Higher National Graded Unit specification

General information for centres

This Graded Unit has been validated as part of the HNC Marine Engineering. Centres are required to develop the assessment instrument in accordance with this validated specification. Centres wishing to use another type of Graded Unit or assessment instrument are required to submit proposals detailing the justification for change for validation.

Graded Unit title: Marine Engineering: Graded Unit 1

Graded Unit code: F914 34

Type of Graded Unit: Examination

Assessment Instrument: Examination

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Purpose: This Graded Unit is designed to provide evidence that the candidate has achieved the following principal aims of the HNC Marine Engineering.

- Develop skills for employability and progression to higher qualifications.
- Develop approach to problem solving and critical thinking.
- Prepare candidates for written and oral examinations for engineer Officer of the Watch.
- Provide academic exemptions for STCW95 Reg III/2 2nd Engineer Unlimited Engineering Certification.

Recommended prior knowledge and skills: It is recommended that the candidate should have completed or be in the process of completing the following Units relating to these specific aims prior to undertaking this Graded Unit:

- *Marine Engineering: Mathematics*
- *Marine Engineering: Propulsion*
- *Marine Engineering: Naval Architecture*
- *Marine Engineering: Ship Construction*
- *Marine Engineering: Electrical and Electronic Devices*
- *Marine Engineering: Marine Heat Engine Principles*
- *Marine Engineering: Auxiliary Thermodynamic Principles*
- *Marine Engineering: Dynamics and Machines*
- *Marine Engineering: Statics and Strength of Materials*
- *Marine Engineering: Electrical Motors and Generators*

General information for centres (cont)

Core Skills: There are no Core Skills embedded in this Graded Unit specification.

Assessment: This examination-based Graded Unit is Marine Engineering: Graded Unit 1**.** It will consist of a written examination of three hours duration.

Administrative Information

Graded Unit code: F914 34

Graded Unit title: Marine Engineering: Graded Unit 1

Original date of publication: August 2010

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

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Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates

Graded Unit title: Marine Engineering: Graded Unit 1

Conditions of assessment

The assessment is based on a closed book examination of three hours duration.

The assessment is based on an examination paper consisting of a Section A covering topics in the Marine Engineering Units: Propulsion, Naval Architecture, Ship Construction and Electrical and Electronic Devices. Candidates should answer all questions in this section and be able to score a maximum of 40%. The paper should also have a Section B which should cover topics in the Marine Engineering Units: Marine Heat Engine Principles, Auxiliary Thermodynamic Principles, Dynamics and Machines, Statics and Strength of Materials and Electrical Motors and Generators. Section B should comprise five questions worth 20% each and candidates should be able to select any three from five questions allowing them to score a maximum of 60%.

If a candidate does not achieve a pass or if a candidate wishes to upgrade, this must be based on a significantly different examination from that given originally. A candidate's grade will be based on his/her achievement on the new assessment event using a significantly different examination, if this results in a higher grade.

The examination should be unseen and the assessment should be conducted in controlled and invigilated conditions. Candidates should be allowed access to standard formula and appropriate data sheets where required.

At all times, the security, integrity and confidentiality of examinations must be ensured.

Instructions for designing the assessment task:

The examination should be designed to assess the candidate's critical knowledge and understanding of the topics relating to the specific aims which this Graded Unit is designed to cover. The questions and corresponding marks should be designed in accordance with the ranges indicated in the tables that follow. However, the overall total mark for the examination is 100.

Section A

Key topics	Level of demand	Percentage weighting for each topic
Marine Engineering: Propulsion	Sketch the layout of ancillary equipment and propulsion plant. Explain the function of named propulsion machinery components.	10%
Marine Engineering: Naval Architecture	Perform calculations on hydrostatic data. Calculate small angle stability. Derive formulae and solve problems involving ships' propellers and resistance.	10%
Marine Engineering: Ship Construction	Explain the construction of a ship. Explain ship construction techniques.	10%
Marine Engineering: Electrical and Electronic Devices	Solve problems on series and parallel resistive d.c. circuits. Solve single phase a.c. circuit problems. Describe transistor applications. Describe applications of semiconductor diodes. Describe secondary cells and batteries for marine applications.	10%

Questions in Section A of the Examination Paper should normally comprise a number of short answer and calculation based questions.

Section B

Key topics	Level of demand	Percentage weighting for each topic
Marine Engineering: Marine Heat Engine Principles	Solve problems on the effect of applying heat energy to liquids and solids. Solve problems on applying the gas laws to non-flow systems and work done. Solve problems on applying the First Law of Thermodynamics to closed and open systems.	20%

Key topics	Level of demand	Percentage weighting for each topic
Marine Engineering: Marine Heat Engine Principles (cont)	Explain combustion cycles associated with marine engines and solve problems on evaluating power and efficiency from test data.	
Marine Engineering: Auxiliary Thermodynamic Principles	Solve problems on single stage reciprocating air compressors. Solve problems on the properties of water and steam. Solve problems on single stage steam turbines. Solve problems on vapour compression refrigeration plant	20%
Marine Engineering: Dynamics and Machines	Explain and solve problems involving linear, angular and relative motion. Explain and solve problems involving dynamics for linear and angular systems. Explain and solve problems relating to fluids in motion. Explain the principles of simple machines and solve associated problems.	20%
Marine Engineering: Statics and Strength of Materials	Explain and solve problems involving forces and moments concerned with static equilibrium and framed structures. Explain and solve problems relating to compressive/tensile loading and bending of sections. Explain and solve problems relating to sections under shear and shafts under torsion. Derive and solve problems related to manometers and fluids at rest.	20%
Marine Engineering: Electrical Motors and Generators	Solve problems on three-phase circuits. Solve problems on the principles of magnetism and electromagnetic induction. Explain the action of generators. Explain the action of motors.	20%

The examination will be marked out of 100. Assessors will aggregate the marks achieved by the candidate to arrive at an overall mark for the examination. Assessors will then assign a grade to the candidate for this Graded Unit based on the following grade boundaries:

- A = 70% — 100%
- B = 60% — 69%
- C = 50% — 59%

Guidance on grading candidates

Candidates who meet the minimum Evidence Requirements will have their achievement graded as a C (competent), A (highly competent), or B (somewhere between A and C). The grade related criteria to be used to judge candidate performance for this Graded Unit is specified in the following table:

Grade A	Grade C
Is a seamless, coherent piece of work or exam script which consistently:	Is a co-ordinated piece of work or exam script which:
♦ Explicitly addresses the main elements of the question. ♦ Shows consistent and precise use of relevant terminology. ♦ Has a logical structure and is coherently expressed. ♦ Shows the candidate can perform calculations in a logical manner to the required level of accuracy. ♦ Demonstrates a detailed knowledge of the subject areas within the award.	♦ Shows recognition of the main elements of the question. ♦ Uses some relevant terminology but in a vague manner. ♦ Has a lack of coherent structure. ♦ Shows the candidate can perform calculations in a competent manner. ♦ Demonstrates an understanding of the subject areas within the award

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)
Support notes

Centres are encouraged to study this Marine Engineering: Graded Unit 1 specification carefully before embarking on the writing of any HNC Marine Engineering Examination paper.

The main purpose of the Marine Engineering: Graded Unit 1 specification is to assess the candidate's ability to solve problems based on the Marine Engineering Units specified under the Recommended Prior Knowledge and Skills in this Graded Unit specification. Centres should make every attempt to ensure that questions are set within a realistic industrial context. Centres should also make every reasonable effort to integrate the knowledge and understanding learnt in one subject area to other areas so that candidates' ability to transfer knowledge and understanding from one subject area to another can also be assessed. Experience shows that candidates often have great difficulty in transferring knowledge, understanding and skills from one subject area to solve problems in another area of study. Candidates tend to compartmentalise knowledge, understanding and skills into subject areas with considerable reluctance to transfer across subject boundaries. It is important however in Engineering that candidates can apply knowledge, understanding and skills from different subject areas to the solution of complex problems.

As well as having a three hour examination, the Unit includes a notional study time of 37 hours to allow candidates to practise solving problems which should include the transfer of knowledge, understanding and skills across the subject boundaries. Centres should use a range of formative assessments to support such skills developments.

Centres are also strongly recommended not to limit opportunities for the transferability of knowledge, understanding and skills within Marine Engineering to the Marine Engineering: Graded Unit 1 only but to seek opportunities for the consolidation of these critical skills throughout the whole HNC Marine Engineering Award.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

General information for candidates

Graded Unit title: Marine Engineering: Graded Unit 1

This Unit is designed to integrate and apply knowledge and skills from a range of Units for the award of HNC Marine Engineering.

The examination will take place toward the end of your HNC study when you have completed or are in the process of completing the following units.

- *Marine Engineering: Mathematics*
- *Marine Engineering: Propulsion*
- *Marine Engineering: Naval Architecture*
- *Marine Engineering: Ship Construction*
- *Marine Engineering: Electrical and Electronic Devices*
- *Marine Engineering: Marine Heat Engine Principles*
- *Marine Engineering: Auxiliary Thermodynamic Principles*
- *Marine Engineering: Dynamics and Machines*
- *Marine Engineering: Statics and Strength of Materials*
- *Marine Engineering: Electrical Motors and Generators*

The examination will be a closed book examination of three hours duration. Standard formula and appropriate data sheets will be provided to candidates.

The examination will contain a part A and a part B.

Part A will account for 40% of the examination marks and will consist of a number of short answer and calculation based questions. Part A questions will be based on the following units.

- *Marine Engineering: Propulsion*
- *Marine Engineering: Naval Architecture*
- *Marine Engineering: Ship Construction*
- *Marine Engineering: Electrical and Electronic Devices*

All the questions in part A of the question paper should be attempted.

Part B will account for 60% of the examination marks and will consist of 5 questions each of which carries 20% of the overall examination mark. Part B questions will be based on the following units.

- *Marine Engineering: Marine Heat Engine Principles*
- *Marine Engineering: Auxiliary Thermodynamic Principles*
- *Marine Engineering: Dynamics and Machines*
- *Marine Engineering: Statics and Strength of Materials*
- *Marine Engineering: Electrical Motors and Generators*

Candidates should attempt any three of the five questions in section B.

General information for candidates (cont)

Individual questions in the examination may integrate the knowledge and understanding from more than one subject area.

The Graded Unit is a compulsory element of the HNC Marine Engineering award and will be awarded at the following grades:

Grade A = 70%–100%
Grade B = 60%–69%
Grade C = 50%–59%