



National Unit Specification: general information

UNIT Fabrication Processes (SCQF level 6)

CODE F5F5 12

SUMMARY

This Unit can be delivered as part of a National Qualification Group Award in Engineering but can also be taken as a free-standing Unit by candidates who wish to enhance their skills in a fabrication environment.

It is suitable for candidates who require knowledge of the methods used to construct assemblies and sub assemblies to industry standards and those interested in pursuing a career which requires these skills.

The Unit will introduce candidates to the processes used in the fabrication industry and to the equipment and machinery used for fabrication purposes. Candidates will have the opportunity to investigate, discuss and observe how fabrication workshop equipment is used safely and correctly.

This Unit will also enable candidates to recognise the processes used to produce work pieces/items from drawings and data sheets. The work pieces/items will reflect the normal standards used in manufacturing such as structural steelwork, pressure vessel manufacture and related industries.

OUTCOMES

- 1 Select material removal processes for the manufacture of a fabricated component.
- 2 Select material forming processes for the manufacture of a fabricated component.
- 3 Complete an operations sheet and a flow diagram for a given fabrication.
- 4 Describe how computer numerically controlled (CNC) machinery is used in the fabrication industry.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: XD

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CREDIT VALUE

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

**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 opportunities to develop the Core Skills of *Problem Solving*, *Working with Others*, *Communication* and *Information Technology* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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

Select material removal processes for the manufacture of a fabricated component.

Performance Criteria

- (a) The main features that will determine the choice of material removal processes are identified for a given material.
- (b) Selection of equipment used for material removal is appropriate for the given material.
- (c) The effects of mechanical cutting on materials are correctly identified.

OUTCOME 2

Select material forming processes for the manufacture of a fabricated component.

Performance Criteria

- (a) The main features that will determine the choice of forming processes are identified for a given fabricated component.
- (b) Selection of equipment used for forming is appropriate for the given fabricated component.
- (c) The effects of forming on the structure of materials are correctly identified.

OUTCOME 3

Complete an operations sheet and a flow diagram for a given fabrication.

Performance Criteria

- (a) The processes and procedures needed to manufacture the fabrication are correctly identified.
- (b) The operations sheet is completed to ensure the correct sequence of operations for the fabrication.
- (c) The diagram is completed correctly to ensure that the flow of materials is appropriate to the manufacturing process.

OUTCOME 4

Describe how computer numerically controlled (CNC) machinery is used in the fabrication industry.

Performance Criteria

- (a) The basic terminology used in CNC is explained correctly.
- (b) Fabrication equipment that can be controlled by computers are correctly identified
- (c) The benefits and limitations of using computer numerical controlled equipment are correctly described.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Written and/or recorded oral evidence produced under closed-book and supervised conditions lasting no more than two hours in total is required to demonstrate the satisfactory achievement of all the Outcomes and Performance Criteria.

The evidence should be produced on one assessment occasion towards the conclusion of the Unit where the candidate will:

- ◆ interpret the requirements of a case study relating to the manufacture of a fabricated component
- ◆ select, with reasons, material removal and material forming processes suitable for the manufacture
- ◆ complete the operations sheet including a flow diagram suitable for the manufacture
- ◆ suggest, with reasons, where CNC machinery may be used in the manufacture

The Assessment Support Pack (ASP) for this Unit provides samples of the questions which exemplify the national standard. Centres wishing to develop their own assessments should refer to the ASP 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

The Unit is a mandatory Unit in the National Qualification Group Award (NQGA) *Fabrication and Welding Engineering* but it can also be taken on a free-standing basis.

Outcome 1

- ◆ Describe and understand how sheet and plate guillotines and universal shearing machines operate safely to produce profiles from materials such as low carbon steel, aluminium and stainless steel.
- ◆ Understand terms such as principles of shearing, blade clearance, rake angle and the effects of shearing on sheet, plate and section material.
- ◆ Understand other methods of material removal tools such as chisels, files drills, which use a single hardened steel blade to produce more precise finishes to a profile.
- ◆ Identify the results of shearing on the edge of material and state the appropriate action to be taken to minimise this damage.

Outcome 2

- ◆ Identify the main forming machines such as pyramid and pinch rolls and brake presses.
- ◆ State that presetting is required on plates rolled in pyramid rolls prior to forming complete cylinder. Alternative methods of producing complete cylinders can be achieved by first presetting on a brake press.
- ◆ State that the dimensions of a set of standard dies (blades and formers) are based on the material thickness being formed and other types of dies are available to produce acute bends and multi bends.
- ◆ Calculate the amount of material that is required to produce complete cylinders and any angular bends between 0° and 180° based on the neutral axis.
- ◆ State that the outside of a bend stretches and the inside of a bend compresses due to the result of a bending action.

Outcome 3

- ◆ Produce a sequence of operations sheet using the processes identified in Outcomes 1 and 2 and clearly show the logical order required to manufacture a fabricated component.
- ◆ Explain the use of other types of charts and diagrams that show the flow of material through a fabrication workshop and select the appropriate processes required.
- ◆ Explain the factors that control the choice of process and the equipment used in that process.

National Unit Specification: support notes (cont)

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Outcome 4

- ◆ Identify the terms used in the CNC process and state the names of the machines that can be controlled by this method.
- ◆ Compare the CNC process with the conventional methods to determine the advantages gained by the use of computers. Processes such as profile cutting, turret punches, and robotic arms can be investigated to determine limitations of these processes.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is suggested that this Unit be taught using a combination of classroom work and investigations in the fabrication workshop.

A series of investigations can be set up to cover Outcomes 1, 2 and 3.

Outcome 1

A variety of material thicknesses can be cut on the guillotine and the resultant edge damage can be highlighted and described by the candidates using incomplete diagrams. Demonstrations related to the speed, accuracy and type of finish achieved could be used to indicate to candidates the results of shearing operations that use only one hardened steel blade.

Outcome 2

The press brake can be set up with a set of standard dies and a range of thicknesses bent to determine the resultant suitability of the bend. The investigation would be staged so that the optimum bend will be produced by the standard dies. Neutral axis investigations may be set up by using a rolling machine to produce a cylinder from a known length of plate and determining the finished diameter's relationship to the ratio Π . (**NOTE:** presetting of leading and trailing edges can be explained at this stage).

Outcome 3

A sample component that requires a series of operations such as shearing, bending and drilling can be used as an exemplar and the candidate asked to produce an operations sheet that covers the processes highlighted. Guidance as to the best approach can be given and a detailed example can be shown to candidates or examples from industry shown via videos or internet websites.

Outcome 4

A glossary of CNC terms can be supplied and explained with the aid of industry videos or internet web sites. A simple approach highlighting the movement of the cutting head of a profile machine can be used to demonstrate the control mechanism and the axis of movement. A further example such as the press brake can be explained by using simple diagrammatic layouts of the x, y and z axes. If suitable hardware is available such as lathes or milling machines then these can be used as a visual aid so that candidates can identify the basic drive and control mechanisms.

National Unit Specification: support notes (cont)

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Health and safety factors should be explained as and when they arise and the delivery should be linked to that of a relevant Health and Safety Unit.

This Unit should be delivered by a combination of teaching and learning approaches which could include:

- ◆ Lecturing
- ◆ Case studies
- ◆ Practical activities
- ◆ Group discussions
- ◆ Tutorials
- ◆ Directed study
- ◆ Investigation including the use of ICT
- ◆ Site visits
- ◆ Audio visual
- ◆ Guest speaker

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Candidates have opportunities to develop skills in *Problem Solving* as they investigate and observe safe use of fabrication workshop equipment and consider the processes involved in production. They have to select and justify material removal and material forming processes suitable for manufacture, and complete an operations sheet. Discussion during formative work will allow candidates to examine and analyse all the factors impacting on such processes, including best practice in safety, and will also enhance oral *Communication* skills in work related contexts. Practical observation can provide an environment in which to discuss, review and evaluate problem solving techniques and approaches to production of work pieces from drawings and data sheets.

In depth understanding of computer numerically controlled (CNC) machinery used in the fabrication industry will be secured by practical demonstration followed by class group discussion on applications, benefits and limitations. There may be practical opportunities to foster skills in group co-operative working at the same time. Candidates could be encouraged to discuss proposed solutions, analyse the task and its component elements and discuss and negotiate the nature and scope of team goals, roles and responsibilities involved in practical fabrication work. They could be asked to demonstrate and explain methodology and resources selected and to review and evaluate their own abilities in communicating and working with others in a workplace environment.

Access to and evaluation of on line information and technical literature on current software programs could be beneficial to support underpinning knowledge. Candidates should produce and present written communication to industry standard; models of operations sheets and flow charts should provide examples of acceptable formats, structures and terminology.

National Unit Specification: support notes (cont)

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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 communications 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)*.

It is suggested that the Unit is assessed by an end of Unit question paper that contains a mix of short answer and structured questions. The paper could be made up of 2 sections covering all Outcomes.

Section A (compulsory) 10 short answer questions (4 marks each)

Section B any three from five structured questions (20 marks each)

Total marks available 100.

The structured questions would be based around a fabricated component where the candidates would be provided with a drawing, associated information and incomplete worksheets.

There may be an opportunity for a centre to develop some or all of the assessment material using E-Assessment to expose candidates to this method.

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)*.