

National Unit Specification: general information

UNIT	Fabrication and Welding Processes (Higher)
NUMBER	D158 12
COURSE	Fabrication and Welding Engineering (Higher)

SUMMARY

This unit focuses on describing the basic principles and characteristics of common fabrication and welding processes including the methods used for planning, setting out, work holding, and positioning of fabricated structures.

OUTCOMES

- 1 Describe the basic principles and characteristics of common welding processes.
- 2 Describe the basic principles and characteristics of fabrication processes.
- 3 Prepare a welding procedure document.
- 4 Describe the use of work holding techniques in the fabrication process.

RECOMMENDED ENTRY

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

- Intermediate 2 Structures together with Standard Grade Mathematics at grade 3
- a minimum of Standard Grade Mathematics at grade 4 and Craft and Design, Graphic Communication or Technological Studies at grade 3 together with Standard Grade Mathematics at grade 3
- equivalent National units
- Intermediate 2 Scottish Group Award in a related area

Administrative Information

Superclass:	XE
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National Unit Specification: general information (cont)

UNIT Fabrication and Welding Processes (Higher)

CREDIT VALUE

1 credit at Higher.

CORE SKILLS

This unit gives automatic certification of the following:

Complete core skills for the unit	None
Core skills components for the unit	Critical Thinking Int 2

Additional information about core skills is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

National Unit Specification: statement of standards

UNIT Fabrication and Welding Processes (Higher)

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 the Scottish Qualifications Authority.

OUTCOME 1

Describe the basic principles and characteristics of common welding processes.

Performance criteria

- (a) Description of the operating principles of common welding processes is comprehensive, clear and accurate.
- (b) Description of the equipment and consumables required for the operation of common welding processes is correct.
- (c) Description of the method used for arc initiation for common welding processes is comprehensive, clear and accurate.
- (d) Selection of a suitable process for a given application is correct.
- (e) Description of the safety requirements for each of the common welding processes is comprehensive, clear and accurate.

Note on range for the outcome

Operating principles: arc initiation, heat distribution, polarity, current control, protection from atmospheric contamination.

Welding processes: manual metal arc, metal arc gas shielded, tungsten arc gas shielded.

Safety requirements: personal, safety equipment, safety hazards.

Evidence requirements

Oral and/or written evidence is required to show that the candidate can describe the operating principles, list and describe the equipment and consumables required, describe the method used for arc initiation, select a suitable process for a given application, and describe the safety requirements for the processes listed in the range.

OUTCOME 2

Describe the basic principles and characteristics of fabrication processes.

Performance criteria

- (a) Description of the operating principles of fabrication processes is comprehensive, clear and accurate.
- (b) Description of the equipment required for fabrication processes is correct.
- (c) Selection of a suitable fabrication process is correct for a given application.
- (d) Description of the safety requirements for each fabrication process is comprehensive, clear and accurate.

Note on range for the outcome

Fabrication processes: bending, rolling, thermal cutting, mechanical cutting.

National Unit Specification: statement of standards (cont)

UNIT Fabrication and Welding Processes (Higher)

Evidence requirements

Written evidence is required to show that the candidate can describe the operating principles and list the equipment required for the fabrication processes and identify and select the following fabrication processes specified in the range.

The description of the operating principles of at least two of these processes should form part of the assessment. The material referred to in the application can be either thick plate or thin plate as required.

OUTCOME 3

Prepare a welding procedure document.

Performance criteria

- (a) The material selected for the welding operation is correct.
- (b) The welding process selected for the welding operation is correct.
- (c) The method used to determine heat input to the weldment is correct.
- (d) The consumables selected are correct in terms of composition and size.
- (e) The description of pre- and post-heat treatment methods is comprehensive, clear and accurate.

Evidence requirements

Written evidence is required to show that the candidate can prepare a welding procedure sheet for one welding application.

OUTCOME 4

Describe the use of work holding techniques in the fabrication process.

Performance criteria

- (a) The description of the methods used for positioning work prior to welding is comprehensive, clear and accurate.
- (b) The description of the methods used for holding work prior to welding is correct.
- (c) The description of the terms jig and fixture is correct.
- (d) The description of the effect of heat on a welding jig is comprehensive, clear and accurate.

Note on range for the outcome

Positioning methods: manual, mechanical, magnetic, self-locating, jigs, tack welded.

Work holding: manual, mechanical, welded, magnetic, jigs.

Evidence requirements

Written/oral or graphic evidence is required to show that the candidate can describe the methods used for the positioning and holding of work during the fabrication of a welded structure.

The candidate should also supply written or oral evidence to describe the effect of heat on a welding jig and the subsequent implications for the type of positioning or work holding method used.

National Unit Specification: support notes

UNIT Fabrication and Welding Processes (Higher)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

It is recommended that you refer to the SQA Arrangements document for Higher Fabrication and Welding Engineering before delivering this unit.

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

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Process demonstration. The principle of arc initiation. The basic principle of arc energy. Polarity and heat distribution. Fabrication process principles. Equipment and techniques. Planning the fabrication of a structure. Types of work holding methods.

Welding processes

The use of actual welding plant is recommended for the identification of cables and ancillary equipment. The effect on weld quality of current settings, electrode coverings, wire feed speeds, voltage settings, arc length and travel speed should be demonstrated using candidate participation where possible. Power source characteristics should be highlighted without the need for an in-depth treatment.

It is worth noting that Outcome 1 is designed to provide a basic introduction to the common manual welding processes and is not intended to be a complete study of each process. It is important that the candidate can select a suitable process for a given application or material and be aware of the associated health and safety requirements.

Fabrication processes

The principles of each process should be taught along with a demonstration of the process in operation where possible. If the process is not available, simulation or industrial visits are recommended. It should be noted that thick and thin plate are part of the range, and processes should reflect this. Candidates are not required to cover every process within the fabrication industry; however, as wide a coverage as possible within the timescale should be the aim. The choice of application associated with the process should reflect the candidate's background and local industry needs.

Health and safety should be emphasised throughout, and use should be made of resources such as videos, manufacturers' charts and, where possible, case studies.

It is worth noting that Outcome 2 is designed to provide a basic introduction to the common fabrication processes and is not intended to be a complete study of each process. This knowledge is essential for the completion of the external assessment which is part of the Higher Fabrication and Welding Engineering Course. It is important that the candidate can select a suitable process for a given application or material and be aware of the associated health and safety requirements.

National Unit Specification: support notes (cont)

UNIT Fabrication and Welding Processes (Higher)

Welding procedures

The candidate should be introduced to welding procedures and the need for this form of quality assurance in fabrication and welding. It should be treated as an introduction to this area of fabrication and welding. An in-depth study is not required. The importance of material selection, process selection, heat input, consumables and post-heating should be taught. The example used could be retained as reference material for external moderation.

Where possible, use should be made of existing weld procedures and reference should be made to current standards at all times.

Candidates should be given tutorials to develop their skills in interpreting the contents of weld procedure documentation.

Work holding and positioning

The candidate should be introduced to the various methods of work holding, clamping, positioning and setting-out methods used in fabrication. It is important to make available visual aids of sample devices such as jacks, strongbacks, chains and tapered bars, angle clamps, angle cleats, tapered wedges, self-locating tubes, magnetic clamps, hydraulic clamps and electrically driven positioners.

The distinct difference between jigs and fixtures should be explained, along with the effects of heat on materials when tack welding, and basic distortion control.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Information on learning and teaching is available in the Subject Guide, produced by the Higher Still Development Unit (HSDU) in partnership with the Scottish Further Education Unit (SFEU) and the Scottish Consultative Council on the Curriculum (SCCC). The Subject Guide is intended to support the information contained in the SQA Arrangements document for the Higher Fabrication and Welding Engineering. The SQA Arrangements document contains the standards against which candidates are assessed.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

PCs (a), (c) and (e) – a restricted response question for each process where the candidate describes the process principles, an initiation method and health and safety requirements.

PC (b) – a diagram or sketch where the candidate identifies equipment and consumables for each process.

PC (d) – a table completion exercise could be used where the candidate is required to select a suitable process for a given application or material. All processes identified in the range should be included in the selection process.

National Unit Specification: support notes (cont)

UNIT Fabrication and Welding Processes (Higher)

Outcome 2

The assessment could be structured around an application in thick plate and an application in thin plate. The candidate would be given a suitable application and would select a fabrication process and describe the equipment and fabrication principles associated with the particular process.

Outcome 3

The assessment could be in the form of an assignment where the candidate is required to produce a simple welding procedure sheet covering the information listed in the performance criteria. The welding operation could be one of the applications used for Outcomes 1 and 2.

Outcome 4

The assessment could be carried out in a workshop setting where candidates have to identify and use the various work holding and positioning methods. Methods which cannot be used or demonstrated should be presented in the form of sketches where candidates could describe the use by the aid of sketches. Oral questions could be used to determine the candidate's understanding of the effect of heat on a welding jig and the difference between a jig and a fixture.

The use of assignments based on workshop demonstrations could be adopted. Where possible, assessments should be integrated.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).