



## Higher National Examination-based Graded Unit Specification

### General Information

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.

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

**Graded Unit code:** HJ4K 34

**Type of Examination:** Closed book

**Publication date:** March 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### Graded Unit purpose

This Graded Unit is designed to provide evidence that the learner 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 learners for written and oral examinations for engineer Officer of the Watch.
- ◆ Provide academic exemptions for STCW 10 III/ 1 EOW Engineering Certification.

### Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

## Higher National Examination-based Graded Unit Specification: General Information (cont)

### Recommended entry to the Graded Unit

It is recommended that the learner should have completed or be in the process of completing the following Units relating to the above principal aims prior to undertaking this Graded Unit:

- ◆ *Marine Engineering: Mathematics 1*
- ◆ *Marine Engineering: Propulsion*
- ◆ *Marine Engineering: Auxiliary Systems*
- ◆ *Marine Engineering: Stability and Structure of Merchant Ships*
- ◆ *Marine Engineering: Electro-Technology*
- ◆ *Marine Engineering: Mechanical Principles*
- ◆ *Marine Engineering: Thermodynamics*

### Core Skills

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

### Assessment Support Pack

The Assessment Support Pack for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable instrument of assessment. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard. Assessment Support Packs are available on SQA's secure website.

### Equality and inclusion

This Graded Unit has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on SQA's website:  
**[www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements)**

## Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

### Assessment

This Graded Unit will be assessed by the use of a *closed-book examination* developed by centres. The examination should provide the learner with the opportunity to produce evidence that demonstrates she/he has met the aims of this Graded Unit.

The assessment is an examination lasting three hours.

The examination should be designed to assess the learner's critical knowledge and understanding of the topics relating to the specific aims which this Graded Unit is designed to cover.

The examination will be marked out of **100**. Only whole marks should be used.

The questions and corresponding marks should be designed in accordance with the key topics (ie the critical knowledge and skills to be covered in the examination), level of demand (eg description, explanation, analysis, application) and relative mark allocation for each key topic outlined in the table below.

### Section A

Key topics	Level of demand	% mark allocation for each key topic
Marine Engineering: Propulsion	Sketch the layout of ancillary equipment and propulsion plant.  Explain the function of named propulsion machinery components.	10%
Marine Engineering: Auxiliary Systems	Sketch the Layout of marine auxiliary systems.  Explain the Operating principles of named marine auxiliary equipment.  Explain the construction of named marine auxiliary equipment.	10%
Marine Engineering: Stability and Structure of Merchant Ships	Draw a cross section of one type of ship.	10%

## Section A (cont)

Key topics	Level of demand	% mark allocation for each key topic
Electrical Engineering knowledge, part of Electro-Technology	<p>Describe a High voltage marine generation system, including protection devices for generators, protection devices for the system and any extra safety features for a High voltage system.</p> <p>Describe Insulated neutral and earthed neutral distribution systems and earthing requirements for these systems.</p> <p>Explain Safe working practice including risk assessment and permit to work, with regard to high voltage systems.</p>	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	% mark allocation for each key topic
Marine Engineering: Thermodynamics	<p>Solve problems on the effect of applying heat energy to liquids and solids.</p> <p>Solve problems on applying the gas laws and the use of the steady flow energy equation to closed and open systems.</p>	20%
Marine Engineering: Thermodynamics	<p>Solve problems on the properties of water and steam including the use of steam tables.</p> <p>Solve problems on evaluating power and efficiency of marine diesel engines.</p> <p>Solve problems on the combustion process for marine diesel engines.</p> <p>Solve problems on a vapour compression refrigeration plant.</p>	20%

## Section B (cont)

Key topics	Level of demand	% mark allocation for each key topic
Marine Engineering: Mechanical Principles	<p>Solve problems involving linear and angular motion.</p> <p>Solve problems involving dynamics for linear and angular systems.</p> <p>Explain the principles of simple machines and solve associated problems.</p> <p>Solve hydrostatic problems to include force on immersed surfaces, centre of pressure and principles of Archimedes</p>	20%
Marine Engineering: Mechanical Principles	<p>Solve problems relating to simply supported beams and forces in equilibrium.</p> <p>Solve problems with regard to strength of materials including tensile, compressive and shear forces.</p> <p>Solve problems with regard to strength of materials including stress, strain young's modulus and Factor of safety.</p>	20%
Marine Engineering: Electro-Technology	<p>Solve problems for DC circuits parallel and series including power.</p> <p>Solve problems for AC circuits to include resistance, capacitance, inductance and magnetism.</p> <p>Solve problems with regard to 3 phase power and power factor.</p>	20%
Marine Engineering: Stability and Structure for Merchant Ships	<p>Explain the relationship between the centre of gravity and the centre of buoyancy.</p> <p>Solve problems for changes to the vessels condition when weights are added, removed or moved.</p> <p>Apply the formula <math>GM = md / \Delta \tan \Theta</math></p>	20%

Questions in Section B of the examination paper should normally comprise of a number of mathematical questions.

## Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

### 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:

- ◆ *Marine Engineering: Propulsion*
- ◆ *Marine Engineering: Auxiliary Systems*
- ◆ *Marine Engineering: Stability and Structure of Merchant Ships*
- ◆ *Marine Engineering: Fundamentals of Electro-Technology*

The Learners 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: (bulleted list)

- ◆ *Marine Engineering: Fundamentals of Electro-Technology*
- ◆ *Marine Engineering: Mechanical Principles*
- ◆ *Marine Engineering: Thermodynamics*
- ◆ *Marine Engineering: Stability and Structure of Merchant Ships*

Section B should comprise six questions worth 20% each and learners should be able to select any three from six questions allowing them to score a maximum of 60%.

If a learner does not achieve a pass or if a learner wishes to upgrade, this must be based on a significantly different examination from that given originally. A learner'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. Learners 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.

The examination is *closed book*.

The examination should be unseen and the assessment should be conducted in controlled and invigilated conditions.

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## Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

### Assessing and grading learners

Learners who meet the minimum Evidence Requirements will have their achievement graded as an A, B or C. The Grade Related Criteria to be used to judge learner performance for this Graded Unit is specified in the following table.

Grade Related Criteria	
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:
<ul style="list-style-type: none"> <li>◆ Explicitly addresses the main elements of the question.</li> <li>◆ Shows consistent and precise use of relevant terminology.</li> <li>◆ Has a logical structure and is coherently expressed.</li> <li>◆ Shows the learner can perform calculations in a logical manner to the required level of accuracy.</li> <li>◆ Demonstrates a detailed knowledge of the subject areas within the award.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Shows recognition of the main elements of the question.</li> <li>◆ Uses some relevant terminology but in a vague manner.</li> <li>◆ Has a lack of coherent structure.</li> <li>◆ Shows the learner can perform calculations in a competent manner.</li> <li>◆ Demonstrates an understanding of the subject areas within the award</li> </ul>

The marks achieved by the learner in the examination should be aggregated to arrive at an overall mark for the examination. Assessors will then assign an overall grade to the learner for this Graded Unit based on the following grade boundaries.

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

These grade boundaries are fixed and should **not** be amended.

If a learner does not achieve a pass or wishes to upgrade, then this must be done using a substantially different examination. In these circumstances, the highest grade achieved should be awarded.

More information on reasonable assistance, remediation and re-assessment may be found in the SQA publication *Guidance for the Implementation of Graded Units in Higher National Certificates and Diplomas* (SQA, 2008, Publication code: CA4405).



## Higher National Examination-based Graded Unit Support Notes

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

### Guidance on approaches to delivery and assessment of this Graded Unit

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 learner'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 learners' ability to transfer knowledge and understanding from one subject area to another can also be assessed. Experience shows that learners often have great difficulty in transferring knowledge, understanding and skills from one subject area to solve problems in another area of study. Learners 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 learners 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 learners 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.

### Opportunities for developing Core and other essential skills

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



## History of changes to Graded Unit

Version	Description of change	Date

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## General information for learners

**Graded Unit title:** Marine Engineering: Graded Unit 1  
(SCQF level 7)

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.

- ◆ *Engineering Mathematics 1*
- ◆ *Marine Engineering: Propulsion*
- ◆ *Marine Engineering: Auxiliary Systems*
- ◆ *Marine Engineering: Stability and Structure for Merchant Ships*
- ◆ *Marine Engineering: Electro-Technology*
- ◆ *Marine Engineering: Mechanical Principles*
- ◆ *Marine Engineering: Thermodynamics*

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

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: Auxiliary Systems*
- ◆ *Marine Engineering: Stability and Structure of Merchant Ships*
- ◆ *Marine Engineering: Electro-Technology*

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 6 questions each of which carries 20% of the overall examination mark. Part B questions will be based on the following units.

- ◆ *Marine Engineering: Stability and Structure of Merchant Ships*
- ◆ *Marine Engineering: Electro-Technology*
- ◆ *Marine Engineering: Mechanical Principles*
- ◆ *Marine Engineering: Thermodynamics*

Learners should attempt any three of the six questions in Section B.

## **General information for learners (cont)**

Examination paper questions may be such that they integrate/combine the level of demand from key topics of Sections A and B. You may need to draw on the knowledge and understanding from more than one subject area.

For more details refer to 'recommended entry to 'Graded Unit 1' and Section B tables as given in the assessment section of this unit.

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%