



## Higher National Unit specification: general information

This Graded Unit has been validated as part of the HND Marine-Electro Technology. 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 Electro-Technology: Graded Unit 1

**Graded Unit code:** H1ST 34

**Type of Graded Unit:** Examination

**Assessment Instrument:** Examination

**Publication date:** October 2017

**Source:** Scottish Qualifications Authority

**Version:** 02

## Unit purpose

This Graded Unit is designed to provide evidence that the candidate has achieved the following principal aims of the HND Electro-Technology.

- ◆ Develop the ability to analyse and plan tasks commonly encountered in the workplace.
- ◆ Develop approaches to problem solving and critical thinking.
- ◆ Develop an evaluative and reflective approach to work and studies.
- ◆ Develop the ability to plan and organise studies.
- ◆ To enable the candidate to consolidate knowledge and skills to enhance career progression.
- ◆ Progression within the SCQF framework.
- ◆ Contribute towards developing skills to enable candidates to contribute to the safe and effective operation and maintenance of merchant vessels.
- ◆ Contribute towards developing skills to deal with emergency situations.

## General information (cont)

### 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:

- ◆ *Mathematics for Engineering 1*
- ◆ *Analogue Electronic Principles*
- ◆ *Mathematics for Engineering 2*
- ◆ *DC and AC Principles*
- ◆ *Fundamentals of Control Systems and Transducers*
- ◆ *Power Electronics*
- ◆ *Electrical Safety*
- ◆ *Pneumatics and hydraulics*
- ◆ *Distributed Control systems*
- ◆ *Marine Engineering: Electrical and Electronic Devices*
- ◆ *Marine Engineering: Electrical Motors and Generators*
- ◆ *Marine Engineering: Propulsion*

### Credit points and level

1 Higher National Unit 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.*

### Core Skills

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

### Assessment

This examination-based Graded Unit is Marine Electro-Technology: Graded Unit 1. It will consist of a written examination of 3 hours.

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

## **Conditions of assessment**

The assessment is based on a closed-book examination lasting 3 hours.

The assessment is based on an examination paper consisting of a Section A covering topics in the Units: Marine Engineering: Propulsion, Fundamentals of Control Systems and Transducers, Pneumatics and Hydraulics and Marine Engineering: Electrical and Electronic Devices. Candidates should answer all questions in this section and be able to score a maximum of 32%. The paper should also have a Section B which should cover topics in the Unit: Electrical Safety. This question should be worth 20% and is a mandatory section. The paper should also have a Section C which should cover topics in the Units: DC and AC Principles, Power Electronics, Distributed Control systems and Marine Engineering: Electrical Motors and Generators. Section C should comprise four questions worth 16% each and candidates should be able to select any three from four questions allowing them to score a maximum of 48%.

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. 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.

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

### 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 table that follows. However, the overall total mark for the examination is 100.

#### Section A

Key topics	Level of demand	Percentage weighting for each topic
<b>Marine Engineering: Propulsion</b>	<p>Sketch the layout of ancillary equipment and propulsion plant</p> <p>Explain the function of named propulsion machinery components</p>	8%
<b>Fundamentals of Control Systems and Transducers</b>	<p>Explain control system elements and signals.</p> <p>Explain the operation and application of a range of transducers used in control systems.</p> <p>Describe the structure and behaviour of control systems.</p> <p>Demonstrate the application of transducers in control systems.</p>	8%
<b>Pneumatics and Hydraulics</b>	<p>Describe the operational and maintenance requirements of compressed air and hydraulic systems.</p>	8%
<b>Marine Engineering: Electrical and Electronic Devices</b>	<p>Solve problems on series and parallel resistive DC circuits.</p> <p>Solve single phase AC circuit problems.</p> <p>Describe transistor applications.</p> <p>Describe applications of semiconductor diodes.</p> <p>Describes secondary cells and batteries for marine applications.</p>	8%

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

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

**Section B**

Key topics	Level of demand	Percentage weighting for each topic
<b>Electrical Safety</b>	<p>Explain the features of an operational plan for safe working on electrical systems.</p> <p>Explain the features of electrical distribution and the need for protection and isolation for safe working on 'dead' systems.</p> <p>Explain the features of a permit-to-work system appropriate to the safe practices of working on an isolated electrical system.</p> <p>Produce permit-to-work documentation for safe working on isolated electrical systems to current standards.</p>	20%

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

**Section C**

Key topics	Level of demand	Percentage weighting for each topic
<b>DC and AC Principles</b>	<p>Solve problems involving basic electrical concepts and theorems.</p> <p>Solve single-phase AC circuit problems using complex notation.</p>	16%
<b>Power Electronics</b>	<p>Analyse the characteristics and applications of power electronic devices.</p> <p>Outline arrangements for the protection of and the dissipation of heat from power electronic devices.</p> <p>Analyse the operation and applications of single phase converters.</p> <p>Analyse the operation and applications of DC to DC choppers.</p>	16%
<b>Distributed Control systems</b>	<p>Explain the concept of DCS.</p> <p>Apply the construction and operation of a DCS controller.</p> <p>Apply field interfaces and networks.</p> <p>Explain operator interfaces.</p> <p>Explain reporting systems.</p> <p>Apply maintenance considerations.</p> <p>Apply DCS applications and implementation.</p> <p>Apply future DCSs.</p>	16%

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

### Section C (cont)

Key topics	Level of demand	Percentage weighting for each topic
<b>Marine Engineering: Electrical Motors and Generators</b>	<p>Explain and solve problems on three-phase circuits.</p> <p>Explain the principles of and solve problems on magnetism and electromagnetic induction.</p> <p>Explain the action of generators.</p> <p>Explain and solve problems on the action of motors.</p>	16%

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%

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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

### 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
<p>Is a seamless, coherent piece of work or exam script which consistently:</p> <ul style="list-style-type: none"><li>◆ Explicitly addresses the main elements of the question.</li><li>◆ Consistent and precise use of relevant terminology.</li><li>◆ Responses have a logical structure and are coherently expressed.</li><li>◆ Shows the candidate 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>	<p>Is a co-ordinated piece of work or exam script which:</p> <ul style="list-style-type: none"><li>◆ Recognition of the main elements of the question.</li><li>◆ Uses some relevant terminology but in a vague manner.</li><li>◆ Responses lack a coherent structure.</li><li>◆ Shows the candidate can perform calculations in a competent manner.</li><li>◆ Demonstrates an understanding of the subject areas within the award.</li></ul>



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

**Graded Unit title:** Marine Electro-Technology: Graded Unit 1

### **Support notes**

Centres are encouraged to study this Marine Electro-Technology: Graded Unit 1 specification carefully before embarking on the writing of any HND Marine Electro-Technology Examination paper.

The main purpose of the Marine Electro-Technology: Graded Unit 1 specification is to assess the candidate's ability to solve problems based on the Marine Electro-Technology 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 Electro-Technology 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 Electro-Technology to the Marine Electro-Technology: Graded Unit 1 only but to seek opportunities for the consolidation of these critical skills throughout the whole HND Marine Electro-Technology 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](http://www.sqa.org.uk/assessmentarrangements)

## History of changes to Unit

Version	Description of change	Date
02	Updated incorrect Unit titles in Prior Knowledge section.	13/10/17

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## General information for candidates

### Graded Unit title: Marine Electro-Technology: Graded Unit 1

This Unit is designed to integrate and apply knowledge and skills from a range of Units for the award of HND Marine Electro-Technology.

The examination will take place toward the end of your first year of HND study when you have completed or are in the process of completing the following Units.

- ◆ *Mathematics for Engineering 1*
- ◆ *Analogue Electronic Principles*
- ◆ *Mathematics for Engineering 2*
- ◆ *DC and AC Principles*
- ◆ *Fundamentals of Control Systems and Transducers*
- ◆ *Power Electronics*
- ◆ *Electrical Safety*
- ◆ *Pneumatics and hydraulics*
- ◆ *Distributed Control systems*
- ◆ *Marine Engineering: Electrical and Electronic Devices*
- ◆ *Marine Engineering: Electrical Motors and Generators*
- ◆ *Marine Engineering: Propulsion*

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, a part B and a part C.

Part A will account for 32% 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*
- ◆ *Fundamentals of Control Systems and Transducers*
- ◆ *Pneumatics and Hydraulics*
- ◆ *Marine Engineering: Electrical and Electronic Devices*

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

Part B consists of one question and is mandatory. This will account for 20% of the examination mark. Part B question will be based on the following Unit.

- ◆ *Electrical Safety*

## General information for candidates (cont)

### Graded Unit title: Marine Electro-Technology: Graded Unit 1

Part C will account for 48% of the examination marks and will consist of 4 questions each of which carries 16% of the overall examination mark. Part C questions will be based on the following Units.

- ◆ *DC and AC Principles*
- ◆ *Power Electronics*
- ◆ *Distributed Control systems*
- ◆ *Marine Engineering: Electrical Motors and Generators*

Candidates should attempt any 3 of the 4 questions in section C.

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 HND Marine Electro-Technology award and will be awarded at the following grades:

Grade A = 70%–100%

Grade B = 60%–69%

Grade C = 50%–59%