National Unit Specification: general information

UNIT Engineering Manufacturing Processes (SCQF level 5)

CODE F5W8 11

SUMMARY

This Unit may form part of a National Qualification Group Award but may also be offered on a free-standing basis.

This Unit is designed to provide candidates with an opportunity to develop their knowledge and understanding of basic engineering manufacturing processes. During the delivery of the Unit candidates will learn about such manufacturing processes in the three broad areas of forming, joining and cutting. Candidates will develop the knowledge and understanding to select and explain appropriate processes for the manufacture of components. They will also learn to plan the sequence of operations for the manufacture of simple engineering components.

This Unit is suitable for candidates training to be manufacturing, mechanical or multi-disciplinary engineering fitters or technicians but may also be delivered to candidates who are being introduced to engineering manufacturing processes for the first time.

OUTCOMES

1 Outline the characteristics of a range of basic engineering manufacturing processes.
2 Select and explain engineering manufacturing processes suitable for the manufacture of given engineering components.
3 Plan the sequence of operations for the manufacture of simple engineering components.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- Standard Grade Craft and Design at General level

Administrative Information

Superclass: WA

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Version: 01

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CREDIT VALUE

1 credit at SCQF level 5 (6 SCQF credit points at SCQF level 5*).

**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 is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

Communication (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Outline the characteristics of a range of basic engineering manufacturing processes.

Performance Criteria

(a) Outline correctly the characteristics of forming processes.
(b) Outline correctly the characteristics of joining processes.
(c) Outline correctly the characteristics of basic cutting processes.

OUTCOME 2

Select and explain engineering manufacturing processes suitable for the manufacture of given engineering components.

Performance Criteria

(a) Outline the principal factors influencing process selection correctly.
(b) Select correctly the most suitable manufacturing processes for given components.
(c) Explain correctly, for given components, the principal factors that influence process selection.

OUTCOME 3

Plan the sequence of operations for the manufacture of simple engineering components.

Performance Criteria

(a) Identify correctly tooling and equipment requirements for the manufacture of simple components.
(b) Complete correctly the sequence of operations for the manufacture of simple components.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral evidence should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

Outcomes 1, 2 and 3 may be assessed on an individual basis, as a combination of Outcomes (eg Outcome 1 on its own and Outcomes 2 and 3 together) or as a single, holistic assessment covering all three Outcomes.

Outcome 1

Outcome 1 must be assessed under supervised, open-book conditions in which candidates are allowed to bring their own notes, handouts, textbooks and other relevant materials into the assessment.

With regard to Outcome 1:

- the characteristics of two forming processes must be outlined from the following list:
  - sand casting
  - die casting
  - injection moulding
  - blow moulding
  - vacuum forming
  - forging or extrusion

- the characteristics of two joining processes must be outlined from the following list:
  - welding
  - adhesion
  - riveting
  - soldering
  - mechanical fastening or brazing

- the characteristics of two basic cutting processes must be outlined from the following list:
  - milling
  - turning
  - grinding
  - drilling
  - piercing, blanking or shearing

Outcomes 2 and 3

Outcomes 2 and 3 must be assessed under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment. The total assessment time for Outcomes 2 and 3 must not exceed 2 hours.

National Unit Specification: statement of standards (cont)

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With regard to Outcome 2:

- a minimum of three principal factors influencing process selection should be outlined from the following list:
  - material
  - size
  - weight
  - manufacturing time
  - quality
  - material properties
  - cost
  - repeatability or quantity

- for three given simple components or assemblies the most suitable manufacturing processes must be correctly selected
- a minimum of two principal factors should be used to explain each process selection

With regard to Outcome 3:

- the tooling and equipment requirements for two given simple components or assemblies must be correctly identified
- a sequence of operations must be completed for the manufacture and/or assembly of two simple components

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

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This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit has been developed for the National Qualification Group Award in Manufacturing Engineering Practice at SCQF level 5 but may also be offered on a free-standing basis.

This aim of this Unit is to provide candidates with an opportunity to develop knowledge and understanding of basic engineering manufacturing processes. On successful completion of the Unit candidates will be able to outline a range of forming, joining and cutting processes. Candidates will also have the knowledge and understanding to select and explain appropriate processes for the manufacture of components. They will also have learnt to plan the sequence of operations for the manufacture of simple engineering components.

In Outcome 1 centres should teach candidates a range of engineering manufacturing processes. In the Evidence Requirement section of this Unit specification these processes have been grouped together under the three main headings of forming, joining and basic cutting. It is left to centres to decide which manufacturing processes they are going to teach although a minimum of two processes must be taught under each of the three headings to satisfy assessment requirements. Centres may choose manufacturing processes on the basis of local industry requirements, progression to other awards and/or candidate interests.

Recommendations as to what processes may be delivered are shown below although the list is not intended to be exhaustive.

- Forming Processes: sand cast, die casting, injection moulding, blow moulding, vacuum forming, forging or extrusion
- Joining Processes: welding, adhesion, riveting, soldering, mechanical fastening or brazing
- Basic Cutting Processes: milling, turning, grinding, drilling, piercing, blanking or shearing

In Outcome 2 candidates should be encouraged to apply their knowledge and understanding of the engineering manufacturing processes they have learnt about in Outcome 1 by:

- identifying the principal factors that influence process selection (eg material, size, weight, manufacturing time, quality, material properties, cost, repeatability and quantity)
- selecting the most suitable manufacturing processes for given components
- explaining the reasons for their choice of manufacturing processes for the given components (in terms of the principal factors)

In Outcome 3 candidates should examine in greater depth the sequence of operations involved in manufacturing components or assemblies with particular reference to tooling and equipment requirements.

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. This Unit may be delivered by a combination of lectures, tutorial work, investigations using paper based and electronic sources, industrial visits and demonstrations of some of the processes mentioned in the previous section.

During demonstrations of processes adequate supervision should be given to candidates at all times to ensure that Health and Safety requirements are being complied with.

Industrial visits to engineering manufacturing organisations may also prove useful in enhancing candidates' knowledge and understanding of manufacturing processes.

It should be noted that the Internet contains a rich source of information on manufacturing processes and candidates should be encouraged to explore these sources to learn more about different engineering manufacturing processes.

CDs, DVDs and videos detailing different engineering manufacturing processes may also enhance candidate learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Although skills in *Communication* are not formally assessed candidates have to summarise and convey technical information effectively as they undertake the Unit. They could be encouraged to investigate, summarise and evaluate a range of source materials which provide information on current standards and codes of practice in engineering manufacture. Guidance should be given to ensure that the communication skills of candidates are to acceptable industry standards. Practical formative activities, including visits, could provide opportunities to discuss manufacturing processes and help to develop oral skills in an engineering environment.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

Formative assessment exercises involving candidates in investigating and describing manufacturing processes, selecting and explaining engineering manufacturing processes suitable for the manufacture of components and planning the sequence of operations for the production of components can play a particularly important role in building candidate knowledge, understanding and confidence of Unit content.

National Unit Specification: support notes (cont)

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Outcome 1

The assessment of Outcome 1 may take the form of an investigation where, with the aid of sketches, candidates outline the characteristics of two processes from each of the following three broad categories: forming, joining and cutting.

Outcomes 2 and 3

The assessment of Outcomes 2 and 3 may consist of a single assessment paper comprising of a balance of short answer, restricted response and structured questions where the candidate is given three simple components and/or assemblies and is asked to select and explain the most suitable manufacturing processes to produce each of the components or assemblies. The candidate should then be asked to select the tools and equipment required to manufacture two of the components and outline the process using a sequence of operations.

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**

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 alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.