems;
- .2 the escape routes from machinery spaces;
- .3 the engine-room alarm systems and be able to distinguish between the various alarms, with special reference to the fire-extinguishing media alarm; and
- .4 the number, location and types of fire-fighting equipment and damage-control gear in the machinery spaces, together with their use and the various safety precautions to be observed.

62. Any machinery not functioning properly, expected to malfunction or requiring special service shall be noted along with any action already taken. Plans shall be made for any further action if required.

63. When the machinery spaces are in the manned condition, the officer in charge of the engineering watch shall at all times be readily capable of operating the propulsion equipment in response to needs for changes in direction or speed.

64. When the machinery spaces are in the periodic unmanned condition, the designated duty officer in charge of the engineering watch shall be immediately available and on call to attend the machinery spaces.

65. All bridge orders shall be promptly executed. Changes in direction or speed of the main propulsion units shall be recorded, except where an Administration has determined that the size or characteristics of a particular ship make such recording impracticable. The officer in charge of the engineering watch shall ensure that the main propulsion unit controls, when in the manual mode of operation, are continuously attended under stand-by or manoeuvring conditions.

66. Due attention shall be paid to the ongoing maintenance and support of all machinery, including mechanical, electrical, electronic, hydraulic and pneumatic systems, their control apparatus and associated safety equipment, all accommodation service systems equipment and the recording of stores and spare gear usage.

67. The chief engineer officer shall ensure that the officer in charge of the engineering watch is informed of all preventive maintenance, damage control, or repair operations to be performed during the engineering watch. The officer in charge of the engineering watch shall be responsible for the isolation, bypassing and adjustment of all machinery under the responsibility of the engineering watch that is to be worked on, and shall record all work carried out.

68. When the engine-room is put in a stand-by condition, the officer in charge of the engineering watch shall ensure that all machinery and equipment which may be used during manoeuvring is in a state of immediate readiness and that an adequate reserve of power is available for steering gear and other requirements.

69. Officers in charge of an engineering watch shall not be assigned or undertake any duties which would interfere with their supervisory duties in respect of the main propulsion system and ancillary equipment. They shall keep the main propulsion plant and auxiliary systems under constant supervision until properly relieved and shall periodically inspect the machinery in their charge. They shall also ensure that adequate rounds of the machinery and steering-gear spaces are made for the purpose of observing and reporting equipment malfunctions or breakdowns, performing or directing routine adjustments, required upkeep and any other necessary tasks.



70. Officers in charge of an engineering watch shall direct any other member of the engineering watch to inform them of potentially hazardous conditions which may adversely affect the machinery or jeopardize the safety of life or of the ship.

71. The officer in charge of the engineering watch shall ensure that the machinery space watch is supervised, and shall arrange for substitute personnel in the event of the incapacity of any engineering watch personnel. The engineering watch shall not leave the machinery spaces unsupervised in a manner that would prevent the manual operation of the engine-room plant or throttles.

72. The officer in charge of the engineering watch shall take the action necessary to contain the effects of damage resulting from equipment breakdown, fire, flooding, rupture, collision, stranding, or other cause.

73. Before going off duty, the officer in charge of the engineering watch shall ensure that all events related to the main and auxiliary machinery which have occurred during the engineering watch are suitably recorded in the Engine room Log book.

74. The officer in charge of the engineering watch shall cooperate with any engineer in charge of maintenance work during all preventive maintenance, damage control or repairs. This shall include, but not necessarily be limited to:

- .1 isolating and bypassing machinery to be worked on;
- .2 adjusting the remaining plant to function adequately and safely during the maintenance period;
- .3 recording, in the engine-room log or other suitable document, the equipment worked on and the personnel involved, and which safety steps have been taken and by whom, for the benefit of relieving officers and for record purposes; and
- .4 testing and putting into service, when necessary, the repaired machinery or equipment.

75. The officer in charge of the engineering watch shall ensure that any engine-room ratings who perform maintenance duties are available to assist in the manual operation of machinery in the event of automatic equipment failure.

76. The officer in charge of the engineering watch shall bear in mind that changes in speed, resulting from machinery malfunction, or any loss of steering may imperil the safety of the ship and life at sea. The bridge shall be immediately notified in the event of fire and of any impending action in machinery spaces that may cause reduction in the ship's speed, imminent steering failure, stoppage of the ship's propulsion system or any alteration in the generation of electric power or similar threat to safety. This notification, where possible, shall be accomplished before changes are made, in order to afford the bridge the maximum available time to take whatever action is possible to avoid a potential marine casualty.

77. The officer in charge of the engineering watch shall notify the chief engineer officer without delay:

- .1 when engine damage or a malfunction occurs which may be such as to endanger the safe operation of the ship;
- .2 when any malfunction occurs which, it is believed, may cause damage or breakdown of propulsion machinery, auxiliary machinery or monitoring and governing systems; and
- .3 in any emergency or if in any doubt as to what decision or measures to take.



78. Despite the requirement to notify the chief engineer officer in the foregoing circumstances, the officer in charge of the engineering watch shall not hesitate to take immediate action for the safety of the ship, its machinery and crew where circumstances require.

79. The officer in charge of the engineering watch shall give the watchkeeping personnel all appropriate instructions and information which will ensure the keeping of a safe engineering watch. Routine machinery upkeep, performed as incidental tasks as a part of keeping a safe watch, shall be set up as an integral part of the watch routine. Detailed repair maintenance involving repairs to electrical, mechanical, hydraulic, pneumatic or applicable electronic equipment throughout the ship shall be performed with the cognizance of the officer in charge of the engineering watch and chief engineer officer. These repairs shall be recorded.

Engineering watchkeeping under different conditions and in different areas

Restricted visibility

80. The officer in charge of the engineering watch shall ensure that permanent air or steam pressure is available for sound signals and that at all times bridge orders relating to changes in speed or direction of operation are immediately implemented and, in addition, that auxiliary machinery used for manoeuvring is readily available.

Coastal and congested waters

81. The officer in charge of the engineering watch shall ensure that all machinery involved with the manoeuvring of the ship can immediately be placed in the manual mode of operation when notified that the ship is in congested waters. The officer in charge of the engineering watch shall also ensure that an adequate reserve of power is available for steering and other manoeuvring requirements. Emergency steering and other auxiliary equipment shall be ready for immediate operation.

Ship at anchor

82. At an unsheltered anchorage the chief engineer officer shall consult with the master whether or not to maintain the same engineering watch as when under way.

83. When a ship is at anchor in an open roadstead or any other virtually "at-sea" condition, the engineer officer in charge of the engineering watch shall ensure that:

- .1 an efficient engineering watch is kept;
- .2 periodic inspection is made of all operating and stand-by machinery;
- .3 main and auxiliary machinery is maintained in a state of readiness in accordance with orders from the bridge;
- .4 measures are taken to protect the environment from pollution by the ship, and that applicable pollution-prevention regulations are complied with; and
- .5 all damage-control and fire-fighting systems are in readiness.

