

SQA Advanced Graded Unit Specification

General Information for Centres

This Graded Unit has been validated as part of the SQA Advanced Certificate in Engineering Practice. 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: HV2D 47

Type of Graded Unit: Examination

Assessment Instrument: Examination

Credit points and level: 1 SQA 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 National 1 to Doctorates.*

Purpose: This Graded Unit is designed to provide evidence that the candidate has achieved the following principal aims of the SQA Advanced Certificate in Engineering Practice award:

- ◆ 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:

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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

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

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- ◆ 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.

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Administrative Information

Graded Unit Code: HV2D 47
Graded Unit Title: Engineering Practice: Graded Unit 1
Original date of publication: August 2018
Version: 02

History of Changes:

| Version | Description of change | Date |
|---------|------------------------------------|----------|
| 02 | Update of Conditions of Assessment | 06/08/18 |
| | | |
| | | |
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| | | |

Source: SQA

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

SQA Advanced 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.

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.

Reasonable assistance is the term used by SQA to describe the difference between providing candidates with some direction to generate the required evidence for assessment and providing too much support, which would compromise the integrity of the assessment. Reasonable assistance is part of all learning and teaching processes. In relation to the assessment of Advanced Certificate/Diploma examination-based Graded Units, assessors may provide advice and guidance on examination technique and clarification on the meaning of command words which may appear within an examination paper, prior to the formal examination.

Remediation is not allowed in Examination-based Graded Unit assessments.

Any candidate who has failed their Advanced Certificate/Diploma examination-based Graded Unit or wishes to upgrade their award must be given a re-assessment opportunity, or in exceptional circumstances, two re-assessment opportunities. This must be done by using a substantially different examination.

The final grading given must reflect the quality of the candidate's evidence at the time of the completion of the graded unit. Candidates must be awarded the highest grade achieved, whether through first sitting or through any re-assessment.

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 SQA 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 SQA Advanced Certificate in 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.

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

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.

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

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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% |
| 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% |

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Section A — Written Test

Engineering Manufacture

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

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Section A — Written Test

Engineering Maintenance

| Key Topics | Level of Knowledge/Understanding | Approximate Weighting/Mark Allocation |
|---|--|--|
| 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% |

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Section A — Written Test

Electrical Engineering

| Key Topics | Level of Knowledge/Understanding | Approximate Weighting/Mark Allocation |
|--|--|--|
| 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% |

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50 marks for Section B — Mandatory for all candidates

Section B — Case Study

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| 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%

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Equality and inclusion

This unit specification 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 our website www.sqa.org.uk/assessmentarrangements.

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 SQA Advanced Certificate in 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 SQA Advanced Certificate in 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.