

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Fabrication: Preparation, Joining and Assembly

**Unit code:** HV2R 47

**Unit purpose:** This Unit is designed to enable candidates to develop knowledge and understanding and apply basic concepts to the marking out of layouts, draw downs and templated work. The Unit also provides candidates with the opportunity to develop knowledge and understanding of the production processes of cutting, joining and assembly of fabricated components.

On completion of the Unit the candidate should be able to:

- 1 Interpret information and identify symbols used in fabrication engineering drawings.
- 2 Describe marking methods used in the construction of cambers and layouts used in the fabrication industry.
- 3 Describe cutting and mechanical joining processes.
- 4 Describe the methods of work holding, clamping, and controlling distortion.

**Credit points and level:** 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*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 National 1 to Doctorates.*

**Recommended prior knowledge and skills:** Candidates should possess a basic/general knowledge of material preparation and forming processes. They should also possess a basic knowledge of engineering drawing skills. This may be evidenced by possession of an appropriate cluster of NC Units.

**Core Skills:** There may be opportunities to gather evidence towards the Core Skills of Communication, Numeracy and Problem Solving in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

**Context for delivery:** If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

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**Assessment:** The assessment for this Unit should be in the form of an end of Unit test such that it covers the Outcome content with the candidate answering a selection of questions. This should be in two sections, Section 'A' consisting of 10 compulsory questions worth 4 marks each and Section 'B' any three from five questions worth 20 marks each.

**The assessment should be constructed in such a way that it reflects at least 60% of all the Evidence Requirements within this Unit descriptor.**

The assessment should be conducted under controlled and supervised conditions.

An assessment exemplar will be available for this Unit.

This integrated assessment should last 2 hours.

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### **SQA Advanced Unit Specification: statement of standards**

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

#### **Outcome 1**

Interpret information and identify symbols used in fabrication engineering drawings

##### **Knowledge and/or skills**

- ◆ Interpretation of fabrication engineering drawings
- ◆ Specifications for structural steelwork
- ◆ Standard marking dimensions in structural steelwork

##### **Evidence Requirements**

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

##### **Assessment guidelines**

The assessment should take the form of:

- ◆ short answer questions on symbols and standard marking dimensions that are used in current drawing standards for fabrication engineering and structural steelwork

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### Outcome 2

Describe marking methods used in the construction of cambers and layouts used in the fabrication industry

#### Knowledge and/or skills

- ◆ Marking tools and equipment
- ◆ Marking methods and calculations
- ◆ Draw downs and patterns
- ◆ Cambers
- ◆ Template materials and their use

#### Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

#### Assessment guidelines

- ◆ Short answer questions on marking tools and methods used in fabrication engineering and structural steelwork.
- ◆ Draw a camber to a given scale

### Outcome 3

Describe cutting and mechanical joining processes

#### Knowledge and/or skills

- ◆ Mechanical cutting methods
- ◆ Thermal cutting methods
- ◆ Mechanical and adhesive joining techniques

#### Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

#### Assessment guidelines

- ◆ Short answer questions on thermal and mechanical cutting techniques
- ◆ Structured questions on mechanical joining techniques

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### **Outcome 4**

Describe the methods of work holding, clamping, and controlling distortion

#### **Knowledge and/or skills**

- ◆ Work holding methods
- ◆ Clamping methods
- ◆ Distortion control

#### **Evidence Requirements**

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

#### **Assessment guidelines**

- ◆ Structured questions on jigs and fixtures
- ◆ Short answer questions on distortion control methods

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### Administrative Information

<b>Unit code:</b>	HV2R 47
<b>Unit title:</b>	Fabrication: Preparation, Joining and Assembly
<b>Superclass category:</b>	XD
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## SQA Advanced Unit Specification

### SQA Advanced Unit specification: support notes

#### Unit title: Fabrication: Preparation, Joining and Assembly

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

##### Outcome 1

- (a) Interpreting information from fabrication engineering drawings.
  - ◆ read drawings to extract information
  - ◆ work out true/scaled sizes
  - ◆ identify individual components/items
  - ◆ determine correct sequence of erection
  - ◆ identify instructions for standard working practices
- (b) Identifying the symbols used in fabrication engineering drawings.
  - ◆ interpret weld symbols/instructions
  - ◆ identify British/International Standard drawing symbols
- (c) Recognising the need for standard marking dimensions in structural steelwork.
  - ◆ interpret manufacturers' tables of standard backmarks and cross centres
  - ◆ determine dimensions of structural steelwork from given data

##### Outcome 2

- (a) Description of the use and accuracy of marking tools and equipment used in the fabrication industry to produce templates, full size layouts and draw downs.
  - ◆ identify marking tools such as rules, tape rules, squares, dividers, trammels, centre punches, hammers, chalk lines, plumb lines, spirit levels, scribes and marking pens and chalks
  - ◆ determine the degree of accuracy of the above tools used in the fabrication industry to produce templates full size layouts and draw downs
  - ◆ camber construction using quarter circle, double camber height and calculation of ordinate heights methods
  - ◆ production of templates, layouts and draw downs from given data
- (b) The use of computer programmes to assist in the automatic marking of fabricated assemblies.
  - ◆ identify the benefits and limitations of current computer programmes used for automatic marking

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(c) Construction of scale drawings of cambers and explain the use of standard formulae to determine accuracy of templates.

- ◆ construct scaled cambers using quarter circle and double height camber methods
- ◆ construct camber using the calculation method
- ◆ compare speed and accuracy of above methods

(d) The types of template and their purpose in fabricated assemblies.

- ◆ identify template materials such as paper, wood, plastic, sheet metal
- ◆ compare above materials in terms of rigidity, durability and strength
- ◆ give reasons for using paper, wood, plastic, sheet metal

### Outcome 3

(a) Description of the cutting of metallic materials using mechanical and thermal cutting methods.

Principles of shearing:

- ◆ identify forces needed for shearing to take place
- ◆ identify secondary cut on single blade shearing set up

Results of shearing on edge of plate and sheet material:

- ◆ identify work hardening on edge of material
- ◆ identify areas of compression on edge of material
- ◆ common features of guillotined edges ie burr/rag, bright top third dull gray bottom two thirds
- ◆ compare punched and drilled holes for finish, speed and accuracy

Single bladed shearing machines and hand tools:

- ◆ identify files, chisels, drills, plate edge planing tools, reamers
- ◆ compare rake angles of common cutting tools used to cut ferrous and non ferrous materials

Two bladed shearing machines and hand tools:

- ◆ identify guillotines, croppers, notchers, punches, snips
- ◆ principles of operation of above machines and hand tools

Principles of thermal cutting on ferrous and non-ferrous material:

- ◆ oxy fuel gas cutting principles (ferrous)
- ◆ laser cutting principles (non ferrous)
- ◆ plasma cutting principles (non ferrous)
- ◆ equipment and consumables required for above processes
- ◆ safety considerations for thermal cutting

Effects of thermal cutting on plate and sheet material:

- ◆ explanation of expansion and contraction on ferrous and non ferrous materials
- ◆ consideration of kerf size

Distortion control during thermal cutting:

- ◆ permissible methods of controlling distortion
- ◆ effects of poor distortion control



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(b) Description of the techniques used to mechanically join plate and sheet assemblies.

- ◆ fitted, black, turned barrel, high strength friction grip, break stem bolts
- ◆ load indicating washers
- ◆ methods of determining torque of bolted joints
- ◆ blind or pop rivets, solid rivets
- ◆ self secured joints

(c) Explanation of the use of adhesives in fabricated assemblies.

- ◆ adhesive joining techniques
- ◆ joint preparation
- ◆ joint types
- ◆ adhesive types

### Outcome 4

(a) The methods of holding work during the pre fabrication stage of erection.

- ◆ dogs and dogging tables, clamps, toggles, wedges, strongbacks, magnetic clamps, hydraulic pumps
- ◆ acceptable standard work practices of above

(b) The use of jigs and fixtures to maintain shape of cylindrical work, fabricated platework structures and pressure vessels.

- ◆ spiders used on cylindrical work
- ◆ chain blocks and come alongs for large structures
- ◆ rotation jigs for ease of fabrication and welding
- ◆ locators and welding jigs

(c) Control of distortion and residual stress in relation to cylindrical work, fabricated platework structures and pressure vessels.

### Guidance on the delivery and assessment of this Unit

This Unit should be delivered using a fabrication workshop to give practical demonstrations of the processes involved. Where certain processes are not available in centres, industrial visits or video programmes should be used to show candidates practical applications of processes. Allocated times are given for guidance purposes only.

#### Outcome 1 (8 hours)

- ◆ Interpreting information from fabrication engineering drawings
- ◆ Identifying the symbols used in fabrication engineering drawings
- ◆ Recognising the need for standard marking dimensions in structural steelwork

#### Outcome 2 (8 hours)

- ◆ Description of the use and accuracy of marking tools and equipment used in the fabrication industry to produce templates, full size layouts and draw downs.
- ◆ The use of computer programmes to assist in the automatic marking of fabricated assemblies.
- ◆ Construction of scale drawings of cambers and explain the use of standard formulae to determine accuracy of templates.
- ◆ The types of template and their purpose in fabricated assemblies.

#### Outcome 3 (16 hours)

- ◆ Principles of shearing
- ◆ Results of shearing on edge of plate and sheet material
- ◆ Single bladed shearing machines and hand tools
- ◆ Two bladed shearing machines and hand tools
- ◆ Principles of thermal cutting on ferrous and non-ferrous material
- ◆ Effects of thermal cutting on plate and sheet material
- ◆ Distortion control during thermal cutting
- ◆ Description of the techniques used to mechanically join plate and sheet assemblies
- ◆ Explanation of the use of adhesives in fabricated assemblies

#### Outcome 4 (8 Hours)

- ◆ The methods of holding work during the pre fabrication stage of erection.
- ◆ The use of jigs and fixtures to maintain shape of cylindrical work, fabricated platework structures and pressure vessels.
- ◆ Control of distortion and residual stress in relation to cylindrical work, fabricated platework structures and pressure vessels.

#### *Opportunities for developing Core Skills*

There may be opportunities to gather evidence towards the Core Skills of Communication, Numeracy and Problem Solving in this Unit.

## **SQA Advanced Unit Specification**

### **Open learning**

The majority of this Unit could be delivered by distance learning, which may incorporate some degree of online support. Arrangements would have to be made for the candidate to have supervised access to workshop machines. This may involve the candidate attending the centre. Alternatively special arrangements could be made for the candidate to be demonstrated the practical aspects.

### **Equality and inclusion**

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

**General information for candidates**

**Unit title:** Fabrication: Preparation, Joining and Assembly

This Unit has been designed to provide you with the knowledge and skills that will enable you to understand and interpret fabrication engineering drawings and produce templated work to scaled and full sized dimensions. You will also study techniques involved in the mechanical and thermal cutting of various materials and the joining and assembly methods used for structural fabrications. The fabrication workshop will be used as a teaching aid so that you may carry out investigations using the above processes to provide an understanding of the basic principles of drawing interpretation, material cutting, work holding and distortion control.

Formal assessment of this Unit will comprise an end of Unit assessment consisting of two sections - 10 compulsory questions in section A worth 4 marks each and any three from five questions in section B worth 20 marks each. The assessment will last 2 hours and will be conducted under supervised closed book conditions.