



National Unit Specification: general information

UNIT Fabrication Processes (SCQF level 5)

CODE F5EW 11

SUMMARY

This Unit can be delivered as part of an NQ Group Award but can also be taken as a free-standing Unit by candidates who wish to enhance their skills in a fabrication environment. The Unit is also suitable for those who are studying the subject for the first time.

This 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 observe how fabrication workshop equipment is used safely and correctly. It will also enable candidates to recognise the processes used to produce work pieces and/or items from drawings and data sheets.

OUTCOMES

- 1 Identify mechanical cutting processes used in the fabrication industry.
- 2 Identify forming processes used in the fabrication industry.
- 3 Complete an operations sheet for a given fabrication.
- 4 Outline 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

Publication date: March 2008

Source: Scottish Qualifications Authority

Version: 01

© Scottish Qualifications Authority 2008

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this Unit Specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre, telephone 0845 279 1000.

National Unit Specification: general information (cont)

UNIT Fabrication Processes (SCQF level 5)

CREDIT VALUE

1 credit at Intermediate 2 (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 are opportunities to develop the Core Skills of *Problem Solving* and *Information Technology* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

National Unit Specification: statement of standards

UNIT Fabrication Processes (SCQF level 5)

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

Identify mechanical cutting processes used in the fabrication industry.

Performance Criteria

- (a) Material removal methods are correctly described.
- (b) Shearing principles are correctly stated.
- (c) The effects of mechanical cutting on materials are correctly identified.

OUTCOME 2

Identify forming processes used in the fabrication industry.

Performance Criteria

- (a) Hot and cold forming methods are correctly described.
- (b) The effects of forming on materials are correctly identified.

OUTCOME 3

Complete an operations sheet 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.

OUTCOME 4

Outline 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 which can be controlled by computers is correctly identified.
- (c) The benefits and limitations of using CNC equipment are correctly described.

National Unit Specification: statement of standards (cont)

UNIT Fabrication Processes (SCQF level 5)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria.

Evidence for this Unit will be in the form of written and/or recorded oral evidence produced under controlled and supervised conditions lasting no more than two hours in total.

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

- ◆ identify any **one** chip and **one** non-chip forming method of material removal
- ◆ identify all the principles of the shearing process
- ◆ identify all the effects of mechanical cutting on the cut edge of a material
- ◆ identify any **one** hot and **one** cold forming method
- ◆ identify the effects of **one** forming method on the material structure
- ◆ correctly select appropriate marking out, cutting, forming and joining methods
- ◆ complete **one** sequence of operations sheet for **one** fabrication
- ◆ identify any **five** terms used in CNC
- ◆ list any **five** pieces of fabrication equipment that can be controlled by computers
- ◆ identify any **two** benefits and **two** limitations of computer controlled equipment

The Assessment Support Pack (ASP) for this Unit provides samples of details 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

UNIT Fabrication Processes (SCQF level 5)

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 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. They will also be able to understand terms such as principles of shearing, blade clearance, rake angle and the effects of shearing on sheet, plate and section material.

Candidates will be able to understand other methods of material removal tools such as chisels, saws, files drills, which use a single hardened steel blade to produce more precise finishes to a profile.

They will be able to 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. They will be able to 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.

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 and that when cold rolling the grains will elongate. Hot and cold forming should be compared.

Outcome 3

Using the processes identified in Outcomes 1 and 2 candidates will be able to produce a sequence of operations sheet which clearly show the logical order required to manufacture a fabricated artefact.

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)

UNIT Fabrication Processes (SCQF level 5)

Outcome 4

Identify the terms used in the computer numerical control 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 demonstrations/investigations in the fabrication workshop.

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). Compare hot and cold working.

Outcome 3

A sample artefact 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.

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.

National Unit Specification: support notes (cont)

UNIT Fabrication Processes (SCQF level 5)

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 speakers

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Candidates have to apply their knowledge and understanding of mechanical cutting and forming processes used in the fabrication industry and consider factors such as resources, equipment, and machinery, which would affect such processes. Access to on line facilities providing current information and technical literature could support underpinning knowledge. Practical observation provides the best environment in which to discuss, review and evaluate the production of work pieces from drawings and data sheets, and further enhance problem solving techniques. Understanding of the uses, benefits and limitations of computer numerically controlled (CNC) machinery used in the fabrication industry can be encouraged by demonstration and explanation with an emphasis on safety.

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 assessment comprising a mixture of multi choice, matching and restricted response question.

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.

National Unit Specification: support notes (cont)

UNIT Fabrication Processes (SCQF level 5)

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).