

**CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY -
MARINE ENGINEER OFFICER**

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY

CHIEF ENGINEER (UNLIMITED)

041-36 - ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 11 December 2012

0915-1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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Materials to be supplied by examination centres:

Candidate's examination workbook

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EXAMINATIONS ADMINISTERED BY THE
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ON BEHALF OF THE
MARITIME AND COASTGUARD AGENCY

STCW 95 CHIEF ENGINEER REG. III/2 (UNLIMITED)

041-36 – ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 17 JULY 2012

0915- 1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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Materials to be supplied by examination centres:

Candidate's examination workbook

ENGINEERING KNOWLEDGE – MOTOR

Attempt SIX questions only

All questions carry equal marks

Marks for each part question are shown in brackets

1.
 - (a) State, with reasons, SIX points that should be covered by a risk assessment for the inspection of a main engine crosshead bearing. (6)
 - (b) State how it can be ensured that the lifting equipment used for the inspection of a crosshead bearing is fit for the purpose intended. (4)
 - (c) List THREE defects which might be detected during inspection of a crosshead pin and bearing, stating the probable cause of such defects. (6)

2.
 - (a) Describe, with the aid of sketches, a main engine hydraulically operated exhaust valve system which is designed to rotate in service. (8)
 - (b) Explain how the timing of the exhaust valve described in Q2(a) is controlled. (4)
 - (c) State why valve rotation is desirable. (4)

3. With reference to diesel engine NO_x emissions:
 - (a) explain how NO_x emissions are formed during operation of the engine; (6)
 - (b) describe ONE means by which diesel engine NO_x emissions may be reduced in order to meet current regulations. (10)

4.
 - (a) Describe, with the aid of a sketch, a main engine and generator engine fuel system which has the capability of changing the generators from HFO to MDO operation whilst maintaining circulation of HFO in the main engine system. (8)
 - (b) Write instructions for the change of the generator engines to operation on MDO whilst keeping the main engine fuel system circulated with HFO during stay in a port where fuel burning restrictions apply. (8)

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5. As Chief Engineer Officer write a report to the engineering superintendent regarding the failure of a main engine cylinder liner due to cracking which resulted in water leakage from the cooling space into the cylinder. The report must explain how the defect was detected, the immediate action taken, the rectifying action taken to ensure that the engine could be operated and the checks made on the engine before and after restarting. (16)
6. With reference to slow speed diesel engine turbocharging:
- (a) explain why water separators are fitted; (4)
 - (b) describe how an engine may be operated in the event of a charge air cooler being damaged beyond immediate repair; (6)
 - (c) describe how an engine may be operated in the event of a turbocharger bearing failure which cannot be repaired immediately. (6)
7. (a) Write the Chief Engineer Officer`s Standing Instructions for the actions to be taken by the watchkeeping engineer in the event of failure of the engine room monitoring and alarm system. (8)
- (b) State the procedure to be followed in the event of repeated activation of an oil mist detector alarm. (8)
8. With reference to a main engine starting air system:
- (a) explain why a *slow turning* system is fitted; (4)
 - (b) explain how the *slow turning* system operates when an engine start is initiated; (4)
 - (c) write a procedure for determining the reason for a main engine starting air system failing to operate. (8)
9. With reference to waste heat steam generation systems:
- (a) describe, with the aid of a sketch, the water/steam circulation system for the waste heat recovery section; (5)
 - (b) explain how the economiser circulation pumps are kept cool; (3)
 - (c) describe how system steam pressure is maintained and the system operated when the associated diesel engine plant is operating on prolonged reduced load. (8)

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STCW 95 CHIEF ENGINEER REG. III/2 (UNLIMITED)

041-36 – ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 27 MARCH 2012

0915- 1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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Materials to be supplied by examination centres:

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ENGINEERING KNOWLEDGE – MOTOR

Attempt SIX questions only

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Marks for each part question are shown in brackets

1. With reference to exhaust valves on medium speed engines burning heavy fuel oil:
 - (a) describe a valve and actuation arrangement, including advantages and disadvantages; (10)
 - (b) state, with reasons, THREE failures of exhaust valve actuation. (6)

2.
 - (a) As Chief Engineer Officer write a procedure for the checking of leaking air start valves before and after starting the engine. (5)
 - (b) Describe, with the aid of a sketch, the operation of an air start system for a reversing engine. (11)

3. With reference to having to change fuels on entering an Emission Control Area:
 - (a) describe, with the aid of a sketch, a fuel system that can supply low and high sulphur fuels to an engine, explaining how the fuel changeover is carried out; (12)
 - (b) describe the advantages and disadvantages of an alternative system which allows the ship to continue burning high sulphur fuel when inside an ECA. (4)

4. Following a crankcase oil mist alarm, the resulting inspection found that the crosshead pin and bearing of one unit has been severely damaged. The crosshead pin cannot be replaced at this time.
 - (a) Describe the procedure to allow the engine to be run. (12)
 - (b) Describe the precautions to be taken before starting the engine and during operation after the procedure described in Q4(a) has been undertaken. (4)

5. (a) State, with reasons, the applications of pulse and constant pressure turbocharging systems. (8)
- (b) Describe what is meant by surging, stating reasons for it occurring. (8)
6. With reference to marine fuel:
- (a) list SIX purposes for the addition of additives to a fuel; (6)
- (b) explain the problems caused by different contaminants in the fuel; (4)
- (c) explain the problems caused by lack of compatibility of fuels, stating how this is minimised. (6)
7. (a) Outline the problems which may be associated with air compressors operating automatically. (6)
- (b) State the planned maintenance procedures a Chief Engineer Officer would put in place to ensure the safe and efficient operation of air compressors. (6)
- (c) Outline the problems that are common to air receivers and machinery space/ship compressed air system. (4)
8. With reference to the chain drive of a large two stroke engine:
- (a) describe, with the aid of sketches, how the tension of a camshaft chain drive is checked and adjusted; (8)
- (b) explain the effects of having the wrong tension in the chain; (4)
- (c) state FOUR faults which may be found during a chain case inspection. (4)
9. With reference to auxiliary boiler safety valves:
- (a) describe, with the aid of sketches, the operation of a High Lift Safety Valve plug and seat assembly; (2)
- (b) write a procedure for setting the Safety Valve; (8)
- (c) explain what is meant by the term *accumulation of pressure*. (6)

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CHIEF ENGINEER (UNLIMITED)

041-36 - ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 16 October 2012

0915-1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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Materials to be supplied by examination centres:

Candidate's examination workbook

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ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) State, with reasons, SIX points which should be covered in a risk assessment for the replacement of a crosshead main engine fuel injection pump in port. (6)
- (b) Write instructions for the replacement of a crosshead main engine fuel injection pump. (10)
2. (a) Explain why multiple exhaust valves are fitted to some medium speed diesel engines. (6)
- (b) Explain how the valve actuator (tappet) clearance is set for multiple valve installations. (4)
- (c) Write instructions for checking the valve operating mechanisms of a medium speed engine. (6)
3. (a) State why *Direct Water Injection* is used on some diesel engines, explaining how it performs the intended duty. (8)
- (b) Describe, with the aid of a sketch, a *Direct Water Injection* system. (8)
4. (a) Sketch a main engine electronically controlled fuel injection system. (6)
- (b) Explain how fuel injector quantity and timing is changed in the fuel injection system sketched in part (a). (6)
- (c) State why it may be necessary to change engine fuel injection timing. (4)
5. Write a report for the engineering superintendent regarding the replacement at sea of bearings on one of the main engine turbochargers. The report must explain how the bearing defects were detected, the likely cause of the damage and the action which has been instituted to prevent further incidents of this type. (16)
6. Write instructions for the actions to be taken by a duty engineer following activation of a slow speed main engine exhaust gas differential temperature alarm during a period of unmanned machinery operation. The instructions must cover the period from activation of the alarm to return of the main engine to normal operation. (16)

7. (a) Explain how the emergency diesel generator is prepared and selected for automatic operation so that it will start and connect to the switchboard in the event of a blackout. (6)
- (b) Write a procedure for manual starting and running of the emergency generator, indicating how frequently this procedure should be carried out and stating which operating parameters should be checked. (6)
- (c) State the procedure for testing the emergency generator automatic start. (4)
8. With reference to a main engine air starting system:
- (a) explain why a slow turning system is fitted; (4)
- (b) state, with reasons, when a slow turning system operates; (2)
- (c) describe, with the aid of a sketch, an air starting system, explaining how the slow turning system operates. (10)
9. State what charge air system parameters must be monitored, explaining how data gathered from charge air system instrumentation is used to determine the operational performance of EACH of the following system parts:
- (a) the suction air filter; (4)
- (b) the turbocharger compressor; (4)
- (c) the turbocharger turbine; (4)
- (d) the charge air cooler. (4)

ENGINEERING KNOWLEDGE - MOTOR

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Section A

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