CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY

MARINE ENGINEER OFFICER

EXAMINATIONS ADMINISTERED BY THE SCOTTISH QULIFICATIONS AUTHORITY ON BEHALF OF MARITIME AND COASTGUARD AGENCY CHIEF ENGINEERS (UNLIMITED)

ENGINEERING KNOWLEDGE - MOTOR

PAST PAPERS FROM MARCH 2013 TO DECEMBER 2016

&

MARKER'S FEEDBACKS

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Engineering Knowledge-Motor March 2013

Attempt SIX questions only

Marks for each part question are shown in brackets

Section A

1. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high scavenge temperature alarm on the main propulsion engine. (6)

   (b) State, with reasons, the possible causes of a high scavenge temperature on a main propulsion engine. (4)

   (c) Explain why a condition resulting in the activation of high scavenge temperature alarm can cause engine damage if the engine is not slowed down when the fault initially occurs. (6)

2. (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)

3. With reference to diesel engine crankshafts:

   (a) explain the causes and effects of *torsional vibration*; (4)

   (b) explain the term *critical speed*, stating why the engine should not be continuously operated at this speed; (6)

   (c) explain the term *fatigue cracking*, stating, with reasons, TWO factors which have an influence on the likelihood of fatigue cracking. (6)

4. With reference to a slow speed diesel engine fitted with a single turbocharger, describe, with reasons, the possible action which could be taken to enable the main engine to be operated, if whilst on oceanic passage, a small portion of one of the impeller vanes breaks off and impacted with the charge air cooler. (16)

5. (a) Describe the procedure for checking and adjusting the timing of a main engine fuel injection pump. (8)

(b) Explain how diesel engine power balance is achieved, stating why it is essential. (8)

6. (a) Describe the symptoms and possible causes of an exhaust gas boiler/economiser fire. (5)

(b) Describe the procedure for inspecting and cleaning the gas side of an exhaust gas boiler/economiser. (5)

(c) Explain how the main engine and auxiliary steam plant may be operated in the event of an exhaust gas boiler/economiser suffering severe damage rendering it inoperable. (6)

7. 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)

8. (a) Describe, with the aid of a sketch, a main engine hydraulically operated exhaust valve which is designed to rotate in service. (8)

(b) Explain TWO methods how the opening of the exhaust valve described in part (a) can be controlled. (4)

(c) Explain why the valve described in part (a) is rotated. (4)

9. (a) Explain how a diesel generator is prepared and selected as a standby generator. (8)

(b) Write a procedure for checking a diesel generator engine after it has been shut down and before it is returned to standby duty. (8)

Engineering Knowledge-Motor July 2013

Marks for each part question are shown in brackets

1. (a) With reference to safety, state, with reasons, THREE fluid pipeline systems which require particular attention prior to dismantling main machinery for overhaul. (9)

   (b) Write instructions for the preparation of a main engine cylinder cover from *finished with engines* to being ready to lift from the engine. (7)

2. (a) Explain fatigue cracking, stating its causesand propagation. (8)

   (b) Explain how the risk of fatigue cracking of cylinder head holding studs is liable to be increased by poor maintenance and engine overload. (8)

3. Write a report for the engineering superintendent regarding the replacement of the fuel injectors of three main engine units due to severe erosion of the nozzle holes and burning of the injector tips. The report must explain how the defects were detected, the likely cause of the damage and the action which has been instituted to prevent further incidents of this type. (16)

4. With reference to abnormal and excessive cylinder liner wear:

   (a) explain how it may be caused, stating how it is detected; (6)

   (b) explain the effects and consequences of excessive cylinder liner wear; (5)

   (c) explain how abnormal cylinder liner wear maybe prevented. (5)

5. With reference to diesel engine exhaustemissions:

   (a) explain the cause and effects of EACH of the following:

      (i) Oxides of Nitrogen (NOx); (3)

      (ii) Oxides of Sulphur (SOx); (3)

   (b) describe ONE method by which the level of NOx emissions may be reduced; (5)

   (c) explain how the effects on the engine components of sulphur in the fuel may be minimised. (5)

6. (a) Sketch a main engine fuel system from the HFO and Low Sulphur service tanks to the main engine, showing all important valves. (6)

(b) Using the sketch drawn in part (a), write instructions for the changeover of a main engine fuel system from HFO to Low Sulphur fuel, indicating the timescale for each operation. (10)

7. (a) Describe, with the aid of a sketch, the lubrication systems of a crosshead type slow speed diesel engine. (8)

(b) Explain the properties required by the lubricating oil in each of the systems described in part (a), stating how these properties compare with those of a lubricating oil used in the crankcase of a trunk piston type diesel engine. (8)

8. With reference to electronically controlled engines:

(a) describe how fuel injection quantity and timing is adjusted; (6)

(b) describe how the exhaust valve timing may be varied; (5)

(c) describe how starting air valves are regulated. (5)

9. (a) Describe, with the aid of a sketch, a waste heat recovery system for electrical generation using main engine exhaust gas in combine gas/steam turbine systems. (8)

(b) Describe the operation of the waste heat recovery system described in part (a) whilst the associated main engine is running. (8)

Engineering Knowledge-Motor October 2013

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Explain why an engine may fail to start on air when the start air receiver is fully charged and the air receiver outlet to the engine is open. (10)

   (b) Describe how problems with air starting systems may be avoided orquickly resolved. (6)

2. With reference to operating medium speed diesel engines on residual fuel:

   (a) state, with reasons, FOUR of the main problems; (4)

   (b) describe how the problems stated in part (a) may be minimised in order to ensure that an engine may be operated correctly; (4)

   (c) explain the dangers associated with fuel systems and how they are mitigated. (8)

3. (a) List TWO automatic main engine *slowdown* parameters, stating why EACH is applied to an engine. (4)

   (b) List TWO automatic main engine *shutdown* parameters, stating why EACH is applied to an engine. (4)

   (c) Explain how EACH of the parameters listed in part (a) and part (b) are tested for the correct operation. (8)

4. As Chief Engineer Officer outline a procedure for the changing of a cylinder liner in a large crosshead diesel engine from the removal of the cylinder cover to the replacement of the liner. (16)

5. (a) Explain how the build up of residue in the scavenge space of a large slow speed two stroke engine is minimised by design, operation and maintenance. (10)

   (b) Explain the possible damage which could be caused by a scavenge fire. (6)

6. With reference to four stroke diesel engine emission control:

(a) describe how the Miller Cycle operates to control NOx emissions; (6)

(b) describe, with reasons, the modifications needed for a medium speed engine to operate on the Miller Cycle; (8)

(c) give the advantages and disadvantages of closed against open scrubber systems. (2)

7. With reference to engine operation:

(a) state, with reasons, the symptoms which would indicate a cylinder head was cracked between the combustion chamber and the water space; (4)

(b) describe the actions that should be taken if the engine with the symptoms in part (a) cannot be immediately stopped; (6)

(c) write a report to the Superintendent outlining the probable cause and actions to prevent further occurrence. (6)

8. With respect to marine fuels:

(a) explain why the use of fuel additives may be considered; (6)

(b) explain the problems caused by different contaminants in the fuel; (6)

(c) explain the problems caused by fuels from different sources and how these are minimised. (4)

9. (a) State, with reasons, the properties required of a lubricating oil for a trunk piston type, medium speed engine, indicating why some properties differ from those required of a lubricating oil used in the crankcase of a crosshead diesel engine. (6)

(b) Describe, with the aid of a sketch, the lubrication system of a trunk piston medium speed engine, explaining how impurities in the lubricating oil are removed. (10)

Engineering knowledge-Motor December 2013

Attempt SIX questions only

Marks for each part question are shown in brackets

1. Write a report for the engineering superintendent regarding the replacement at sea of a main engine cylinder cover. The report must explain how the problem was detected, the likely cause of the damage and the action which has been instituted to prevent further incidents of this type. (16)

2. (a) Explain the term scuffing in relation to cylinder liners, stating how it is caused. (5)

   (b) Describe another form of abnormal cylinder liner wear which does not involve scuffing, explaining how this form of abnormal wear is caused. (5)

   (c) Explain how incidents of abnormal cylinder liner wear may be kept to a minimum. (6)

3. As Chief Engineer write instructions for the main and auxiliary engine fuel change -over procedures to be followed when a vessel is due to move into an Emission Control Area. Approximate times must be mentioned to ensure that the vessel does not infringe any regulations and the instructions must mention steps required to avoid cross-contamination of fuel in service tanks, where MGO is carried as the low sulphur fuel. (16)

4. (a) Explain the term torsional vibration, indicating the effect this can have on an engine crankshaft. (6)

   (b) Explain why a detuner/vibration damper might be fitted to an engine. (5)

   (c) Explain why an engine might have a barred speed range and why the engine should not be operated continuously in that range. (5)

5. (a) Describe, with the aid of a sketch, a main engine starting air system, stating the safety devices which are incorporated. (8)

   (b) In the event of the main engine failing to turn over on air even though there was suffficient air pressure in the starting air receivers, explain the procedure for tracing the cause of the failure. (8)

6. (a) Describe, with the aid of a sketch, an electronically controlled main engine fuel injection system. (8)

   (b) Explain how the system described in part (a) functions to change the fuel injection timing

when instructed by an engineer at the control terminal. (8)

7. With reference to main engine crankcase explosions:

   (a) explain the cycle of events leading to a secondary crankcase explosion. (6)

   (b) as Chief Engineer, explain how an engine system should be managed in order to minimise the risk of a crankcase explosion and the effects of a crankcase explosion should one occur. (10)

8. (a) Discuss the dangers associated with a main engine starting air system, explaining how these dangers are mitigated. (9)

   (b) State, with reasons, THREE causes of an engine failing to fire on fuel after successfully turning over on starting air. (3)

   (c) Explain how the engine is transferred to local (engine side) control in the event of failure of the main engine remote control system. (4)

9. With reference to a waste heat boiler/economiser:

   (a) write a procedure for the cleaning of the gas side of a waste heat boiler/economiser when the associated main engine is:

      (i) running; (5)

      (ii) stopped. (5)

   (b) write a procedure for operation of the main engine when the associated waste heat boiler/economiser cannot be operated due to tube failure. (6)

Engineering Knowledge- Motor April 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

1. While operating in heavy weather the main engine loses power and misfires. Investigation shows considerable quantities of water in the fuel.

   (a) As Chief Engineer Officer explain the immediate action which should be taken to ensure safe operation of the ship. (6)

   (b) State, with reasons, the possible sources of water entering the fuel storage, handling and supply system. (5)

   (c) As Chief Engineer Officer write the standing orders that would be issued with respect to operation of the fuel storage, handling and supply system in order to prevent problems due to water in the fuel. (5)

2. With reference to an 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)

3. With reference to a ship with a single service tank, write a procedure for changing the entire main engine and auxiliary engine fuel oil supplies and treatment system from Heavy Fuel Oil (HFO) to Low Sulphur Heavy Fuel Oil (LSHFO) in preparation for the vessel entering an Emission Control Area (ECA), indicating the approximate times of EACH action prior to entering the ECA. (16)

4. With reference to main slow speed engine safety systems:

   (a) list FOUR engine operating parameters which will initiate an automatic engine *slowdown*, indicating in EACH case why an automatic *slowdown* is necessary; (8)

   (b) list TWO engine operating parameters which will initiate an automatic engine *shutdown*, indicating in EACH case why an automatic *shutdown* is necessary; (4)

   (c) explain how the operation of EACH shutdown listed on part (b) may be tested. (4)

5. With reference to slow speed diesel engineturbocharging:

(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)

6. With reference to electronically controlled engines:

(a) describe how fuel injection quantity and timing is adjusted; (6)

(b) describe how the exhaust valve timing may be varied; (5)

(c) describe how starting air valves are regulated. (5)

7. (a) Describe the sequence of events that could lead to a crankcase explosion. (6)

(b) Describe an obscuration type oil mist detector, explaining its operation. (10)

8. (a) With reference to safety, state, with reasons, THREE fluid pipeline systems which require particular attention prior to dismantling main machinery for overhaul. (9)

(b) Write instructions for the preparation to lift a main engine cylinder cover from *finished with engines* to being ready to lift from the engine. (7)

9. (a) Explain why variable exhaust valve closing can be advantageous in the operation of large slow speed main engines. (8)

(b) Explain, with the aid of a sketch, how variable exhaust valve closing is achieved. (6)

(c) Explain how high impact is avoided as the valve closes. (2)

Engineering Knowledge- Motor July 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

1. With reference to diesel engine NOxemissions:

   (a) explain how NOx is formed during operation of the engine indicating why the aim of high engine efficiency increases the problem; (6)

   (b) describe ONE external means by which diesel engine NOx emissions may be reduced in order to meet current regulations. (10)

2. As Chief Engineer Officer write a report to the company superintendent engineer concerning bacterial attack of lubricating oil in the sumps of the main engine and one of the generator engines. The report should explain how the attack was detected, damage found in the engines, investigations into the possible cause of the attack, how the immediate problem was resolved and how future incidents may be prevented. (16)

3. With reference to main engine safety systems:

   (a) state, with reasons, THREE engine operating parameters which should initiate an automatic slowdown if engine operation is outside of set value conditions; (6)

   (b) describe how the operation of each slowdown listed in part (a) may be tested; (6)

   (c) list two engine operating parameters which should be selected to initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

4. (a) Write instructions for the actions to be taken in the event of a scavenge fire outbreak during a night-time period of UMS operations. The instructions must cover the period from the initial alarm until the engine is in a safe condition. (6)

   (b) Describe the procedure for restarting of the engine and operation up to the changeover to UMS. (4)

   (c) Explain the possible consequences if a scavenge fire is not attended to immediately. (6)

5. (a) Describe the actions and checks required to ensure that a crosshead main propulsion engine may be operated in a Slow Steaming condition. (8)

   (b) Explain the problems which may arise during a prolonged period of Slow Steaming. (4)

   (c) Explain what actions should be taken before and after the engine is returned to normal

operation after a period of Slow Steaming. (4)

6. (a) Describe, with the aid of sketches, the procedure for removing a turbocharger rotor. In this description it may be assumed that permissions have been granted and that a risk assessment has been conducted. (6)

   (b) State the risks associated with lifting the various turbocharger components involved in the procedure in part (a). (6)

   (c) Explain the system which must be in place on board ship to ensure that all lifting equipment has a current test certificate and is fit for use. (4)

7. (a) Explain why a diesel engine cylinder is supplied with excess air. (4)

   (b) Explain why fuel droplet size produced during injection has to be within narrow limits in order to enable good cylinder combustion tobe achieved. (4)

   (c) Explain how the desired fuel droplet size is produced by fuel injectors. (4)

   (d) State why fuel injection timing has to be controlled within narrow limits to enable economic engine operation without bearing overload. (4)

8. With reference to a main engine starting air system:

   (a) explain why a *slow turning* system is fitted; (3)

   (b) explain how the *slow turning* system operates when an engine start is intiated; (5)

   (c) write a procedure for determining the reason for a main engine starting air system failing to operate. (8)

9. (a) Describe, with the aid of a sketch, a waste heat recovery system for electrical generation using main engine exhaust gas in combined gas/steam turbine systems. (8)

   (b) Describe the operation of the waste heat recovery system described in part (a) whilst the associated main engine is running. (8)

Engineering Knowledge-Motor October 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

1. With reference to diesel engine exhaustemissions:

   (a) explain the cause and effects of EACH of the following:

   (i) Oxides of Nitrogen (NOx); (3)

   (ii) Oxides of Sulphur(SOx); (3)

   (b) describe ONE method by which the level of NOx emissions may be reduced; (5)

   (c) explain how the effects on the engine components of sulphur in the fuel may be minimised. (5)

2. (a) Explain the action to be taken to ensure that the main engine may be operated in the event of an exhaust gas economiser developing a serious leak which cannot be immediately repaired. (6)

   (b) Describe how the heat transfer surfaces of an economiser are maintained in a clean condition. (4)

   (c) Explain the actions which should be taken in the event of a soot fire in the economiser. (6)

3. With reference to main engine crankshafts:

   (a) explain the termaxial vibration; (4)

   (b) describe, with the aid of a sketch, how axial vibration may be minimised; (6)

   (c) state with reasons which bearing would be most at risk due to the effects of axial vibration; (3)

   (d) describe how damage to the bearing stated in part (c) may be repaired. (3)

4. (a) State why *Direct Water Injection* is used on some engines, explaining how it performs the duty intended. (8)

   (b) Describe, with the aid of a sketch, a *Direct Water Injection* system. (8)

5. With reference to exhaust valves on medium speed engines burning heavy fuel oil:

(a) state the disadvantages of the mechanical operation of valves; (4)

(b) explain how multiple inlet exhaust valves reduce pumping losses; (4)

(c) explain the reasons for multiple springs oneach valve; (4)

(d) state reasons for rotating exhaust valves and how this can be achieved. (4)

6. While operating in heavy weather the main engine loses power and misfires. Investigation shows considerable quantities of water in the fuel.

(a) As Chief Engineer Officer explain the immediate actions which should be taken to ensure safe operation of the ship. (6)

(b) State, with reasons, the possible sources of water entering the fuel storage, handling and supply system. (5)

(c) As Chief Engineer Officer write the standing orders that would be issued with respect to operation of the fuel storage, handling and supply system. (5)

7. (a) Describe the procedure for entry into, and inspection of, the inside of a starting air bottle, stating the types of defects which may be present with their possible causes. (12)

(b) Describe the procedure of closing up the bottle and the initial pressurisation to working pressure. (4)

8. With reference to main engine safety systems:

(a) list FOUR engine operating parameters which will initiate an automatic engine *slowdown,* indicating in EACH case why an automatic *slowdown* is necessary; (8)

(b) list TWO engine operating parameters which will initiate an automatic engine *shutdown*, indicating in EACH case why an automatic *shutdown* is necessary; (4)

(c) explain how the operation of EACH *shutdown* listed in part (b) may be tested. (4)

9. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating the reasons for EACH action. The procedure must cover the period from activation of the alarm to return of the engine tonormal operation. (16)

Engineering Knowledge- Motor December 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

1. As Chief Engineer, write a report to the engineering superintendent regarding failure of a four-stroke main engine, to complete a slow turning procedure and the discovery of water around a cylinder head gasket after the failed slow turning attempt. The report must outline possible causes of the problem and the steps taken to identify the exact cause. The report must also explain the measures taken to rectify the defect(s) and the steps taken to prevent similar futureincidents. (16)

2. (a) Describe, with the aid of a sketch, a main engine holding down system explaining how the design features help prevent excessive stress in the holding down studs. (8)

   (b) Describe, with the aid of a sketch, an engine top bracing arrangement, explaining why they are fitted and checked for operational performance. (8)

3. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high cylinder exhaust temperature on the main propulsion engine. (6)

   (b) State, with reasons, the possible causes of a high exhaust temperature on a single cylinder of a main propulsion engine. (5)

   (c) Explain why a defect resulting in a high exhaust temperature on one cylinder can cause engine damage if the engine is not slowed down when the fault initially occurs. (5)

4. (a) Describe, with the aid of a sketch, an external system for reducing engine NOx emissions, explaining the chemistry of the process. (8)

   (b) Explain why Urea is used in the Selective Catalytic Reduction process instead of ammonia. (4)

   (c) Explain why the exhaust gas quality must be monitored before and after the Selective Catalytic Reduction unit, stating how such monitoring influences operation of the SCR unit. (4)

5. (a) Explain why an engine`s cylinders should develop equal power at all loads, indicating the possible consequences if cylinder power balance is not maintained. (5)

   (b) Describe ONE method which may be used for assessing cylinder power, explaining the steps involved in the assessment. (5)

   (c) Explain how cylinder power adjustments are made to achieve cylinder power balance. (6)

6. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating the reasons for EACH action. The procedure must cover the period from activation of the alarm to return of the engine tonormal operation. (16)

7. (a) Describe the causes and effects of bacterial attack on crankcase lubricating oil. (6)

   (b) Explain how bacterial attack on crankcase oil may be detected. (4)

   (c) Describe how a crankcase lubricating oil system may be returned to service following bacterial attack of the lubricating oil. (6)

8. With reference to main starting air reservoirs:

   (a) state, with reasons, FOUR safety devices fitted; (4)

   (b) write a procedure in order to prepare a reservoir for internal inspection; (6)

   (c) describe an internal inspection, stating TWO defects which may be found and the possible causes of such defects. (6)

9. With reference to main engine safety systems:

   (a) state, with reasons, THREE engine operating parameters which should initiate an automatic slowdown if engine operation is outside of set value conditions; (6)

   (b) describe how the operation of each slowdown listed in part (a) may be tested; (6)

   (c) list two engine operating parameters which should be selected to initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

Engineering Knowledge-Motor March 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Describe, with the aid of a sketch, an open loop system for reducing SOx emissionsfrom engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (6)

   (b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SOx from engine exhaust gas, explaining the operation of this unit and stating when it would be used. (10)

2. (a) Define the term *Torsional Vibration* with respect to an engine crankshaft, stating the effect that high levels can have on an engine crankshaft. (6)

   (b) Explain how engine deterioration influences the risk of *Torsional Vibration*, stating what can be done to minimise that risk. (4)

   (c) Explain TWO possible reasons for the activation of a *Torsional Vibration* alarm after an engine has been started if there had been no previous history of such an alarm and if no maintenance had been undertaken on the engine whilst it was stopped. (6)

3. As Chief Engineer Officer, write instructions for the actions to be taken in the event of a high temperature scavenge alarm being activated during a period of UMS operation, stating the reasons for EACH action. (16)

4. (a) Explain why charge air coolers are fitted to turbocharged diesel engines, stating the possible effects on engine operation and performance if they are not maintained in good condition. (6)

   (b) As Chief Engineer, write instructions for the routine in-service checking of charge air cooler performance and cleanliness together with the checking of condensate draining. (6)

   (c) State, with reasons, the possible consequences if condensate is not drained from the charge air cooler. (4)

5. As Chief Engineer write a report to the engineering superintendent regarding the failure of a high pressure fuel pump unit on an electronically controlled engine. The report must explain the nature of the failure, how the failure was detected and the immediate action taken. The report must also explain the actions taken to replace the pump and the steps taken to minimise the risk of future similar fuel pump failures. (16)

6. (a) State, with reasons, THREE properties required of a cylinder lubricant for a main engine operating on HFO. (6)

(b) Describe, with the aid of sketches, an electronically controlled cylinder lubrication system, stating how the timing and quantity of cylinder lubricant is regulated and set. (10)

7. With reference to turbochargers:

(a) explain how the operating performance of a turbocharger system may be assessed; (10)

(b) state, with reasons, defects which adversely affect the operating performance of a turbocharger. (6)

8. With reference to two stroke, slow speed engine pistons:

(a) explain what is meant by the term *thermal stress* and how this can cause cracking of crown surfaces; (4)

(b) sketch a cross-section of a piston, labelling the main components and indicating coolant flow; (8)

(c) state a cause of EACH of the following defects:

(i) burning of the crown upper surfaces; (2)

(ii) carbon deposits in the cooling spaces. (2)

9. With reference to an 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)

Engineering Knowledge-Motor July 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Describe the dangers associated with a main engine starting air system, explaining how these dangers are mitigated. (9)

   (b) State, with reasons, THREE causes of an engine failing to fire on fuel after successfully turning over on starting air. (3)

   (c) Explain how the engine is transferred to local (engine side) control in the event of failure of the main engine remote control system. (4)

2. (a) State why *Direct Water Injection* is used on some engines, explaining how it performs the duty intended. (8)

   (b) Describe, with the aid of a sketch, a *Direct Water Injection* system. (8)

3. Following the failure of the engine monitoring and alarm systems, explain the checks that will have to be made and how the engine room will be operated without these systems. (16)

4. With reference to the survey of diesel main propulsion machinery by the Classification Society:

   (a) explain the terms *Continuous Survey of Machinery (CSM);* (3)

   (b) explain how classification societies have reduced the need for attendance by the surveyor; (4)

   (c) describe how a planned maintenance scheme may be used in conjunction with CSM; (5)

   (d) describe TWO programmes that are approved by the classification societies so that physically opening the machinery is not necessary on every occasion. (4)

5. (a) Describe, with the aid of a sketch, a waste heat recovery system for electrical generation using main engine exhaust gas in combined gas/steamturbine systems. (8)

(b) Describe the operation of the waste heat recovery system described in part (a) whilst the associated main engine is running. (8)

6. With reference to slow speed diesel engines

(a) explain why electrically driven scavenge air blowers are fitted to engines even though turbochargers are fitted. (4)

(b) describe how a turbocharger may be disabled to allow for operation of the main engine in the event of failure of the turbocharger rotor. (6)

(c) describe the procedure for operating an engine in the event of a turbocharger not being operational. (6)

7. With reference to diesel engine lubricating oil and distillate fuel oil:

(a) describe the causes and effects of microbial attack; (6)

(b) explain how microbial attack may be detected; (4)

(c) describe how an oil system may be returned to service followingmicrobial attack. (6)

8. With reference to the use of HFO in marine diesel engines:

(a) state, with reasons, the difficulties EACH of the following Fuel Properties may cause:

(i) density; (2)

(ii) viscosity; (2)

(iii) suplhur; (2)

(iv) catalytic fines. (2)

(b) exlain what system adjustments are required when these properties change. (8)

9. (a) Outline the probable events leading to a crankcase explosion, describing the affects and hazards. (12)

(b) As a Chief Engineer Officer state the standing orders regarding the activation of the oil mist detector. (4)

Engineering Knowledge-Motor October 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

1. With reference to slow speed diesel engineturbocharging:

   (a) explain why electrically driven scavenge air blowers are sometimes fitted; (4)

   (b) describe how a turbocharger may be disabled to allow for operation of the main engine in the event of failure of the turbocharger rotor; (8)

   (c) describe the procedure for running an engine in the event of a turbocharger not being operational. (4)

2. With reference to medium speed diesel engine cylinder liners:

   (a) explain the cause and effects of liner *polishing* or *glazing*; (6)

   (b) explain the action of an anti-polishing ring during the operation of the engine; (5)

   (c) describe how effective cyliner lubrication is achieved. (5)

3. With reference to engine fuel injector nozzle cooling:

   (a) explain why fuel injector nozzle cooling is necessary; (4)

   (b) describe, with the aid of a sketch, the operation of a nozzle cooling system for a generator engine; (8)

   (c) explain how fuel injector nozzles are cooled on engines which are not fitted with a separate nozzle cooling system. (4)

4. While operating in heavy weather the main engine loses power and misfires. Investigation shows considerable quantities of water in the fuel.

   (a) As Chief Engineer Officer explain the immediate actions which should be taken to ensure safe operation of the ship. (6)

   (b) State, with reasons, the possible sources of water entering the fuel storage, handling and supply system. (5)

   (c) As Chief Engineer Officer write the standing orders that would be issued with respect to operation of the fuel storage, handling and supply system. (5)

5. With reference to diesel engine cylinder head exhaust valves:

   (a) state, with reasons, the indications of valve *burn out*; (4)

   (b) state the causes of *burnt out* valves; (4)

   (c) describe the onboard procedures and practices that would minimise valve failure. (8)

6. Write a report to the engineeering superintendent regarding the failure at sea of a crosshead main engine bottom end bearing. The report must explain how the defect was detected, the immediate action taken to prevent further engine damage, the subsequent action taken to ensure that the vessel was able to continue on passage to the next port, probable cause of the bearing failure and other checks made on the engine. (16)

7. (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)

8. (a) Describe, with the aid of a sketch, a hydraulic top bracing for a large 2 stroke diesel engine. (14)

   (b) State the advantage of the hydraulic type over the friction type top bracing. (2)

9. Most medium speed diesel engines at sea do not have tie bolts. Explain the design and manufacturing aspects of why this is possible when medium speed engines have combustion pressures equal to or even greater than slow speed engines. (16)

Engineering Knowledge-Motor December 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

1. Write a report for the engineering superintendent regarding the replacement at sea of a damaged main engine cylinder cover. The report must explain how the problem was detected, the likely cause of the damage and the action which has been instituted to prevent further incidents of this type. (16)

2. 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)

3. (a) Explain why highly efficient diesel engines tend to produce more NOx than low performance diesel engines. (4)

   (b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsiondiesel engine. (8)

   (c) Explain why accurate monitoring of the exhaust gas flows entering and leaving a Selective Catalytic Reduction unit are required and how these readings are used to control the reduction chemical supplied to the SCR unit. (4)

4. (a) Describe the procedure for entry into, and inspection of, the inside of a starting air bottle, stating the types of defects which may be present with their possible causes. (12)

   (b) Describe the procedure of closing up the bottle and the initial pressurisation to working pressure. (4)

5. (a) Explain why a diesel engine cylinder is supplied with excess air. (4)

   (b) Explain why fuel droplet size produced during injection has to be within narrow limits in order to enable good cylinder combustion tobe achieved. (4)

   (c) Explain how the desired fuel droplet size is produced by fuel injectors. (4)

   (d) State why fuel injection timing has to be controlled within narrow limits to enable economic engine operation without bearing overload. (4)

6. (a) Describe, with the aid of a sketch, either a diesel engine Open Loop SOx scrubber system or a Closed Loop SOx scrubber system. (10)

(b) Explain what systems need to be monitored in order to ensure that the scrubber system meets all IMO regulations. (6)

7. With reference to main engine crankcase explosions:

(a) explain the cycle of events leading to a secondary crankcase explosion. (6)

(b) as Chief Engineer, explain how an engine system should be managed in order to minimise the risk of a crankcase explosion and the effects of a crankcase explosion should one occur. (10)

8. With reference to main engine safety systems:

(a) state, with reasons, THREE engine operating parameters which should initiate an automatic slowdown if engine operation is outside of set value conditions; (6)

(b) describe how the operation of each slowdown listed in part (a) may be tested; (6)

(c) list two engine operating parameters which should initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

9. With reference to an economiser:

(a) write a procedure for the cleaning of the gas side of an economiser when the associated main engineis:

(i) running; (5)

(ii) stopped. (5)

(b) write a procedure for operation of the main engine when the associated economiser cannot be operated due to tube failure. (6)

Engineering Knowledge - Motor April 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

1. With reference to *Fuel Water Emulsification* to reduce diesel engine NOx emissions:

   (a) Describe, with the aid of a sketch such a system. (12)

   (b) Explain the disadvantages of this method. (4)

2. (a) Explain, with the aid of a graph, a large 2 stroke diesel engine load diagram, labelling the operating andlimit lines. (12)

   (b) On the graph sketched in part (a), with the vessel fully ballasted, at constant load and in calm weather, mark point 'x' to show the position if the hull was clean and point 'y' to show the position if the hull was fouled. (4)

3. With reference to main starting air reservoirs:

   (a) state, with reasons, FOUR safety devices fitted; (4)

   (b) write a procedure in order to prepare a reservoir for internal inspection; (6)

   (c) describe an internal inspection, stating TWO defects which may be found and the possible causes of such defects. (6)

4. (a) Explain, with the aid of sketches, the gas combustion process in a dual fuel medium speed main engine, operating with pilot injection. (10)

   (b) Explain what is meant by exhaust gas recirculation and how this may be effective in reducing air pollution. (6)

5. A significant number of machinery failures are due to poor maintenance techniques.
   State, with reasons, the possible consequences of poor maintenance techniques on EACH of the following:

   (a) mainenginelubricating oilselfcleaningfilters; (4)

   (b) cylinder liner honing; (4)

   (c) auxiliary engine bottom end bearing overhaul; (4)

   (d) fitting ofpiston compression and oil control rings. (4)

6. (a) Explain why variable exhaust valve closing can be advantageous in the operation of large slow speed main engines. (8)

(b) Explain, with the aid of a sketch, how variable exhaust valve closing is achieved. (6)

(c) Explain how high impact is avoided as the valve closes. (2)

7. Describe FOUR defects which may be found during a piston/liner inspection via cylinder scavenge ports, explaining the possible causes and the action which should be taken to prevent their re-occurence. (16)

8. With reference to failure of fuel injector nozzles due to burning:

(a) state, with reasons, THREE possible causes; (6)

(b) write a procedure to be used when investigating the cause of fuel injector nozzle burning; (6)

(c) describe a system which should be operated in order to minimise the risk of future fuel injector nozzle burning. (4)

9. (a) Explain, with the aid of sketches, the purpose of balance weights fitted to the crankshaft of a medium speed engine. (8)

(b) Describe the maintenance checks required for detachable balance weights. (4)

(c) Explain why composite pistons may be fitted to medium speed engines, stating the reasons for the materials used. (4)

Engineering Knowledge- Motor July 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Describe, with the aid of a sketch, the water/steam circulation system for the waste heat recovery system. (5)

   (b) Explain how economiser circulation pumps are maintained in a cool condition to allow for prolonged operation withoutproblem. (3)

   (c) Describe how a waste heat recovery system steam pressure is maintained and the system operated when the associated diesel engine plant is operating on EACH of the following:

   (i) lowengineload; (4)

   (ii) low steam demand. (4)

2. As Chief Engineer Officer write a report to the engineering superintendent regarding the failure of a high pressure fuel pump unit on an electronically controlled engine. The report must explain the nature of the failure, how the failure was detected and the immediate action taken. The report must also explain the actions taken to replace the pump and the steps taken to minimise the risk of future similar fuel pump failures. (16)

3. As Chief Engineer Officer write a report to the company superintendent engineer concerning bacterial attack of lubricating oil in the sumps of the main engine and one of the generator engines. The report should explain how the attack was detected, damage found in the engines, investigations into the possible cause of the attack, how the immediate problem was resolved and how future incidents maybe prevented. (16)

4. (a) Describe, with the aid of a sketch, a cylinder arrangement for a dual fuel 2-stroke engine, explaining how the gaseous fuel is delivered to the cylinder and ignited. (12)

   (b) Explain the term *Methane Slip* in reference to a dual fuel engine, stating why it occurs and the effect on the atmosphere. (4)

5. (a) List TWO automatic main engine *slowdown* parameters, stating why EACH is applied to an engine. (4)

   (b) List TWO automatic main engine *shutdown* parameters, stating why EACH is applied to an engine. (4)

   (c) Explain how EACH of the parameters listed in part (a) and part (b) are tested for the correct operation. (8)

6. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high cylinder exhaust temperature on the main propulsion engine. (6)

(b) State, with reasons, the possible causes of a high exhaust temperature on a single cylinder of a main propulsion engine. (5)

(c) Explain why a defect resulting in a high exhaust temperature on one cylinder can cause engine damage if the engine is not slowed down when the fault initially occurs. (5)

7. (a) Describe, with the aid of a sketch, an exhaust gas recirculation system, explaining how the system reduces the level of NOx in the engineexhaust gas. (12)

(b) Explain the operating and thermal efficiency problems associated with Exhaust Gas Recirculation systems. (4)

8. (a) Define the term *Torsional Vibration* with respect to an engine crankshaft, stating the effect that high levels can have on an engine crankshaft. (6)

(b) Explain how engine deterioration influences the risk of *Torsional Vibration,* stating what can be done to minimise that risk. (4)

(c) Explain TWO possible reasons for the activation of a *Torsional Vibration* alarm after an engine has been started if there had been no previous history of such an alarm and if no maintenance had been undertaken on the engine whilst it was stopped. (6)

9. (a) Explain why charge air coolers are fitted to turbocharged diesel engines, stating the possible effects on engine operation and performance if they are not maintained in good condition. (6)

(b) As Chief Engineer Officer, write instructions for the routine in-service checking of charge air cooler performance and cleanliness together with the checking of condensate draining. (6)

(c) State, with reasons, the possible consequences if condensate is not drained from the charge air cooler. (4)

Engineering Knowledge- Motor October 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (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)

2. With reference to engine operation:

   (a) state, with reasons, the symptoms which would indicate a cylinder head was cracked between the combustion chamber and the water space; (4)

   (b) describe the actions that should be taken if the engine with the symptoms in part (a) cannot be immediately stopped; (6)

   (c) write a report to the Superintendent outlining the probable cause and actions to prevent further occurrence. (6)

3. With reference to turbochargers:

   (a) explain how the operating performance of a turbocharger system may be assessed; (10)

   (b) state, with reasons, defects which adversely affect the operating performance of a turbocharger. (6)

4. (a) Explain how the fitting of multiple air inlet and exhaust valves to a four-stroke engine can improve the gas exchange process. (4)

   (b) Explain how multiple air inlet valves allow for the development of increased cylinder power. (4)

   (c) Explain how multiple exhaust valves allow for an mcrease in engine output power available at the flywheel. (4)

   (d) Sketch a rocker/pushrod arrangement for actuating a double valve system, showing where the pushrod (tappet) clearances are adjusted. (4)

5. With reference to main starting air reservoirs:

(a) state, with reasons, FOUR safety devices fitted; (4)

(b) write a procedure in order to prepare a reservoir for internal inspection; (6)

(c) describe an internal inspection, stating TWO defects which may be found and the possible causes of such defects. (6)

6. With reference to the local control of a main engine following failure of the automatic control system, explain how the engine can be monitored and controlled. (16)

7. (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 part (a) is controlled. (4)

(c) State why valve rotation is desirable. (4)

8. As Chief Engineer Officer, explain how the quantity and quality of the fuel delivered during bunkering should be verified. (16)

9. With reference to diesel engine exhaust emissions, describe the causes and effects of EACH of the following:

(a) carbon monoxide; (4)

(b) carbon dioxide; (4)

(c) hydrocarbons; (4)

(d) particulate matter. (4)

Engineering Knowledge- Motor December 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high cylinder exhaust temperature on the main propulsion engine. (6)

   (b) State, with reasons, the possible causes of a high exhaust temperature on a single cylinder of a main propulsion engine. (5)

   (c) Explain why a defect resulting in a high exhaust temperature on one cylinder can cause engine damage if the engine is not slowed down when the fault initially occurs. (5)

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. With reference to marine diesel engine Selective Catalytic Reduction (SCR):

   (a) explain, with the aid of a graph, the influence that fuel sulphur content has on the operation of an SCR unit; (4)

   (b) explain how the operation of a turbocharger system can have a detrimental effect on the unit when burning high sulphur fuel; (4)

   (c) describe, with the aid of a sketch, a system which maintains good engine performance of the turbocharger system and good NOx reduction when burning high sulphur fuel, explaining how conflicting conditions are met. (8)

4. As Chief Engineer Officer write a report to the company superintendent engineer concerning bacterial attack of lubricating oil in the sumps of the main engine and one of the generator engines. The report should explain how the attack was detected, damage found in the engines, investigations into the possible cause of the attack, how the immediate problem was resolved and how future incidents may be prevented. (16)

5. (a) Explain why charge air coolers are fitted to turbocharged diesel engines, stating the possible effects on engine operation and performance if they are not maintained in good condition. (6)

   (b) As Chief Engineer Officer, write instructions for the routine in-service checking of charge air cooler performance and cleanliness together with the checking of condensate

draining. (6)

(c) State, with reasons, the possible consequences if condensate is not drained from the charge air cooler. (4)

6. (a) Describe, with the aid of sketches, the procedure for lifting a cylinder cover from a slow speed crosshead engine, explaining how the lifting gear is attached to the cover. (6)

(b) State the risks that may be associated with lifting a cylinder cover using the procedure described in part (a). (4)

(c) Describe the arrangements which must be in place to ensure that all lifting equipment has a current test certificate and is fitfor operation. (6)

7. With reference to diesel engine hybrid SOx scrubber systems:

(a) state the fluids used in the open and closed loops of the scrubber, explaining how these fluids are controlled to meet the scrubbing demand at different engine loads; (6)

(b) state the circumstances under which Open Loop scrubbing would be used and Closed Loop scrubbing wouldbe used; (2)

(c) describe how the effective SOx neutralising effect of the fluid used in the closed loop system is maintained during long operating periods and how pollution of the sea is avoided. (8)

8. With reference to two stroke, slow speed engine pistons:

(a) explain what is meant by the term *thermal stress* and how this can cause cracking of crown surfaces; (4)

(b) sketch a cross-section of a piston, labelling the main components and indicating coolant flow; (8)

(c) state a cause of EACH of thefollowing defects:

(i) burning of the crown upper surfaces;

(ii) carbon deposits in the cooling spaces.

9. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating the reasons for EACH action. The procedure must cover the period from activation of the alarm to return of the engine to normal operation. (16)

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

MARKER'S FEEDBACK SUBJECT - Motor DATE: 05/04/2016

General Comments on Examination Paper

Chief Engineers are managers-many candidates did not manage their timing and efforts well this exam, with many doing too much for the first questions and running out of time for the last, one candidate (twice!) used 8 pages to answer a question-I lose interest after about 3 (Chiefs are expected to produce detail but be concise). Sketches drawn in pencil with a ruler get more marks as they look more professional. If explain, describe or procedure is asked for, a bullet point list is not the correct layout and loses marks. Candidates would do well to read books such as the classic MEP series, Reeds etc as this is where many questions come from. Do candidates still have tutorials in college where they can show lecturers what they think is a good answer and get feedback?-

General Comments of Specific Examination Questions

Question 1. Many did DWI instead of FWE so scored no marks. b) Many wrote adding water lowers the power of the engine, do candidates mean the ship slows down when using FWE?

Question 2. Only four candidates attempted, once again proving candidates are not learning engineering but only the last couple of year's solutions. Some had curves-normally it is shown using a log scale. Some missed out the overspeed, overload, torque, light running, heavy running lines.

Question 3. Are bursting discs fitted to air receivers? Many temperatures were received for the melting point of fusible plugs 90, 120, 150, 160, 170°C? Make sure to read the question carefully as it may change (previously it was asked describe a procedure, this time write a procedure) many lost marks as it was not in numerical order. Chiefs are required to give more than a seconds answer e.g. not just isolate, but double valve or blank, etc. c) Particular areas need more intense inspection, taking impressions or photographs etc.

Question 4. a) Three sketches are required. More detail is needed on how the pilot injection is achieved. b) Many did not do EGR, doing SCR instead so scored no marks. Those that did EGR concentrated too much on the cooling effect, yes it exists, but the main objective was barely mentioned or even missed altogether. Some wrote it is onlyused on medium speed engines?

Question 5. Poorly answered by many who gave 'seconds' answers a) The candle type are a very delicate mesh-chemical and compressed air cleaning techniques must be done carefully or? b) Getting the angle correct by speed (spiral) setting, stones condition, pressure against liner wall or? d) What if they are overstretched? Incorrect way up? Groove not cleaned properly?

Question 6. a) Is VEC used during 'slow steaming' or just at reduced (75%) load? Not many mentioned smoke? b) Some showed lots of valve detail (not needed)-only the system that controls the timing is needed, some had no drilled hole in the pump, some wrote about changing the opening timing? c) Many small, scruffy (no ruler) sketches.

Question 7. Question is mainly asking for piston and liner defects, no need to mention the scavenge space.

Question 8. a) Some gave more than three, only the first three were marked. b) Again watch out for the change in wording-those that did not write in numerical order lost marks, many just gave a list of faults rather than writing how to investigate i.e. don't just say "* bad fuel", say "the fuel analysis report should be checked again for clues" etc. c) By 'system' it means-what procedures/policies/checks etc can be put in place to make sure it doesn't happen again?-some understood and wrote that, but some did a water nozzle cooling system, the clue is "which should be operated".

Question 9. a) The more technical (maths not needed for proof though) explanations involving things like the sketch of a vector triangle of ($\sin\theta$ and $\cos\theta$) forces etc was more Chiefs level and received more marks. c) Some only mentioned one material so scored no marks. One sketch showed a slow speed engine piston.

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

MARKER'S FEEDBACK SUBJECT - Motor DATE: 17/07/2016

General Comments on Examination Paper

A reasonable set of exam scripts but some candidates still do not appear to read the questions properly and so do not answer the question as asked. Some handwriting is very difficult to read

General Comments of Specific Examination Questions

Question 1. A number of candidates concentrated on a combined steam/gas turbine electrical generation system which was asked in a previous paper; they wasted time and did not look at the question asked with reference to waste heat steam systems.

Question 2. A number of candidates produced an essay and did not write a report.

Question 3. Similar to Question 2, some candidates did not write the answer in the form of a report..

Question 4. Very few candidates attempted this question which was a new topic. Those that did described a 4-stroke dual fuel engine which means that they either did not read the question or did not know the difference between 2-stroke and 4-stroke engines.

Question 5. Question generally answered well but some candidates were too brief in their descriptions for the marks available.

Question 6. Question answered reasonably well.

Question 7..Not too many candidates attempted this question and many of those that did seemed not to appreciate that EGR aims at changing the specific heat of the gas in the cylinder so that more heat is required to raise the temperature; many answers referred to less oxygen being present. Some candidates described selective catalytic reduction so there is some confusion

Question 8.

Question 9

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

MARKER'S FEEDBACK SUBJECT - Motor DATE: 15 December 2015

Total No. of Candidates	*Pass*	*Fail*	*% Pass*
57	44	13	77.2%

General Comments on Examination Paper

A reasonable set of exam scripts but some candidates still do not appear to read the questions properly and so do not answer the question as asked.

General Comments of Specific Examination Questions

Question 1. A number of candidates did not write a report but merely presented an essay. The question clearly asks for a Report and even indicates what should be in the report. At class 1 level candidates must have encountered reports during qualifying sea-time but, obviously, do not read them properly.

Question 2. A number of candidates produced an essay and did not write instructions as asked. At class 1 level they must have seen instructions written by a Chief Engineer. If a candidate for a class 1 certificate cannot write instructions then that candidate should not become a Chief Engineer.

Question 3. Reasonable attempts made but some diagrams were poor.

Question 4.

Question 5.

Question 6. Hardly any of the candidates understood what was required for part b) which means they did not know the emission regulations.

Question 7..

Question 8.

Question 9

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

SUBJECT: 041-36 Chief Engineer Motor

MARKER'S FEEDBACK SUBJECT:–Motor DATE: MARCH 2015

General Comments on Examination Paper

Overall a good set of papers as can be seen by the pass rate. At Chiefs level I need specifics/detail-terms such as 'fluid' or 'damage' or 'running gear' for example are too vague-please say which fluids are likely, please say what type of damage and which parts of the running gear are most affected. One candidate (even though 3 questions attempted asked for sketches) did not produce a single sketch.

General Comments of Specific Examination Questions

Question 1. a) One candidate sketched a DWI system, one wrote Ph is initially high and the system brings it down, one wrote Sodium is removed by the system, several sketches looked like spray water could fall into the engine. b) One candidate sketched a Urea system, one sketched EGR system, one was too simple-no cleaning, sensing or dosing, many did not state when the system would be used.

Question 2. a) Some candidates wrote about effect on bearings and little on the crankshaft as asked, b) Some candidates wrote about the fuels CCAI and viscosity? c) Some candidates did not explain as asked and some gave more than TWO reasons (only the first TWO are marked).

Question 3. Many candidates used the wrong format-instructions should be in numerical order, some jumped straight in and assumed a scavenge fire without writing about confirming this, some did not mention the coming off UMS, some did not mention staying clear of scavenge space door area. Many did not give reasons for the actions.

Question 4. b) Some candidates used the wrong format again giving a list without numerical order. Some wrote about the turbocharger when only the cooler was asked for. Some used abbreviations "pr" for pressure and "sc" for scavenge making sentences harder to mark. c) The main emphasis for this question is related to the occurrence on the Carnival Splendor. One candidate wrote that water will impinge on turbocharger blades?

Question 5. Not many attempted this question. The report should include the failures nature, detection, immediate action, replacement, reduction of reoccurrence.

Question 6. A good attempt from most.

Question 7. a) Many candidates did not mention comparing at similar load to previous/test/trials data or that sometimes ambient conditions need to be taken into account-it's that sort of thing that changes an answer from Seconds to Chiefs and bring the marks up. b) Lots of repetition from a) showing no clear plan for the whole question.

Question 8. a) Many candidates did not mention the terms I was looking for such as:-tensile/compressive, gradient, section thickness, many wrote the thermal stress is caused by the liner restricting expansion. b) Many sketches were small and scruffy-drawn without a ruler, unsymmetrical, poorly labelled. c) i) Some did not mention fuel on/near surface. ii) Some wrote the carbon comes from contaminated LO-can the carbon deposit without contamination?

Question 9. Many candidates repeated themselves for a) and b), I read a wide variety of answers for timing of when the slow turn operated (from 20 minutes to 2 hours-Carnival Splendor!), c) Some did not include in sketch or description how only the slow turn valve opens (Main valve remains shut) during slow turn.

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

SUBJECT: 041-36 Chief Engineer Motor

MARKER'S FEEDBACK SUBJECT: Motor DATE: 13/10/2015

General Comments on Examination Paper

Many answers were class 2 level. Many put bullet points when the question asked explain or describe (I dislike the constant use of bullet point lists)-this receives less or no marks. 4 pages is way too much for one answer and ran out of time to complete the sixth answer-losing many marks.

General Comments of Specific Examination Questions

Question 1. Question may have been overlooked due to appearing in the last exam. a) Not many mentioned ***constant pressure*** issues whilst starting and at low load in this engine type. c) Only a few mentioned fans, manning, rate of load increase, smoke, etc.

Question 2. a) Some just mentioned normal wear between rings/liner, some mentioned carbon on the ***top*** of the crown. some sketched the MAN B&W water cooled cross section-which was not asked for and not needed to answer the question-wasting time. c) Some mentioned LO injection only-no mention of spreading and scraping!

Question 3. a) Many class 2 answers-general terms such as damage or failure is not enough for chiefs. b) I expected a cooler (many had nothing) to be inserted in the sketch of a cooling system using water.

Question 4. The MV Braer disaster report will help with this question. a) Many did not contact the Bridge! Some said look for possible water in fuel even though question says investigation shows considerable quantities found. Many did not test to see if FW or SW to help find cause. Some did not mention generators or boilers.

Question 5. a) EGB? T/C? b) Some said ***early*** injection? Many talked about non temperature related issues, some mentioned Sulphur but not Na/V?

Question 6. Many were not in the form of a report and lost marks.

Question 7. a) Many did not give reasons. b) Many were not in the form of instructions i.e. numerical order and lost marks.

Question 8. Only two students attempted this question showing no effort to learn engineering

Question 9. Only one candidate attempted this question, same as Q8.

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM
PART I

MARKER'S FEEDBACK SUBJECT: Motor DATE:14th July 2015

General Comments on Examination Paper

Although the pass rate is high, overall this was not a good set of scripts with very few candidates achieving very good marks. The average mark is probably in the mid 50% area. Many candidates show poor examination technique with the layout of answers being poor and disjointed. In a few cases question parts were distributed throughout the answer book with little indication where the parts might be found. At class 1 level candidates should be able to communicate much better; communication is one of the essential requirements to be a Chief Engineer and few of these candidates show themselves to be ready for that responsibility despite gaining a pass mark in the examination.

General Comments of Specific Examination Questions

Question 1 Answers lacked depth and in part c) a sketch would have shown exactly what was needed but all but one answer tried to explain a graphical solution with text; this is poor technique.

Question 2. In general most candidates understood what was required but some candidates did not appreciate that the water spray absorbed heat because water has a higher specific heat capacity than air.

Question 3.Many candidates just wrote an essay rather than dealing with the answer as a series of topics which required attention. Sub-headings and/or lists with explanations should have been used and then candidates would not have repeated the same thing a number of times. Nobody mentioned checking the systems to see exactly what had failed and what was still available (eg fire detection) and nobody mentioned essential system adjustments such as coolers with change in seawater temperature.

Question 4. Only a few candidates attempted this question indicating that few had any idea about a topic which is a growing part of a Chief Engineer`s responsibility. This is the sort of thing a candidate should have found out during time at sea; this is what qualifying sea time is all about.

Question 5. A set of reasonable answers but the sketches were almost always the same indicating that it is all just book work and memory.

Question 6. The answer to part c) was, in most cases, a repeat of the answer to part b); bad examination technique and indicates that the candidates did not actually read the question correctly. Part b) required a mechanical answer but part c) required an answer which dealt with the procedure for operation of the system. Poor technique was also indicated by the fact that most candidates described at least two systems (eg. One or two turbochargers). The question does not ask for all possible solutions and the candidate only needed to provide a solution to one instance; candidates at class 1 level should be able to provide an answer to what is asked.

Question 7. Many candidates ignored the important aspect that water plays in a bacterial attack and failed to mention the need for correcting water leaks or other sources of water contamination in the answer to part c)..

Question 8. In many cases the answer to part b) was a rehash of the information previously used to answer part a).

Question 9. Answers to part a) could have been better structured and this shows poor technique. For part b) candidates should have provided the answer in the form of standing order instructions but very few did. At class 1 level a candidate should be able to produce an answer in the form of such instructions and should know how such instructions are structured from qualifying sea time, if the candidate actually paid attention during such sea time..

SCOTTISH QUALIFICATIONS AUTHORITY
MARKERS REPORT FORM

MARKER'S FEEDBACK SUBJECT: Motor DATE: 18/10/2016

General Comments on Examination Paper

Many seconds answers. Incorrect format for procedures and reports. Excessive use of bullet point format for explain and describe questions. Many did not read the question properly and wasted time giving information not asked for, failing to finish 6 questions.

General Comments of Specific Examination Questions

Question 1. a) Explain means a requirement for reasons not just a list of checks. Many items were missed out. b) Many did not use the correct format i.e numerical order, many did not mention how frequently or all of the parameters. c) Many did not inform anyone or shut down sensitive equipment etc.

Question 2. a) Many concentrated on what happens during the low pressure part of the cycle only (water entering combustion space). c) Many where not in the correct format.

Question 3. a) Question says turbocharger 'system', some did not mention the cooler. Only a few gave the chiefs answer which included reference to information in the instruction manual (read one). b) Many concentrated on other component defects rather than the turbocharger which has many possibilities that were ignored.

Question 4. a) Many gave ALL the advantages instead of just those that improved the gas flow as asked-I got cylinder head construction, cooling etc. The two cylinder head sketches were clearly 'copied' without labelling or explanation of why they were drawn (waste of time). d) Many went into detail describing how to set-not asked for and wasted time.

Question 5. a) Some gave no reasons, some said the door was a safety device? c) Some did not give an inspection, just the defects. Some did not say which areas are of more concern.

Question 6. Question says 'engine', how can it be monitored and controlled? Many did not mention the engine parameters or how to drive from local control.

Question 7. a) Question says 'system', the pump is therefore required. Some sketches were poor-no ruler, some did not work-the seat was drawn under the valve so it couldn't open! Some did a sketch but no description some the other way around. c) Some lacked detail.

Question 8. Many just described how to bunker, safety issues etc, they then did not go into sufficient detail on how to ensure the quantity is correct (accurate). Many simply gave a description of on board tests for quality verification.

Question 9. Only four candidates attempted as it has not been up for the last 5 years.

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