

## National Unit Specification: general information

<b>UNIT</b>	Basic Principles of Fabricated Component Design, Manufacture and Test Methods (Higher)
<b>NUMBER</b>	D157 12
<b>COURSE</b>	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.

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### Administrative Information

<b>Superclass:</b>	XE
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## **National Unit Specification: general information (cont)**

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

### **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

### **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.

## **National Unit Specification: statement of standards (cont)**

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

#### **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,  
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### **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)**

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### **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).