



# **Maritime & Coastguard Agency**

## **APPROVED ENGINE COURSE – 2 (AEC 2)**

### **Guidelines**

## **35 Contact Hours Course**

(recent changes highlighted in yellow)

**Guidelines for MCA “APPROVED ENGINE COURSE 2”  
(AEC 2) - 35 Contact Hours Course**

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## COURSE CONTENTS

Guidelines for MCA - Approved Engineering Course 2 (AEC 2)

### 1. Aim of the Course.

- 1.1 All new AEC 2 Course approvals and re-approvals must be undertaken in accordance with these guidelines. Existing courses should now transition to the new requirements within 6 months of this document being published (by 02 September 2020). A desk top submission should be sent for approval to your local Marine Office or in the case of overseas training providers, the Seafarer Training and Certification Branch. This should demonstrate changes in your procedures and course content to meet the new requirements. If you are unable to transition within this period then you should write to the Chief Examiner ([stc.courses@mcga.gov.uk](mailto:stc.courses@mcga.gov.uk)) providing a valid explanation and action plan for your transition
- 1.2 The aim is to give the basic training to the engineer officers who want to pursue a career on “Small Vessels” (Fishing Vessels, Yachts, Tugs, Workboats, Standby, Seismic Survey, Oceanographic Research Vessels and Government Patrol Vessels). The training documents outlines the certification structure, examination and training requirements. It also explains the regulatory requirements regarding the implementation of intended training elements, as may be applicable.
- 1.3 The AEC 2 basic theoretical learning and relevant practical hands on trainings course, may be completed individually or together with the MCA AEC 1 (35 hours) Course.
- 1.4 The objective of this AEC 2 course is to provide students, with theoretical knowledge and practical hands on experience of additional areas, as laid down in the Maritime and Coastguard Agency (MCA) AEC 2 syllabus. The aim is to enable them to meet the CoC requirements of the new common “Small Vessel” (Yachts, Tugs, Fishing Vessels, Workboats, Standby, Seismic Survey, Oceanographic Research Vessels and Government Patrol Vessels, of less than 3000 GT and Power Less than 9,000 kW with Unlimited Area of operation.)
- 1.5 This short course provides base foundation for Small Vessel engineers from the course participants and enable students to carry out regular servicing of onboard machinery/equipment by developing an understanding of possible faults developing before they become major problems.
- 1.6 This training is relevant to wide ranges of personnel that require the knowledge and understanding to build up a career as an Engineer of a Small Vessel.
- 1.7 The overall aim is to provide Small Vessel engineer with the necessary knowledge, understanding and proficiency to carry out safe and effective operations onboard.

## **2. Background of the Course**

- 2.1** Article IX of the STCW Convention allows an administration to adopt alternative arrangements of education and training for special types of ships and trades. The MCA has utilised this alternative arrangement to create a certificate structure for engineers working in Small Vessels.
- 2.2** MIN 524 outlines the certification structure and examination and training requirements for engineer officers wanting to work on “Small Vessels” (Fishing Vessels, Yachts, Tugs, Workboats, Standby, Seismic Survey, Oceanographic Research Vessels and Government Patrol Vessels). It also explains the regulatory requirements regarding the implementation of training elements applicable.
- 2.3** This document includes the criteria for the development of courses to deliver training for service on ships

## **3. Health and Safety: conduct of training**

- 3.1** At all times the safety of learners and staff delivering training must be ensured.
- 3.2** Practical exercises should be designed and delivered solely to meet the course criteria.
- 3.3** All training centres must adhere to applicable regulations made under the Health and Safety at Work Act 1974, as amended, and take proper account of the advice given in associated guidance documents and ‘Approved Codes of Practice’. Outside the UK, training centres must adhere to relevant national legislation.
- 3.4** Training centres are required to make assessments of any potential risks to the health and safety of staff and learners that may be associated with their activities. They are also required to identify, implement, monitor and review effective measures for minimising and controlling risks.
- 3.5** Centres are required to make effective arrangements for dealing with any emergency, incident or accident that may occur during the training course. In the UK, the foregoing is required in accordance with the Management of Health and Safety at Work Regulations 1999, as amended.
- 3.6** Centres must draw up their own safe working procedures to meet statutory Health and Safety obligations.

#### **4. Training Structure**

- 4.1** Approved Engine Course (AEC) The AEC will be available in two parts, AEC I and AEC II. The existing AEC will be known as AEC I. The AEC 2 will be an enhanced continuation with the delivery of approximately 50% practical tasks and half theory. The AEC part I and part II will be known as the full AEC.
- 4.2** Centres will need to develop training program covering the AEC 2 syllabus requirements and then submit their training plans to commence approval process. **Approvals within the UK should be directed to the local Marine office. Outside of the UK approval requests must come to the Seafarer Training and Certification Branch ([STC.Courses@mcqa.gov.uk](mailto:STC.Courses@mcqa.gov.uk)).**
- 4.3** The training plans must, define education and training objectives and related standards of competence to be achieved. Also, the levels of knowledge, understanding and skills appropriate to the assessments required under these criteria, are required to be identified.
- 4.4** The training should be structured around the outcomes although centres should devise their own training schedules and detailed lesson plans to ensure effective and logical delivery of the subject matter and achieve the objectives of the training.

#### **5. Training day and Training duration**

- 5.1** A training day is defined as one which has no more than eight contact hours and cannot be in excess of 10 hours, including relevant breaks.
- 5.2** The training shall be not less than 35 contact hours and will be delivered as a stand-alone module (this includes the assessment).

#### **6. Entry requirements**

- 6.1** Minimum 18 years of age.
- 6.2** Must have completed MCA approved AEC 1 course or equivalent<sup>1</sup> or possess a suitable exemption as per MIN 524.

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<sup>1</sup> where one can clearly demonstrate that previous qualifications and experience held cover the contents of the AEC 1 syllabus. This will be reviewed case for case review, when an application for exemption is received

## **7. Trainer to learner ratio.**

- 7.1 The trainer to learner ratio should not exceed 1:24 for non-practical sessions and 1:8 for practical sessions. However, an Approved Training provider may raise this to 1:10 if they can complete a risk assessment to ensure all training outcomes can be monitored and assessed.
- 7.2 The training centre, having due regard to health and safety and the objectives of the training, should determine other staffing requirements.

## **8. Qualifications of instructors and assessors**

Instructors and assessors are required to be qualified in accordance with the requirements of Regulation I/6 STCW. Guidance on relevant qualifications & experience required to deliver & assess the training is given in Annex C.

## **9. Facilities and equipment**

- 9.1 Training centres seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process.
- 9.2 All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.
- 9.3 A classroom or equivalent for general instruction and the theoretical aspects of the course, to include suitable presentation facilities and audio-visual aids (e.g. DVDs, posters, diagrams)
- 9.4 Sufficient and suitable equipment to enable practical sessions and assessment of learning objectives.
- 9.5 A list of recommended equipment is given in Annex B, for guidance. The training centres may to use additional or similar equipment, as considered to be suitable, to deliver their training course.

## **10. Assessment requirements**

- 10.1 Assessment must be organised so that learners can, through demonstration and examination, show that they meet the competences stipulated, as identified in the AEC 2 syllabus.
- 10.2 The assessment system, methods and practice must be valid, reliable and authentic.

- 10.3** Each learner shall receive an assessment plan at the start of the training.
- 10.4** The assessment system should support appeals made by learners against assessment decisions.
- 10.5** A variety of sources of evidence may be used and must include evidence of learners' ability to meet the criteria for evaluating competence.
- 10.6** A range of direct observation, oral questioning, simulation and role play are considered ideal approaches to generating much of the evidence required.
- 10.7** All assessment must be formally documented and be made available for verification audits.
- 10.8** The practical exercises must be conducted, and achievement of competency must be assessed throughout the course under the supervision of trainer. The end of week assessment must be marked by an independent appropriately qualified person (same requirements as set out in Annex C).

## **11. Certification**

On achievement of the desired standard of competence, a certificate will be issued by the centre in the MCA approved specimen certificate format, is given in Annex D.

### **Outcomes:**

There are eleven outcomes to the training:

Outcome 1 - The learner demonstrates competent knowledge of the function of the components and their arrangement in a compression type refrigerant plant, and is able to demonstrate competency in basic fault finding.

Outcome 2 - The learner demonstrates competent knowledge of the legislative and management requirements within engineering operations.

Outcome 3 – The learner demonstrates competent knowledge of maintenance systems on-board.

Outcome 4 - The learner demonstrates competent knowledge of safe systems of work within an engineering environment.

Outcome 5 - The learner demonstrates competent knowledge of safe operations when undertaking lifting and/or slinging operations<sup>2</sup>.

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<sup>2</sup> If you choose to carry out slinging operations, you must be appropriately qualified in accordance with UK legislation (the object must weigh no more than 50 KG).

Outcome 6 - The learner demonstrates competent knowledge of the electrical distribution system on-board.

Outcome 7 - The learner demonstrates competent knowledge to maintain basic hydraulic systems.

Outcome 8 - Ensure the learner gains **theoretical knowledge** that would allow them to complete the practical skills to undertake basic maintenance.

Outcome 9 – Using that theoretical knowledge from outcome 8 the learner demonstrates **practical skills to undertake basic maintenance**.

Outcome 10 - The learner demonstrates competent knowledge of the **Potable** Fresh Water system onboard.

Outcome 11- The learner demonstrates competent knowledge of the Sewage system onboard.

**Outcome 1 - The learner demonstrates competent knowledge of the function of the components and their arrangement in a compression type refrigerant plant and is able to demonstrate competency in basic fault finding.**

### **Learning Objectives:**

1. Describe the refrigeration cycle, identifying the function and operation of the following key components.
  - a) Compressor
  - b) Condenser
  - c) Evaporator
  - d) Expansion valve
2. Explain the condition of the refrigerant at different points around the circuit
3. Identify common system faults and the corrective actions required
4. Explain how the level of the refrigerant is checked, and filling / emptying the system contents including disposed regulations



## **Outcome 2 - The learner demonstrates competent knowledge of the legislative and management requirements within engineering operations.**

### **Learning Objectives:**

2.1 Outline the Pollution legislation within the following MARPOL convention Annex IV, with respect to the handling of Pollution from Ships and the operational procedures to enable compliance.

2.1.1 Annex I - Regulations for the Prevention of Pollution by Oil

2.1.2 Annex IV- Prevention of Pollution by Sewage from

2.1.3 Annex V - Prevention of Pollution by Garbage from

2.1.4 Annex VI- Prevention of Air Pollution

2.2 Understand and able to use The Code of Safe Working Practices for Seafarers in relation to an identified engineering maintenance task. Be able to risk assess at least two practical scenarios, one of which must be entry into confined or enclosed spaces.

2.3 Describe the documentation required within the legislative requirements to record engineering operations and ability to correctly enter the relevant data

2.3.1 Engine Room logbook

2.3.2 Oil Record Book, Ozone depleting substances book [refrigerant etc] and Garbage record book

2.3.3 Records of consumptions fuel, lubrication and chemicals.

## **Outcome 3 - The learner demonstrates competent knowledge of maintenance systems on-board.**

### **Learning Objectives:**

3.1 Demonstrate an understanding of the maintenance management systems that can be used, including planned and condition monitoring

3.2 Demonstrate an understanding of the need for record, keeping, and providing data to monitor trends.

3.3 Demonstrate an understanding of the range of techniques that can be used within a condition monitoring system, such as:

3.3.1 Comparison between measured and datum readings;

3.3.2 Lubricating oil analysis;

- 3.3.3 Vibration analysis;
- 3.3.4 Endoscope inspections;
- 3.3.5 Thermographic surveys;
- 3.3.6 Insulation readings;

3.4 Undertake practically two of the above condition monitoring techniques

**Outcome 4 - The learner demonstrates competent knowledge of safe systems of work within an engineering environment.**

**Learning Objectives:**

- 4.1 Complete risk assessment for two defined machinery related tasks.
- 4.2 Demonstrate the knowledge of Material Safety Data Sheets and how to make use the information contained.
- 4.3 Complete a Permit to work as defined by the Code of Safe Working Practises for a selected electrical and mechanical maintenance task.
- 4.4 Demonstrate the knowledge of safe systems of work with respect to an enclosed space and identify where they exist on-board
- 4.5 Identify the risks involved for entry into enclosed spaces and identify how these can be minimised
- 4.6 Operate the following detection equipment required for entry into enclosed spaces,
  - 4.6.1 Oxygen detectors
  - 4.6.2 Combustible gases
  - 4.6.3 Toxic substances

**Outcome 5 – The learner demonstrates competent knowledge of safe operations when undertaking lifting and/or slinging operations<sup>3</sup>.**

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<sup>3</sup> If you choose to carry out supervised slinging operations, you must be appropriately qualified in accordance with UK legislation (the object must weigh no more than 50 KG).

## **Learning Objectives:**

Demonstrate practical use of the followings:

- 5.1 Techniques of Safe manual lifting
- 5.2 The inspection requirement of lifting equipment, the subsequent record keeping and tagging arrangements
- 5.3 The safe use of suitable lifting equipment by completing a practical exercise to transport a 50kg object

## **Outcome 6 - The learner demonstrates competent knowledge of the electrical distribution system on-board**

### **Learning Objectives:**

- 6.1 Demonstrate knowledge of the electrical supplies on-board, including generators, batteries and shore supply and how they can be isolated from the distribution system
- 6.2 Describe the distribution system, including protection devices for the system
- 6.3.1 Describe the appropriate use of PPE and avoidance of electric shock.
- 6.3.2 Undertake practical (on a mimic panel or electric panel), fault finding procedures following supply interruption, the possible causes and the checks to be undertaken before the supply can be re-established
- 6.4 Demonstrate knowledge of need for effective insulation, and its testing, for electrical equipment.
- 6.5 The requirement for all Portable Application to have Portable Application Testing (PAT)
- 6.6 Practical skills to be able to undertake PAT and the subsequent record keeping and appliance tagging.
- 6.7 Demonstrate practical use of an insulation (megger) tester and Avometer (Amp, Volt and Ohm meter)
- 6.8 Demonstrate knowledge of the synchronisation of AC generators

## **Outcome 7 - The learner demonstrates competent knowledge to maintain basic hydraulic systems**

### **Learning Objectives:**

- 7.1 Explain the components within a basic hydraulic system, such as pump, motor, control system and filtration
- 7.2 Identify the symbols used within hydraulic system drawings
- 7.3 Undertake the basic maintenance requirements of filters and fluids
- 7.4 Explain how the faults are identified within a basic hydraulic system
- 7.5 Explain how a basic maintenance task is carried out on a hydraulic system

## **Outcome 8 - Ensure the learner gains theoretical knowledge that would allow them to complete the practical skills to undertake basic maintenance**

Understand the control measures identified within a risk assessment created for maintenance work, including use of permit to work<sup>4</sup> and lockout and tagout procedures. This must include entry into confined space permit to work and at least one other type (not working aloft).

- 8.1 Identify the correct work clothing and personal protection equipment that would be used within a machinery environment
- 8.2 Explain the isolation procedures that would be undertaken before working on
  - 8.3.1 A fuel supply system,
  - 8.3.2 A pressurised water system,
  - 8.3.3 An electrical motor

## **Outcome 9 - Using that theoretical knowledge from outcome 8 the learner demonstrates practical skills to undertake basic maintenance.**

### **Learning Objectives:**

- 9.1 Undertake the torque up of a bolt and nut assembly to a pre-determined torque setting
- 9.2 Inspect a bolted connection for defects to the threads and the fastening device

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<sup>4</sup> As defined in COSWP 2014.

- 9.3 Undertake the correct fitting of a split pin, nyloc or lock nut (with either a lock washer, locking clip or locking plate) assembly.
- 9.4 Undertake the removal and replacement of an air or oil filter

**Outcome 10 - The learner demonstrates competent knowledge of the Potable Fresh Water system onboard.**

**Learning Objectives:**

- 10.1 Fresh water generation, storage and treatment, and compliance with regulation.
- 10.2 Undertake testing of fresh water. Demonstrate knowledge of Fresh Water Safety Plan MGN 565 (Amendment 1).

**Outcome 11 - The learner demonstrates competent knowledge of the Sewage system onboard.**

**Learning Objectives:**

- 11.1 Understand methods of compliance with MARPOL Annex IV & Sewage treatment plant operation onboard
- 11.2 Explain the hazards associated with sewage, chemicals used for sewage plant disinfecting, including generation of gases such as H<sub>2</sub>S, Ammonia and Methane and also including disease transmission.

## Conditions for MCA Approval of Short Courses

1. Training centres offering training and assessment leading to the issue of a certificate of proficiency must be approved by the Maritime and Coastguard Agency.
2. MCA approval requirements are for a functional Quality Management System to be in place that ensures:
  - a. Continued satisfactory delivery of the programme to the current standards, reflecting changes of technology and best practice;
  - b. The training programme entry standards are met;
  - c. The agreed assessment process is maintained;
  - d. Only those who complete the training programme and meet any other necessary requirements are issued with certificates/documentary evidence;
  - e. Certificates are issued in a format that meets the MCA requirements, as per the examples provided for the operational and management levels within sections two and three of this document;
  - f. Records of certificates issued are securely maintained until the 70th birthday of the certificate holder or five years from the date of issue whichever is the longer;
  - g. The record system enables authenticity of certificates to be verified and replacement certificates issued;
  - h. This course cannot be approved for peripatetic delivery,
  - h. The approving MCA Office is informed of dates, timing and venues of all courses delivered;
  - i. Any changes made to the course content, facilities, equipment, training staff or other matter that may affect the delivery of the programme are reported to the approving Marine Office without delay.
3. Monitoring of the training programme by the MCA proves to be satisfactory.
4. Re-approval by the MCA is carried out within 5 years of the approval or re-approval. Such approval and re-approval will incur costs in line with the fees in force at that time
5. If, as the result of an audit, or if the MCA otherwise becomes aware that the Training Centre is no longer complying with the conditions of approval, or has serious non-compliance issues as regards health and safety, the MCA reserves the right to suspend or cancel the approval of the course.
6. Should the training establishment cease to trade then all records of certificates issued should be sent to the MCA to enable them to carry out the verification and replacement functions.

## List of Equipment

**1. Outcome 1 - The learner demonstrates competent knowledge of the function of the components and their arrangement in a compression type refrigerant plant and is able to demonstrate competency in basic fault finding.**

- 1.1 Compression type refrigeration plant in working condition or an animated working model.
- 1.2 Following components (or models) of the refrigeration circuit for physical inspections. Compressor, Condenser, Evaporator, drier and Expansion valve
- 1.3 Large posters showing refrigeration circuit, condition of the refrigerant at different points around the circuit, how the level of the refrigerant is checked and filling / emptying the system contents

**2. Outcome 2 -The learner demonstrates competent knowledge of the legislative and management requirements within engineering operations.**

- 2.1 A copy of The Code of Safe Working Practices for Seafarers
- 2.2 A copy of The EIAPP certificate
- 2.3 A copy of the garbage record book. Few blank pages for each candidate to practice, how to enter the data and maintain the documentation.
- 2.4 A copy of the oil record book. Few blank pages for each candidate to practice, how to enter the data and maintain the documentation. Few copies of filled in Bunker delivery notes to study.
- 2.5 Couple of pages of filled in Engine Room logbook pages (showing fuel, lubrication oil and chemical consumptions records. At least one blank page for each candidate to practice the correct way of entering the data.

**3. Outcome 3 - The learner demonstrates competent knowledge of maintenance systems on-board.**

- 3.1 At least 2 Fuel oil analysis report copy as sample to study and compare.
- 3.2 At least 2 Lubricating oil analysis report copy as sample to study and compare.
- 3.3 A range of samples of Lubricating oil and diesel fuel samples clean and contaminated

- 3.4 At least 3 pages of Insulation test readings (report) taken for a range of electrical equipment, as sample to study and compare.
- 3.5 An oil viscosity comparator, a water content test device, onboard test kits.
- 3.6 At least 2 endoscopic cameras, to carry out endoscopic inspections
- 3.7 At least one thermal camera to carry out a thermographic survey. (For example, a high temperature within electrical distribution systems).
- 3.8 An Insulation testing equipment and at least 2 Multi-testers (Ohm Voltmeter Ammeter readings).

**4. The learner demonstrates competent knowledge of safe systems of work within an engineering environment.**

- 4.1 At least 2 copies of Material Safety Data Sheets (MSDS)
- 4.2 One portable oxygen meter, one portable combustible gases meter, one portable toxic gas meter (can be combi meters) **AND one gas personal meter**. 2 Toxic Draeger tubes (Benzine and H<sub>2</sub>S) or suitable demonstrative alternative (i.e. clear real-life animation).
- 4.3 A fuel pump, a duplex fuel oil filter assembly, a duplex lubricating oil filter assembly **OR** a diesel engine showing the above.
- 4.4 Blank risk assessment forms
- 4.5 Blank permit to work forms – As defined in COSWP 2014 – this must include entry into an enclosed space and another appropriate example (not working aloft).

**5. The learner demonstrates competent knowledge of safe operations when undertaking lifting and/or slinging operations.**

- 5.1 The safe use of suitable lifting equipment to carry out a practical exercise to transport a 50kg object such as chain block, trolleys, skates and bean clamps. If you choose to carry out supervised slinging operations, you must be appropriately qualified in accordance with UK legislation (the object must weigh no more than 50 KG).

**6. The learner demonstrates competent knowledge of the electrical distribution system on-board.**

- 6.1 A mimic panel showing electrical distribution system on-board, including shore supply lines
- 6.2 An electric motor starter and a circuit breaker.



**7. The learner demonstrates competent knowledge to maintain basic hydraulic systems.**

7.1 A mini basic hydraulic system, with as pump, motor, control system and filtration. (Steering gear Actuator)

7.2 Spare hydraulic system components for inspection.

**8. Ensure the learner gains theoretical knowledge that would allow them to complete the practical skills to undertake basic maintenance.**

8.1 Sample maintenance plan with completed risk assessments documents

8.2 A running engine showing fuel and cooling water system.

8.3 Duplex fuel and/or lubricating oil filters. They can be demonstrated through the components of a diesel engine.

8.4 Two electric motors (one assembled and other for dismantling and inspection).

**9. Using that theoretical knowledge from outcome 8 the learner demonstrates practical skills to undertake basic maintenance.**

9.1 At least 2 Torque wrenches.

9.2 Bolts with usual defects, split pin, nyloc or lock nut, lock washer, locking clip and locking plate.

**10. The learner demonstrates competent knowledge of the Fresh Water system onboard.**

10.1 Large posters / video clips showing freshwater management, tank cleaning procedure, showing supply connections and pipeline arrangements. Availability and knowledge of MGN 595(F) and MSN 1845(M).

10.2 Video clips/ large posters showing the treatment process. Samples of components commonly used for water treatments

**11. The learner demonstrates competent knowledge of the Sewage system onboard.**

11.1 Actual, model, animation video or large posters of a typical sewage system used onboard, showing various components and pipelines.

11.2 Video showing hazards (presence of H<sub>2</sub>S, Ammonia and Methane) of sewage system operation and maintenance.

## Instructor/Assessor Awareness Qualification and Experience Requirements/Final Written Assessment requirements

All training and instruction should be given, and assessments carried out, by suitably qualified and experienced personnel. This annex provides guidance regarding the suitability and acceptability of qualifications and experience for personnel designated to carry out training, instruction and assessment in AEC 2 courses. The list is not exhaustive, and suitable equivalent qualifications and experience will be considered.

All trainers and assessors should:

- a) Understand the specific objectives of the training;
- b) Be familiar with the use, operation and handling of various machineries and equipment commonly found in onboard pleasure or merchant vessels.
- c) Have an understanding of basic fault finding, before breakdown.

### Instructional qualifications and experience

All trainers and assessors must have:

- a. A minimum Yacht 4, Small Vessel Second Engineer, Merchant vessel EOOW, or higher Certificate of Competency. Other equivalent qualifications and experience may also be considered by the MCA, on a case for case basis only – you must email [stc.course@mcga.gov.uk](mailto:stc.course@mcga.gov.uk) for equivalency approval (e.g. other commercial sectors tugs, fishing etc). The MCA may consider the use of shore based maritime engineers with the relevant marine based experience (e.g. ship building, ship repair, ship maintenance etc) – Shore based engineers must be approved by the Seafarer Training and Certification Branch on a case by case basis: email [stc.courses@mcga.gov.uk](mailto:stc.courses@mcga.gov.uk).
- b. A knowledge of instructional techniques, training methods and training practice at least to the level of IMO Training for Instructors;
- c. An understanding of assessment methods and practice;
- d. Practical instructional and assessment experience;
- e. The practical exercises must be conducted, and achievement of competency must be assessed throughout the course under the supervision of trainer. The end of week assessment must be marked by an independent appropriately qualified person (same requirements as set out in Annex C).

## Requirements for Training Centres

Training centres should have procedures in place to enable staff to update their profession knowledge of onboard machinery and equipment, plus their knowledge of instruction and assessment techniques, in accordance with Continuous Profession Development practices.

### Requirements for the final Written Assessment

To ensure a robust final written assessment, centres should have a question bank that will allow them to develop a minimum of 4 Written papers. The paper must be independently marked by appropriately qualified person (see point A of “**Instructional qualifications and experience section**” from this Annex). The marking can take place onsite or from a remote location. This process must be detailed in the centres QMS. Due to the descriptive nature of the answers the questions raised the marking process cannot be completed by an automated computer.

**Specimen Certificate**

Certificate of completion of MCA Approved Engine Course 2, training, covered within the AEC 2 syllabus. (to be produced and registered locally by the issuing authority).

Certificate No: (Unique identifier number allocated by the training centre)

MCA Approval Certificate Number: (issued by MCA)

Address and contact details including telephone and email of the issuing Authority (Approved Training Centre)

**Approved Engine Course 2 (AEC 2) Course Certificate**

This is to certify that (Full name)

Date of birth (MM/DD/YYYY)

**Has successfully completed a programme of theoretical and practical training sessions, that delivers the knowledge requirements, set out in the Maritime and Coastguard Agency, AEC 2 course syllabus.**

This certificate is issued under the authority Maritime and Coastguard Agency, of the United Kingdom of Great Britain and Northern Ireland, an executive agency of the department for transport.

Name and signature of Principal or Authorised Representative of the Approved Training Centre

Issuing Authority

Stamp and Date

Deep emboss OR Hologram

Signature of the person to whom this certificate was issued

## Syllabus of MCA “Approved Engine Course 2 (AEC 2)”

| <b>Learning outcomes the learner will:</b>   | <b>Assessment criteria, the learner can:</b>  |
|--|---|
| <p>1. The learner demonstrates competent knowledge of the function of the components and their arrangement in a compression type refrigerant plant and is able to demonstrate competency in basic fault finding.</p> | <p>1.1 Describe the function of the following components of the refrigeration circuit</p> <ul style="list-style-type: none"> <li>• Compressor</li> <li>• Condenser</li> <li>• Evaporator</li> <li>• Expansion valve</li> </ul> <p>1.2 Explain the condition of the refrigerant at different points around the circuit</p> <p>1.3 Identify common system faults and the corrective actions required</p> <p>1.4 Explain how the quantity of the refrigerant is checked, and how filling / emptying the system contents is undertaken including disposed regulations</p> |
| <p>2. The learner demonstrates competent knowledge of the legislative and management requirements within engineering operations.</p>   | <p>Demonstrate knowledge of:</p> <p>2.1 Operational procedures to enable compliance with MARPOL annexes I, IV, V and VI requirements</p> <p>2.2 The Code of Safe Working Practices and how they relate to an identified engineering maintenance task</p> <p>2.3 The documentation required to record engineering operations, including</p> <p>2.3.1 Engine Room logbook</p> <p>2.3.2 Oil and garbage record book</p> <p>2.3.3 Fuel, lubrication oil and chemical dosage consumptions records</p>  |

|   |  |
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| <p>3. The learner demonstrates competent knowledge of maintenance systems on-board.</p>               | <p>Demonstrate knowledge of</p> <p>3.1 An understanding of the maintenance management systems that can be used, including planned and condition monitoring</p> <p>3.2 An understanding of the need for record keeping and providing data to monitor trends</p> <p>3.3 An understanding of the range of techniques that can be used within a condition monitoring system, such as</p> <p>3.3.1 Comparison between measured and datum readings</p> <p>3.3.2 Lubricating oil analysis</p> <p>3.3.3 Vibration analysis</p> <p>3.3.4 Endoscope inspections</p> <p>3.3.5 Thermographic surveys</p> <p>3.3.6 Insulation readings</p> <p>3.4 The practical skills to be able to undertake two of the above condition monitoring techniques</p> |
| <p>4. The learner demonstrates competent knowledge of safe systems of work within an engineering.</p> | <p>Demonstrate knowledge of</p> <p>4.1 Risk assessments, by completing a risk assessment for two defined machinery related tasks</p> <p>4.2 Material Safety Data Sheet (MSDS).</p> <p>4.3 Permit to Works, by completing a Permit to Work for both a defined electrical and mechanical maintenance task. Blank permit to work forms – As defined in COSWP 2014 – this must include entry into an enclosed space and another appropriate example (not working aloft).</p>   |

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|   | <p>4.4 What constitutes an enclosed space and identify where they exist on-board</p> <p>4.5 The risks involved for entry into enclosed spaces and how these can be minimised</p> <p>4.6 The practical operation of the detection equipment required for entry into enclosed spaces, such as</p> <p>4.6.1 Oxygen detectors (mandatory)</p> <p>4.6.2 Combustible gases (optional)</p> <p>4.6.3 Toxic substances (optional)</p> |
| <p>5. The learner demonstrates competent knowledge of safe operations when undertaking lifting and/or slinging operations. If you choose to carry out supervised slinging operations, you must be appropriately qualified in accordance with UK legislation (the object must weigh no more than 50 KG).</p> | <p>Demonstrate knowledge of</p> <p>5.1 Safe manual lifting techniques</p> <p>5.2 The inspection requirement of lifting equipment, the subsequent record keeping and tagging arrangements</p> <p>5.3 The safe use of trolleys; skates, slings and pull lifts by completing a practical exercise to transport a 50 KG object</p>   |

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| <p>6. The learner demonstrates competent knowledge of the electrical distribution system on-board.</p> | <p>Demonstrate knowledge of</p> <p>6.1 The electrical supplies on-board, including generators, batteries and shore supply and how they can be isolated from the distribution system</p> <p>6.2 The distribution system, including protection devices for the system and personal safety</p> <p>6.3 Use of PPE and avoidance of electrical shock. Fault finding following supply interruption, the possible causes and the check to be undertaken before the supply can be re-established.</p> <p>6.4 The need for effective insulation and its testing, for electrical equipment used onboard.</p> <p>6.5 The requirement for all portable equipment to be PAT tested</p> <p>6.6 Practical skills to be able to undertake Portable Application Testing (PAT) and the subsequent record keeping and appliance tagging</p> <p>6.7 Demonstrate practical use of an insulation (megger) tester and Avometer (Amp, Volt and Ohm meter)</p> <p>6.8 The synchronisation of AC generators.</p> |
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| <p>7. The learner demonstrates competent knowledge to maintain basic hydraulic systems.</p>  | <p>Demonstrate understanding of:</p> <p>7.1 The components within a basic hydraulic system, such as pump, motor, control system and filtrations.</p> <p>7.2 The symbols used within hydraulic system drawings</p> <p>7.3 The basic maintenance requirements of filters and fluids</p> <p>7.4 The identification of the basic faults that can be present and their rectification</p> <p>7.5 Undertake basic maintenance on a hydraulic system</p>             |
| <p>8. Ensure the learner gains <b>theoretical knowledge</b> that would allow them to complete the practical skills to undertake basic maintenance.</p> | <p>Demonstrate understanding of:</p> <p>8.1 The control measures identified within a risk assessment created for maintenance work.</p> <p>8.2 The correct work clothing and personal protection equipment that would be used within a machinery environment</p> <p>8.3 The isolation procedures that would be undertaken before working on</p> <p>8.3.1 A fuel supply system,</p> <p>8.3.2 a pressurised water systems,</p> <p>8.3.3 an electrical motor</p> |
| <p>9. Using that theoretical knowledge from outcome 8 the learner demonstrates practical skills to undertake basic maintenance.</p>                    | <p>Demonstrate the practical skills to undertake:</p> <p>9.1 The torque up of a bolt and nut assembly to a predetermined torque setting</p> <p>9.2 The inspection of a bolted connection for defects to the threads and the fastening device</p> <p>9.3 The correct fitting a split pin, nyloc or lock nut (with either a lock washer, locking clip or locking plate) assembly.</p>  |

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|  | 9.4 The removal and replacement of an air or oil filter.   |
| 10. The learner demonstrates competent knowledge of the potable freshwater system onboard. | Demonstrate knowledge of:<br><br>10.1 Fresh water stowage and treatment, and compliance with regulation.<br><br>10.2 Undertake testing of fresh water. |
| 11. The learner demonstrates competent knowledge of the Sewage system onboard.             | Demonstrate knowledge of:<br><br>11.1 Sewage treatment plant<br><br>11.2 Awareness of hazards of H2S, Ammonia and Methane                              |

### Additional information about the unit

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| Unit aim(s)   | To provide the learner with the knowledge and practical skills required to undertake duties as the engineer on board Small Vessels. |
| Details of the relationship between the unit and other standards or curricula (if appropriate). | This unit satisfies the requirements of the MCA AEC 2 training course.  |
| Assessment requirements specified by a sector or regulatory body (if appropriate)               | MCA   |
| Endorsement of the unit by a sector or other appropriate body (if required)                     | MCA   |
| Location of the unit within the subject/sector classification system                            | Transportation  |
| <b>Required Minimum Learning Hours (including assessment)</b>                                   | 35 Condition hours. (40 hrs with 1-hour break period every day).  |
| Relevant M Notices  | MSN 1859 and MIN 524  |