SCOTTISH QUALIFICATIONS AUTHORITY

FABRICATION AND WELDING ENGINEERING

Higher

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SCOTTISH QUALIFICATIONS AUTHORITY

NOTE OF CHANGES TO ARRANGEMENTS
THIRD EDITION PUBLISHED ON CD-ROM DECEMBER 1999

COURSE TITLE: Fabrication and Welding Engineering (Higher)

COURSE NUMBER: C030 12

National Course Specification

Course Details: Core skills statements expanded

National Unit Specification

All Units: Core skills statements expanded

SCOTTISH QUALIFICATIONS AUTHORITY

National Course Specification

FABRICATION AND WELDING ENGINEERING (HIGHER)

COURSE NUMBER C030 12

COURSE STRUCTURE

This course comprises four mandatory units as follows:

D156 12	***Materials – Effects of Force and Protection (H)***	***0.5 credit (20 hours)***
D157 12	***Basic Principles of Fabricated Component Design, Manufacture and Test Methods (H)***	***1 credit (40 hours)***
D158 12	***Fabrication and Welding Processes (H)***	***1 credit (40 hours)***
D159 12	***Inspection – Non-Destructive Testing Skills (H)***	***0.5 credit (20 hours)***

In common with all courses, this course includes 40 hours over and above the 120 hours for the component units. This is for induction, extending the range of learning and teaching approaches, support, consolidation, integration of learning and preparation for external assessment. This time is an important element of the course and advice on its use is included in the course details.

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
- equivalent National units
- Intermediate 2 Scottish Group Award in a related area

Administrative Information

Publication date: December 1999

Source: Scottish Qualifications Authority

Version: 03

National Course Specification: general information (cont)

COURSE Fabrication and Welding Engineering (Higher)

CORE SKILLS

This course gives automatic certification of the following:

Complete core skills for the course	None	
Core skills components for the course	Critical Thinking	Int 2
	Planning and Organising	Int 2
	Using Graphical Information	Int 2

For information about the automatic certification of core skills for any individual unit in this course, please refer to the general information section at the beginning of the unit.

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

National Course Specification: course details

COURSE Fabrication and Welding Engineering (Higher)

RATIONALE

Fabricated and welded structures are vital features of a wide range of major systems within a modern economy. They are of fundamental importance in key sectors such as transport, construction, food processing and petrochemicals.

The Fabrication and Welding Engineering course focuses on an understanding of the ways in which the design, manufacture and final testing of a product are interrelated. The transferable skills developed feature in all main engineering disciplines and help to equip the individual for the demands of modern industry. Course delivery should be integrated as far as possible to reflect the rationale and the inter-relationship of design, manufacture, inspection and test.

This broad-based course will introduce the candidate to the principles and technology of fabrication and welding processes, and the design, manufacture, inspection and testing of fabricated and welded products. It will be particularly suited to those whose aspirations and abilities are towards employment at technician level in the fabrication and welding industry, notably in the areas of design, manufacture and quality assurance. It is important to note, however, that while the successful candidate will have an understanding of fabricated component design and its relationship with manufacturing processes, he or she will not be qualified to design structures, components or pressure vessels.

Successful completion of the course will increase a candidate's technological capability by developing knowledge and understanding of the application of engineering principles, particularly in the fabrication and welding discipline. It provides a useful foundation for further study at HNC, HND or degree level.

The course will allow the candidates to understand the characteristics and behaviour of the materials used for fabrication and welding processes, the design of welded joints and structures, and the related quality assurance. The emphasis in quality assurance will be on the operation of modern processes and procedures used in industry, and these will include inspection methods and non-destructive testing.

Skills and knowledge developed during the course will in turn develop confidence, perspective, sensitivity and technological creativity. The content is such that it will make a significant contribution to the candidates' general education.

COURSE CONTENT

All of the course content will be subject to sampling in the external assessment.

The course is based on the interrelationship of the processes of design, manufacture, inspection and test. It should be delivered in a holistic way, with all the units being taught concurrently. Where this is difficult, for example in teaching the unit Materials – Effects of Force and Protection, problems can be overcome by relevant reference being made to those inter-related processes which always depend on the types of material being used.

Integration should be developed using part of the additional 40 hours. The added value of the course award is achieved by the integration of knowledge and understanding contained within the individual units. This will be reflected in the external assessment. This is based on a case study which requires the candidate to produce the necessary manufacturing, testing and inspection data for a fabricated structure. This documentation might be produced to varying degrees of complexity and detail, and this can be used as evidence for grading higher levels of performance.

Throughout the course candidates will have access to current standards, manufacturers' information and a comprehensive materials database.

SUMMARY OF COURSE CONTENT

Materials – Effects of Force and Protection (H)

This area of the course covers the deforming effects of applied force on a material, the modifying result of heat treatment or mechanical working on the material structure and properties, and further work on protective processes used to combat the effects of corrosion.

CONTENT STATEMENTS

Materials – Effects of Force and Protection (H)

The content statements given in the left-hand column of the table below describe what the candidate should be able to do in demonstrating knowledge and understanding.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the content statement.

	Knowledge and Understanding	***Contexts, Applications, Illustrations and Activities***
1	Engineering materials.	Low carbon steel, cast iron, copper, brass and aluminium.
2	Loading effects.	Deformation, elongation, shear, elastic.
3	Atomic structures and heat treatment.	Annealing, normalising, hardening and tempering.
4	Material protection.	Principles of material protection, preparation methods, finishing processes.

National Course Specification: course details (cont)

COURSE Fabrication and Welding Engineering (Higher)

SUMMARY OF COURSE CONTENT

Basic Principles of Fabricated Component Design, Manufacture and Test Methods (H)

This unit covers the basic principles of fabricated component design and includes an understanding of the manufacture of pressure vessels and simple structures together with the associated quality assurance processes and techniques.

CONTENT STATEMENTS

Basic Principles of Fabricated Component Design, Manufacture and Test Methods (H)

The content statements given in the left-hand column of the table below describe what the candidate should be able to do in demonstrating knowledge and understanding.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the content statement.

Knowledge and Understanding	*Contexts, Applications, Illustrations and Activities*
1 Drawing interpretation.	Drawing principles: projection methods, identification of welding symbols.
2 Weld joint specifications.	Design of weld joint specifications, simple design calculations and graphics, dimensional accuracy.
3 Manufacturing operations.	Operational sequences, manufacturing methods, flowcharts, equipment, continuous testing.
4 Design principles.	Structural integrity, functional aspects, environmental requirements.
5 Quality assurance.	Inspection and testing methods, dimensional checks, leak testing.

National Course Specification: course details (cont)

COURSE Fabrication and Welding Engineering (Higher)

SUMMARY OF COURSE CONTENT

Fabrication and Welding Processes (H)

This unit covers the principles of the fabrication and welding process such as manual metal arc welding, metal arc gas shielded welding and tungsten arc gas shielded welding, bending, rolling and cutting.

CONTENT STATEMENTS

Fabrication and Welding Processes (H)

The content statements given in the left-hand column of the table below describe what the candidate should be able to do in demonstrating knowledge and understanding.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the content statement.

Knowledge and Understanding	*Contexts, Applications, Illustrations and Activities*
1 Welding process.	Process principles, selection criteria, consumables, tools and equipment associated with welding processes, health and safety requirements, process advantages and limitations, practical demonstrations, health and safety.
2 Fabrication processes.	Metal forming methods, hot and cold, machine tools and equipment, presses, folding machines, rolls, types of rolls, bending allowances, metal thickness, health and safety.
3 Location and clamping.	Jigs, fixtures, work holding methods and techniques, problems with the effects of heat on jigs and fixtures, magnetic clamping, automatic clamping.
4 Quality assurance.	Welding procedures and standards, content of a welding procedure sheet, weld joint configuration.

National Course Specification: course details (cont)

COURSE Fabrication and Welding Engineering (Higher)

SUMMARY OF COURSE CONTENT

Inspection – Non-Destructive Testing Skills (H)

This unit covers the testing of components using methods of non-destructive testing (NDT).

CONTENT STATEMENTS

Inspection – Non-Destructive Testing Skills (H)

The content statements given in the left-hand column of the table below describe what the candidate should be able to do in demonstrating knowledge and understanding.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the content statement.

Knowledge and Understanding	*Contexts, Applications, Illustrations and Activities*
1 NDT methods.	Penetrant, magnetic particle and ultrasonic.
2 Component types.	Carbon steel, wrought products, plate and T-joints.
3 NDT operations.	The factors which underpin the conduct of NDT methods, health and safety requirements.
4 Reporting of results.	Assessing, reporting and recording of test results, using standard documentation, use of current standards.

ASSESSMENT

To gain the award of the course, the candidate must pass all the unit assessments as well as the external assessment. External assessment will provide the basis for grading attainment in the course award.

When the units are taken as component parts of a course, candidates will have the opportunity to achieve a level beyond that required to attain each of the unit outcomes. This attainment may, where appropriate, be recorded and used to contribute towards course estimates, and to provide evidence for appeals.

Additional details are provided, where appropriate, with the exemplar assessment materials. Further information on the key principles of assessment is provided in the paper *Assessment*, (HSDU, 1996) and in *Managing Assessment* (HSDU, 1998).

National Course Specification: course details (cont)

COURSE Fabrication and Welding Engineering (Higher)

DETAILS OF THE INSTRUMENTS FOR EXTERNAL ASSESSMENT

The external assessment will comprise a written closed book examination which will assess knowledge and understanding across all of the course units. The time allocation for the question paper will be three hours. The paper will be worth 100 marks.

The question paper will be in the form of a case study. The candidate will be required to produce the necessary manufacturing information for the production of a fabricated structure which could be in the form of a pressure vessel or a plate structure (or a combination of both).

The case study will be based on a detailed sketch for a fabricated structure along with other relevant information including extracts from appropriate standards, data charts and manufacturers' charts. The candidate will be required to answer a series of questions, which will all relate to the fabricated structure.

The fabricated structure will reflect the work done in the course and will be sufficiently complex to allow the candidate to demonstrate the ability to integrate knowledge and understanding across the course units.

The approximate weighting of each component part of the assessment is given in brackets. The candidates will produce the following information:

- a detailed planning operations sheet for the manufacture of the component (35%)
- a detailed weld joint specification (15%)
- a welding procedure specification sheet (30%)
- details of the final inspection and testing processes (20%)

Candidates will be required to demonstrate knowledge and understanding across all the course units, the ability to manage and present written information of a technical nature, and the ability to demonstrate retention of knowledge over the whole course.

The complexity and detail contained within the material produced by candidates in the responses to the case study will determine the level of achievement. For example, the more information given within the procedures and weld joint specifications, the higher the level of attainment will be.

GRADE DESCRIPTIONS

The descriptions overleaf are of expected performances at grade C and at grade A. They are intended to assist candidates, teachers, lecturers and users of the certificate and to help establish standards when question papers are being set. The grade of the award will be based on the total score obtained in the examination.

For performance at grade C:

- drawings and sketches produced contain relevant information to a satisfactory standard
- in respect of manufacturing instructions, planning sheets, and weld joint specifications and procedure sheets, they should contain sufficient information to enable the fabricated component to be manufactured
- documentation is supplied (pro forma)
- appropriate procedural and specification information from manufacturers' charts or standard documentation is utilised
- heat input/pre-heat information is obtained from standards or charts

For performance at grade A:

- drawings and sketches are produced to a high and consistent standard, related to current standards and specification. For example, arrow details, line shading, title boxes, text style, correct positioning of text should be included on drawings
- weld joint specifications and procedures are precise, relevant and display a deep understanding of good practice. For example alternative joint specifications can be produced along with a short written report justifying the alternative specification
- a welding procedure sheet is produced for the welding of a non-ferrous material, **and** the design of planning sheets is of a high standard and produced by the candidate, thus allowing for innovation
- planning sheets and manufacturing instructions are clear, comprehensive and display good insight into the nature and limitations of manufacturing processes and the properties of materials used. For example, heat input/pre-heat information is obtained by calculation

APPROACHES TO LEARNING AND TEACHING

Integration of the candidate's understanding of the key processes of design, manufacture, inspection and testing is central to the philosophy of this course. Some sequential teaching will have to take place to ensure that the candidate acquires a firm understanding of the roles that each of these key processes play in relation to each other before holistic tasks can be undertaken.

A variety of approaches should be used to sustain interest. Extensive use should be made of participative methods which help develop candidates' independent thinking and communication skills. Small-group work should be used to encourage teamwork and develop interpersonal skills. Site visits should be arranged, if possible, to see large pressure vessel or oil tank manufacture and assembly. Extensive use should be made of ideas and sample components and artefacts.

Where possible, more formal teaching should be backed up with practical demonstration, activities and assignments to reinforce theoretical concepts and principles. The focus should always be on the manufacture of a component and the associated processes and procedures which surround this. It should be emphasised that the external assessment and the additional 40 hours will be used to reinforce and assess the knowledge and understanding gained during the course.

National Course Specification: course details (cont)

COURSE Fabrication and Welding Engineering (Higher)

SPECIAL NEEDS

This course 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).

SUBJECT GUIDES

A Subject Guide to accompany the Arrangements documents has been produced by the Higher Still Development Unit (HSDU) in partnership with the Scottish Consultative Council on the Curriculum (SCCC) and Scottish Further Education Unit (SFEU). The Guide provides further advice and information about:

- support materials for each course
- learning and teaching approaches in addition to the information provided in the Arrangements document
- assessment
- ensuring appropriate access for candidates with special educational needs

The Subject Guide is intended to support the information contained in the Arrangements document. The SQA Arrangements documents contain the standards against which candidates are assessed.

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Materials – Effects of Force and Protection (Higher)

NUMBER D156 12

COURSE Fabrication and Welding Engineering (Higher)

SUMMARY

This unit focuses on understanding the effect produced in a material by the application of a force and the effect of heat treatment and mechanical working on the structure of materials.

OUTCOMES

1 Identify the effect produced in a material by force.
2 Explain the effect of heat treatment and mechanical working on the structure of a material.
3 Explain the principles and methods of material protection.

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
- equivalent National units
- Intermediate 2 Scottish Group Award in a related area

Administrative Information

Superclass: XD

Publication date: December 1999

Source: Scottish Qualifications Authority

Version: 03

National Unit Specification: general information (cont)

UNIT Materials – Effects of Force and Protection (Higher)

CREDIT VALUE

0.5 credit at Higher.

CORE SKILLS

There is no automatic certification of core skills or core skills components in this unit.

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 Materials – Effects of Force and Protection (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

Identify the effect produced in a material by force.

Performance criteria

(a) The identification of the type of stress expected in a material for a given loading is correct.
(b) The identification of typical load extension graphs for given materials is correct.

Note on range for the outcome

Materials: low carbon steel, cast iron, copper, brass, aluminium.
Loadings: tension, compression, shear.

Evidence requirements

Written evidence that the candidate can identify and describe the type of stress expected in the materials for the three given types of loading. Written evidence that the candidate can identify extension graphs for given materials.

Supplementary oral evidence resulting from questioning to ensure full coverage of the range.

OUTCOME 2

Explain the effect of heat treatment and mechanical working on the structure of a material.

Performance criteria

(a) Identification of the effect of heating on the grain structure of iron is correct.
(b) Explanation of the heat treatment processes available for steel is comprehensive, clear and accurate.
(c) The interpretation applied to hardness test results is correct.
(d) Explanation of the effect of hot working on steel is comprehensive, clear and accurate.
(e) Explanation of the effect of cold working on steel is comprehensive, clear and accurate.

Note on range for the outcome

Heat treatment: annealing, normalising, hardness, tempering, surface hardening.
Hardness testing: 0.27% carbon steel, 0.7% carbon steel.
Hot working: deformation, recrystallisation.
Cold working: work hardening, annealing, stress relieving, recrystallisation, grain growth.

Evidence requirements

Written evidence that the candidate can give an explanation of the heat treatment process for a specific task.

Written and/or oral evidence that the candidate can give an explanation of the effect of mechanical working for a specific task.

Supplementary oral evidence resulting from questioning to ensure full coverage of the range.

OUTCOME 3

Explain the principles and methods of material protection.

Performance criteria

(a) Explanation of the principles and methods of protection for a given material is comprehensive, clear and accurate.
(b) Description of methods of cleaning and surface preparation for a given material is correct.
(c) Description of methods of polishing and finishing work for a given material is correct in terms of the end result required.

Note on range for the outcome

Materials: steel, copper, brass, aluminium.
Protection methods: alloying, metallic, oxide, cathode.
Cleaning methods: degreasing, blast, flame, acid pickling.
Polishing methods: mechanical, manual.

Evidence requirements

Written evidence that the candidate can give a description of the cleaning method for 2 materials and oral evidence for the remainder.

Written evidence that the candidate can give a description of the method of polishing and finishing for a specific material and written and/or oral evidence for the remainder.

Written and/or oral evidence is required of the candidate's ability to explain principles and methods of material protection.

National Unit Specification: support notes

UNIT Materials – Effects of Force and Protection (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 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The deformation effect produced in a material with the application of external forces. The effects on the structure of a material after being subjected to some form of heat treatment and/or mechanical working. Protection from environmental elements.

Reinforcement of the properties and identification of materials. Simple calculations of compressive, tensile and shear stress. Structural change of iron using the iron carbon equilibrium diagram. The use of workshop tests to show the effects of the heat treatment processes on steel. The effects of hot and cold working on the grain structure of low carbon steel. The principles and methods of protecting materials from the effects of environmental attack. The methods of cleaning metals and preparing surfaces for the required protective finishes.

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

Examples of instruments of assessment which could be used are as follows.

Outcome 1

Written/graphics exercise to assess the candidate's ability to identify the type of stress expected in the materials for the loadings identified in the PCs.

Outcome 2

Assignment report to assess the candidate's ability to identify and explain a heat treatment process given a specific task and explain the effect of mechanical working for a specific task.

National Unit Specification: support notes (cont)

UNIT Materials – Effects of Force and Protection (Higher)

Outcome 3

Written exercise to assess the candidate's ability to describe cleaning operations and methods of polishing and finishing artefacts for protection against environmental conditions. In general, the approach should be to develop candidates' insight into the external factors to be considered in the selection of a material for a particular task. The learning programme should be activity-based and candidate-centred.

Note: Carefully structured practical worksheets should support the delivery and assessment of the unit.

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).

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)

NUMBER D157 12

COURSE Fabrication and Welding (Higher)

SUMMARY

This unit focuses on developing a basic understanding of the design of fabricated components, the methods used in their manufacture and the quality assurance procedures employed during and after construction.

OUTCOMES

1 Interpret fabrication drawings, identify and interpret welding symbols.
2 Illustrate the factors affecting the design of fabricated components.
3 Describe the manufacturing methods used for a fabricated component.
4 Describe inspection and test procedures used during and after manufacture of fabricated components.

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
- equivalent National units
- Intermediate 2 Scottish Group Award in a related area

Administrative Information

Superclass: XE

Publication date: December 1999

Source: Scottish Qualifications Authority

Version: 03

National Unit Specification: general information (cont)

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)

CREDIT VALUE

1 credit at Higher.

CORE SKILLS

There is no automatic certification of core skills or core skills components in this unit.

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 Basic Principles of Fabricated Component Design, Manufacture and Test Methods (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

Interpret fabrication drawings, identify and interpret welding symbols.

Performance criteria

(a) Interpretation of welding symbols is correct in terms of manufacturers' instructions and relevant standards.
(b) Interpretation of fabrication drawings is correct in terms of manufacturers' instructions.

Note on range for the outcome

Welding symbols: butt welds, fillet welds, resistance welds, welding process, weld location, weld details (contour, dimension, pitch, site instructions).
Fabrication drawings: assembly instructions, forming instructions, dimensions, conventions, general information.

Evidence requirements

Graphic and written/oral evidence to demonstrate that the candidate can identify and interpret common welding symbols.

Graphic and written exercises to demonstrate that the candidate can interpret simple fabrication drawings according to manufacturers' instructions, including details identified in the range.

OUTCOME 2

Illustrate the factors affecting the design of fabricated components.

Performance criteria

(a) Explanation of the factors affecting the structural integrity of design is accurate in terms of the component.
(b) Explanation of the factors affecting the functional aspect of design is correct in terms of the component.
(c) Illustration of the interrelationship among structural, functional and manufacturing aspects of the fabricated component design is clear and accurate.

Note on range of the outcome

Components: tanks, drums, pressure vessels.
Structural integrity: structural stiffening, shape, change of shape, added stiffness.
Functional: external service environment, internal service environment.

Evidence requirements

Written and/or pictorial evidence that the candidate clearly understands the difference between the structural and the functional aspects of design and of the methods used to add rigidity and/or stiffness to the container.

Written and/or pictorial evidence that the candidate can select a container which incorporates the structural, functional and manufacturing aspects of design and annotates the pictorial evidence accordingly.

Supplementary oral evidence to ensure that the candidate can cover the range.

OUTCOME 3

Describe the manufacturing methods used for a fabricated component.

Performance criteria

(a) Description of the advantages and limitations of the methods used for component manufacture is comprehensive, clear and accurate.
(b) Identification of the equipment and the sequence of manufacturing methods used for a component is correct.
(c) Completion of a flowchart is correct in terms of the given specification.
(d) Explanation of the reasons why continuous testing is carried out on fabricated components as they are being manufactured is clear, comprehensive and accurate.

Note on range for the outcome

Component: tanks, drums, pressure vessels, structures.
Manufacturing methods: cutting, forming, jointing, handling, finishing.
Continuous testing: stage inspection, material checking.

Evidence requirements

Written and/or pictorial evidence that the candidate can describe the manufacturing methods in use for container construction together with their relative advantages and limitations.

Performance evidence that the candidate can produce a flowchart and specify the appropriate methods in the correct sequence.

National Unit Specification: statement of standards (cont)

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)

OUTCOME 4

Describe inspection and test procedures used during and after manufacture of fabricated components.

Performance criteria

(a) Description of pressure tests and associated safety regulations is comprehensive, clear and accurate.
(b) Specification of functional dimensions used in a dimensional test is correct.

Note on range for the outcome

Tests: pneumatic, hydrostatic.
Functional dimensions: tolerances, component size.

Evidence requirements

Performance evidence that the candidate can mark from given drawings the functional dimensions of the component.

Written and/or pictorial evidence that the candidate can explain testing and the reasons for choice of methods.

National Unit Specification: support notes

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (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

BS EN 22553: 1995 (BS 499 Part 2) should be used and actual industrial drawings employed as a source for identification of symbols and drawings interpretation. The emphasis should be on the identification and interpretation of the weld symbol rather than the drawing of the symbol.

Elements of fabricated component design and their interrelationship. Examples of design, such as a pressed steel car wheel, a fuel container, a car radiator, liquid food containers with radiused corners, bridges or gantries should be exploited.

Sheets of paper or cardboard having round or square holes cut in the centre, should be torn to observe where the tear starts. Simple tests such as these will give qualitative indications of failure.

Operational layout using the correct processes and sequences for given components. Support sheets giving cutting, forming, jointing and finishing processes, together with sheets on handling and costs comparisons for the various processes, should be used. Flowcharts (ideally a mini-blackboard with scale models of machines and coloured chalk to distinguish the flow of different parts) are essential for the teaching of operation layouts. A selection of 'master' or 'model' layouts giving reasons for the choice of process/sequence as examples would also be helpful. Awareness of the influence of design, manufacturing process choice and dimensional accuracy on costs.

Awareness of the variety of tests that a component may be subjected to during and after manufacture.

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.

National Unit Specification: support notes (cont)

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

An integrated assessment for the unit could be designed using worksheets covering Outcomes 1-3. Examples of instruments of assessment which could be used for individual Outcomes are as follows.

Outcome 1

The assessment could be in the form of a table which contains welding symbols. Candidates would complete the table, alternating between identifying a symbol from a sketch to sketching a symbol from a description. Candidates could be required to sketch the weld joint as identified by the symbol.

Drawing interpretation could be based on a series of questions relating to features found on fabrication drawings.

Outcome 2

Restricted response questions and pictorial questions. An appropriate number of questions to fully assess the candidate's understanding of the differences between the structural and functional design criteria and of the methods used to impart rigidity and/or stiffness to a container.

The suggested number of questions for PCs (a) and (b) combined is a minimum of six, of which at least two should be on PC (a) and at least two should be on PC (b).

PC (c) could be met by the candidate annotating a sketch, or photograph, with two design aspects from each of the structural, functional and manufacturing design criteria.

Outcome 3

Restricted response questions and pictorial questions are required for PCs (a) and (b).

PC (c) requires an operational layout or flowchart for the manufacture of a container to a given drawing and specification, listing reasons for the sequence and choice of processes.

Short answer questions on the reasons for and the type(s) of appropriate continuous or periodic tests used during manufacture are required for PC (d).

Outcome 4

Extended response questions are required for PC (a).

PC (b) requires the candidate to be presented with drawings of components requiring the candidate to identify functional dimensions. One of these components should show tolerances in order that the overall tolerance can be calculated by the candidate.

The delivery of the unit could be organised so that an assignment or project forms the backbone where the design parameters of a container are assessed. Manufacturing processes and, finally, the integration of testing methods are considered to ensure that the design criteria have been complied with during manufacture. Hands-on candidate activities and support material should be used wherever possible. It should be the teacher or lecturer's aim to constantly relate the Outcomes to practical situations.

National Unit Specification: support notes (cont)

UNIT Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)

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).

SCOTTISH QUALIFICATIONS AUTHORITY

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

Publication date: December 1999

Source: Scottish Qualifications Authority

Version: 03

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.

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.

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.

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).

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Inspection – Non-Destructive Testing Skills (Higher)

NUMBER D159 12

COURSE Fabrication and Welding Engineering (Higher)

SUMMARY

This unit focuses on applying the principles of non-destructive testing to a range of general applications.

OUTCOMES

1 Test components using non-destructive testing (NDT) methods.
2 Assess and record results from each NDT test.
3 Complete a proforma report with the results from each test.
4 Comply with regulations, procedures and safe working practices specified for the use of NDT methods in workshops and laboratories.

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
- equivalent National units
- Intermediate 2 Scottish Group Award in a related area

Administrative Information

Superclass: WD

Publication date: December 1999

Source: Scottish Qualifications Authority

Version: 03

National Unit Specification: general information (cont)

UNIT Inspection – Non-Destructive Testing Skills (Higher)

CREDIT VALUE

0.5 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	Planning and Organising	Int 2
	Using Graphical Information	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 Inspection – Non-Destructive Testing Skills (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

Test components using non-destructive testing (NDT) methods.

Performance criteria

(a) Identification of appropriate test locations on components is correct.
(b) Interpretation of NDT instructions and technique sheets is correct.
(c) Application of the appropriate NDT method to the component and defects to be detected is correct.
(d) Post-test instructions are carried out correctly.

Note on range for the outcome

NDT methods: penetrant, magnetic particle, ultrasonic.
Technique factors: surface condition, consumables, equipment, calibration, test parameters, post-test requirements.
Components: carbon steel, wrought products, plate and T-joint.

Evidence requirements

Performance evidence of the candidate's ability to carry out NDT tests using each of the methods given in the range on selected components, for the detection of either surface breaking or sub-surface flaws, as appropriate.

Supplementary oral/written questioning to establish that the criteria in the test technique, and its application, for the methods given in the range statement, are correctly understood. Supplementary evidence may be in the form of completed checklists.

OUTCOME 2

Assess and record results from each NDT test.

Performance criteria

(a) Defects in components are recorded correctly on related drawings.
(b) The thickness of component is measured accurately using ultrasonic NDT.

Note on range for the outcome

Defects: surface breaking, internal.
NDT methods: penetrant, magnetic particle, ultrasonic.

Evidence requirements

Performance evidence which may be in the form of drawings showing thickness measurement where appropriate and accurate location of defect(s) detected, using each of the NDT methods identified in the range statement.

OUTCOME 3

Complete a proforma report with the results from each test.

Performance criteria

(a) Information contained in each test report complies with relevant current standards and NDT instruction sheet.
(b) The faults detected are correctly stated with respect to type, location and size.

Note on range for the outcome

Proforma report: surface condition, consumables, equipment, calibration, test parameters, inspection, acceptance criteria, test results, post-inspection, cleaning.
NDT methods: penetrant, magnetic particle, ultrasonic.

Evidence requirements

Oral and written evidence of the candidate's ability to complete test reports for the NDT methods listed in the range statement. Oral evidence may be in the form of completed staff checklists.

OUTCOME 4

Comply with regulations, procedures and safe working practices specified for the use of NDT methods in workshops and laboratories.

Performance criteria

(a) Applications of working practices are safe and in accordance with health and safety regulations for the given NDT methods.
(b) Applications of all necessary safety clothing and protective accessories are correct.

Note on range for the outcome

Working practices: visual, penetrant, magnetic particle, ultrasonic NDT.
Safety clothing: overalls, footwear, safety glasses.

Evidence requirements

Performance evidence that practical application of NDT methods (visual, magnetic particle, penetrant and ultrasonic) are carried out safely and in accordance with health and safety regulations.

Written and/or oral evidence that the candidate knows how to comply with the safety criteria that must be observed when using ionising radiations.

National Unit Specification: support notes

UNIT Inspection – Non-Destructive Testing Skills (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 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Awareness of the safety requirements applicable to the NDT methods. Awareness of safety aspects to be considered in the use of X-ray and gamma ray (X and γ) radiography. The factors that underpin the conduct of NDT operations according to written instructions and under close supervision at all times. Setting up of equipment, developing skills in carrying out the tests, recording and classifying the results in terms of given criteria and reporting accordingly for the NDT methods.

PCN is the national scheme for the certification of competence in NDT methods. The first level of competence is Level 1. This unit will not provide training or competence to Level 1 requirements.

All Outcomes should be taught in the context of the classroom/lecture room and the workshop. The workshop should be equipped for the NDT methods covered in the unit. Each NDT method should be related to the appropriate British Standard or EN Standard, from which guidance on technique factors and their relevance to the quality of the test will be obtained. Attention should be given to examples of relevant and non-relevant test indications.

For penetrant testing it is recommended that portable inspection kits are used with colour contrast and fluorescent penetrant types. Guidance should be taken from BS 6443: Penetrant Flaw Detection.

For magnetic particle testing the magnetising techniques should use both contact current flow and magnetic flow and take into account defect orientation and detecting media, both colour contrast and fluorescent with black light. Guidance should be taken from BS 6072: Method for Magnetic Particle Flaw Detection.

Ultrasonic testing should in the main be applied to calibration blocks, samples for thickness and lamination checking, samples with machine-made artificial defects to simulate components with easily detectable defects, and selected wrought products and weldments suitable for this initial development of NDT skills.

Guidance should be taken from BS 2704: Specification for Calibration Blocks for Use in Ultrasonic Flaw Detection, BS 4124: Methods for Ultrasonic Detection of Imperfections in Steel Forgings and BS 3923: Ultrasonic Examination of Welds. (It is anticipated that EN Standards will replace the above standards in due course.)

Eddy current testing may be included for comparison purposes. It is not included as a mandatory part of the unit.

National Unit Specification: support notes (cont)

UNIT Inspection – Non-Destructive Testing Skills (Higher)

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

Centres may use the instruments of assessment which are considered by teachers or lecturers to be the most appropriate. Examples of instruments of assessment which could be used are as follows.

Outcome 1

Observation checklists are required for the stated criteria and they should be related to each of the NDT methods used. The assessment and record of the results for each test undertaken should be made in the workshop/laboratory, with due account being taken of the guidance given in the references listed in the content/context section. Candidates should be provided with appropriate components for testing, accompanied by drawings where required to enable candidates to determine the test location(s).

Outcome 2

Each report presented by the candidate should be compared with the exemplar report held by the teacher/lecturer and due account taken of its compliance with British or related standards and the satisfactory detection of any defects. The preparation of each report with the results from the related test may be carried out either in the workshop/laboratory or in the lecture room. If in the latter environment, access to the item tested should be maintained until the report has been completed. For reporting, the guidance given in the references listed in the content/context section should be observed.

Outcome 3

Observation checklists are required for the stated criteria for Outcome 4. The checklists should be applied to the application of each NDT method used. Reference to Health and Safety Regulations and British Standards will be a core part of the practical work to support this outcome. The 'practical element' will be the core part of Outcomes 1, 2 and 3 and this gives an opportunity for the assessment process to be integrated.

Outcome 4

It is essential that candidates are made aware of safety considerations for X and γ radiography during the coverage of Outcome 4.

The delivery of this unit should be organised in such a way that the greater proportion of all activity is carried out in the workshop/laboratory. Equipment, safety and test method criteria should reflect the item to be tested and the defects to be detected.

National Unit Specification: support notes (cont)

UNIT Inspection – Non-Destructive Testing Skills (Higher)

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).