

# Higher National Graded Unit Specification

## General Information for Centres

This Graded Unit has been validated as part of the Advanced Certificate/ HNC Engineering Practice awards. 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:** Engineering Practice: Graded Unit 1

**Graded Unit Code:** DW92 34

**Type of Graded Unit:** Examination

**Assessment Instrument:** Examination

**Credit points and level:** 1 HN Credit(s) 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 Advanced Certificate in Fabrication/Welding or Engineering Manufacture or Engineering Maintenance or Electrical Engineering and the HNC Engineering Practice awards:

- ◆ develop knowledge, understanding and skills in advanced engineering craft principles and technologies in Fabrication/Welding or Engineering Manufacture or Engineering Maintenance or Electrical Engineering
- ◆ develop knowledge, understanding and skills to undertake the role of an engineering supervisor in a business environment
- ◆ develop candidates' ability to apply analysis skills to the solution of engineering and supervisory problems
- ◆ develop learning and transferable skills (including Core Skills)

**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:

**Section A — one of the following sections**

### Welding and Fabrication

- ◆ Welding Principles and Applications 1
- ◆ Containers: Design and Manufacture
- ◆ Inspection Systems
- ◆ Fabrication: Preparation, Joining and Assembly

## General Information for Centres (cont)

### Engineering Manufacture

- ◆ Mechanical Engineering Principles
- ◆ CNC
- ◆ Computer Aided Draughting for Engineers
- ◆ Engineering Measurement

### Engineering Maintenance

- ◆ Plant Systems: Services
- ◆ Plant Systems: Utilities
- ◆ Mechanical Engineering Principles
- ◆ Industrial Plant Maintenance

### Electrical Engineering

- ◆ Electrical Engineering Principles 1
- ◆ Electrical Engineering Principles 2
- ◆ Application of Electrical and Electronic Instruments
- ◆ Electrical Motors and Motor Starting

### Section B

#### HNC Engineering Practice

- ◆ Engineering Supervision: Team Working and Continuing Professional Development
- ◆ Quality Assurance Management: An Introduction
- ◆ Value Engineering

**Core Skills:** There are no Core Skills embedded in this Graded Unit. However, there may be opportunities for candidates to develop the following Core Skills components:

Reading Communication	SCQF level 6
Written Communication	SCQF level 6
Using Number	SCQF level 6
Critical Thinking	SCQF level 6

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

An exemplar instrument of assessment and marking guidelines has been produced to indicate the national standard of achievement required at SCQF level 7.

## Administrative Information

**Graded Unit Code:** DW92 34

**Graded Unit Title:** Engineering Practice: Graded Unit 1

**Original date of publication:** May 2006

**Version:** 02 (June 2013)

### History of Changes:

Version	Description of change	Date
02	Amendment to Conditions of Assessment for Section B. Hand written notes being taken in to the examination has now been removed.	13/06/13

**Source:** SQA

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

**Graded Unit Title:** Engineering Practice: Graded Unit 1

### **Conditions of Assessment**

The assessment is based on an examination lasting three hours.

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 event using a significantly different examination.

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

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

The examination paper should consist of the following two sections:

Section A

Section B

Section A should be subdivided into up to four individual sub-sections to reflect the four different engineering disciplines candidates may have studied at Advanced Certificate level: namely Fabrication and Welding, Engineering Manufacture, Engineering Maintenance and Electrical Engineering. Each sub-section should comprise of a suitable balance of between 8 to 12 short answer, restricted response and structured questions. Candidates should answer all questions in the relevant sub-section of Section A. Candidates should be able to score up to a maximum of 50% from the sub-section they have answered questions from.

Section B should comprise of a Case Study based around the HNC Engineering Practice Units in which candidates have to answer questions on appropriate engineering supervisory issues and problems. All candidates, irrespective of which engineering discipline they have studied at Advanced Certificate level, should answer questions in Section B. The question paper associated with the Case Study should comprise of between 6 and 10 restricted response questions. Candidates should answer all questions and be able to score a maximum of 50% from Section B. Candidates should be given a copy of the Case Study only, a minimum of 14 days before they sit the examination.

The examination should be conducted under closed-book, supervised conditions. Candidates should be allowed to bring a scientific calculator into the examination.

The grade given will reflect the candidate's achievement on the first assessment event. Where a candidate is unsuccessful in the Graded Unit she/he can be given the opportunity to re-sit another significantly different examination at the earliest opportunity.

The examination paper should be unseen prior to the assessment event which should be conducted under controlled and invigilated conditions.

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

**Graded Unit Title:** Engineering Practice: 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.

**50 marks for Fabrication and Welding or Engineering Manufacture or Engineering Maintenance or Electrical Engineering section.**

### Section A — Written Test

#### Fabrication and Welding

Key Topics	Level of Knowledge/Understanding	Approximate Weighting/Mark Allocation
Welding processes	Explains the principles and technologies associated with welding processes	12%
Welding variables/parameters	Explain the significance of variables/parameters in the welding process and the achievement of quality	10%
Closed container	Design a closed container	12%
Strategy for manufacturing a container	Identify the stages involved in manufacturing a closed container	8%
Standards and inspection	Specify the role of standards and inspection types in the fabrication industry	8%
Dimensional inspection techniques	Identify the components of dimensional inspection techniques	10%
Surface methods of non-destructive testing	Describe surface methods of non-destructive testing	10%

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

**Graded Unit Title:** Engineering Practice: Graded Unit 1

<b>Key Topics</b>	<b>Level of Knowledge/Understanding</b>	<b>Approximate Weighting/Mark Allocation</b>
Sub-surface methods of non-destructive testing	Describe sub-surface methods of non-destructive testing	10%
Interpret fabrication information	Interpret information and symbols used in fabrication drawings	12%
Cutting and mechanical joining methods	Describe cutting and mechanical joining methods	8%

**Section A — Written Test**

**Engineering Manufacture**

<b>Key Topics</b>	<b>Level of Knowledge/Understanding</b>	<b>Approximate Weighting/Mark Allocation</b>
Linear motion	Solve problems involving linear motion	5%
Work and power	Solve problems involving work and power	10%
Engineering materials	Apply knowledge to solve problems involving the mechanical properties of engineering materials	20%
CNC	Describe CNC systems with respect to industrial requirements	15%
CAD	Describe the benefits of using a CAD system  Explain advantages of 3D versus 2D CAD drawing/input	20%
Measurement procedures	Determine features to be measured and the sequence of measurements for a given product	20%

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

**Graded Unit Title:** Engineering Practice: Graded Unit 1

<b>Key Topics</b>	<b>Level of Knowledge/Understanding</b>	<b>Approximate Weighting/Mark Allocation</b>
Specialist measuring equipment	Describe the operation of specialist measuring equipment	10%

**Section A — Written Test**

**Engineering Maintenance**

<b>Key Topics</b>	<b>Level of Knowledge/Understanding</b>	<b>Approximate Weighting/Mark Allocation</b>
Linear motion	Solve problems involving linear motion	5%
Work and power	Solve problems involving work and power	10%
Factory air distribution system	Describe the operation of a factory air distribution system	10%
Hydraulic systems	Describe plant equipment used in hydraulic plant	10%
Pumps and fans	Describe the operation of pumps and fans	20%
Boiler systems	Describe the operation of boiler systems and ancillary equipment	10%
Plant Maintenance techniques	Explain standard techniques used in plant maintenance	15%
Maintenance Planning	Explain maintenance planning techniques (software)	10%
Health and safety relevant to plant maintenance	Identify typical health and safety regulations relevant to plant maintenance	10%

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

**Graded Unit Title:** Engineering Practice: Graded Unit 1

**Section A — Written Test**

**Electrical Engineering**

<b>Key Topics</b>	<b>Level of Knowledge/Understanding</b>	<b>Approximate Weighting/Mark Allocation</b>
DC circuit problems	Solve dc circuit problems	10%
Network theorems	Solve a network problem using Kirchhoff's Laws or the Superposition Theorem or Thevenin or Norton's Theorems	12%
Inductance	Solve problems involving self or mutual inductance	8%
Capacitance	Solve capacitive network problems	8%
AC theory	Solve a single phase series or parallel circuit problem	12%
3-phase	Solve a balanced three-phase problem	10%
Measuring and test instruments	Explain the function of measuring and test equipment and their effects on circuits to which they are connected	10%
Universal and single phase induction motor	Explain the operation of the universal motor or a single phase induction motor	15%
Three phase motor and starting methods	Explain the operation of a three phase induction motor or explain a three phase motor starting method	15%



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

**Graded Unit Title:** Engineering Practice: Graded Unit 1

**50 marks for Section B — Mandatory for all candidates**

### Section B — Case Study

**HNC Engineering Practice**

Key Topics	Level of Knowledge/Understanding	Approximate Weighting/Mark Allocation
Engineering Supervisor	Explain the role and responsibilities of the modern engineering supervisor	20%
Teamwork	Explain approaches to developing effective teams	16%
Quality Control and Quality Assurance	Explain the principles of Quality Control and Quality Assurance	18%
ISO 9000	Explain the stages in achieving ISO 9000	8%
Quality Improvement Techniques	Explain Quality Improvement Techniques	20%
Value Engineering	Outline Value Engineering techniques	18%

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:** Engineering Practice: Graded Unit 1

### **Candidates with Disabilities and/or Additional Support Needs**

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative assessment arrangements. For information on these, please refer to the SQA document *Guidance on Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk).

### **Guidance to Centres**

Centres are encouraged to study this Engineering Practice: Graded Unit 1 specification and the associated Assessment Exemplar paper carefully before embarking on the writing of any Advanced Certificate/HNC Engineering Practice examination paper.

The main purpose of the Engineering Practice: Graded Unit 1 specification is to assess the candidate's ability to solve problems based on the Engineering Practice 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 another area(s) 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 3 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 development.

Centres are also strongly recommended not to limit opportunities for the transferability of knowledge, understanding and skills within the Advanced Certificate/HNC Engineering Practice to the Engineering Practice: Graded Unit 1 only but to seek opportunities for the consolidation of these critical skills in other Units in the award.