



## National Unit Specification: general information

**UNIT** Weld Procedure Specification and Testing (SCQF level 6)

**CODE** F5FE 12

### SUMMARY

This Unit can be taken as part of a National Certificate Group Award in Engineering but can also be taken as a free standing Unit by candidates who wish to enhance their skills in a fabrication and welding environment.

This Unit will enable candidates to understand the need for welding standards and welding procedure specifications on the quality of deposited welds, the requirements in planning the welding operation and the documentation associated with approving weld procedures. Candidates will complete weld procedure and welder approval documentation and also determine the pre-heat temperature for a range of materials. Candidates will also be introduced to Non Destructive Testing (NDT) processes and their related procedures.

In addition, the candidates will be aware of the role of the Welding Co-ordinator and Welding Engineer.

The Unit would be suitable for candidates studying the subject for the first time as well as those interested in pursuing a career as a weld technician.

### OUTCOMES

- 1 Interpret and use weld procedure approval standards and specifications.
- 2 Interpret and use welder approval qualification standards and specifications.
- 3 Interpret and use standards and specifications for assessing weldability of a material.
- 4 Outline the principles, procedures and applications for Non Destructive Testing.

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#### Administrative Information

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## **National Unit Specification: general information (cont)**

**UNIT**      Weld Procedure Specification and Testing (SCQF level 6)

### **RECOMMENDED ENTRY**

While entry is at the discretion of the centre, it would be beneficial if candidates had attained the following:

- ◆ some experience in a practical welding situation
- ◆ some knowledge of engineering materials
- ◆ knowledge of welding processes

### **CREDIT VALUE**

1 credit at Higher (6 SCQF credit points at SCQF level 6\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### **CORE SKILLS**

There are opportunities to develop the Core Skills of *Problem Solving* and *Numeracy* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

## **National Unit Specification: statement of standards**

### **UNIT      Weld Procedure Specification and Testing (SCQF level 6)**

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

#### **OUTCOME 1**

Interpret and use weld procedure approval standards and specifications.

##### **Performance Criteria**

- (a) The standards and specifications listed for procedure specifications are correct.
- (b) The requirements listed for a weld procedure specification are correct.
- (c) Testing requirements for weld procedure approval are correctly stated.

#### **OUTCOME 2**

Interpret and use welder approval qualification standards and specifications.

##### **Performance Criteria**

- (a) The lists of standards and specifications used for welder qualifications are correct.
- (b) The stated requirements for welder qualification approval are correct.
- (c) The stated testing requirements for welder approval are correct.
- (d) The range of approval for a specified welder qualification is determined correctly.

#### **OUTCOME 3**

Interpret and use standards and specifications for assessing weldability of a material.

##### **Performance Criteria**

- (a) The factors listed in assessing the weldability of steels is correct.
- (b) The pre heat temperature of the material to be welded is determined accurately.
- (c) The completed weld procedure pro forma for a given material is correct.

#### **OUTCOME 4**

Outline the principles, procedures and applications for Non Destructive Testing.

##### **Performance Criteria**

- (a) The principles of an NDT process are correctly stated.
- (b) The procedure for carrying out a Non Destructive Test is correct.
- (c) The applications for an NDT process are correctly stated.

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

### UNIT Weld Procedure Specification and Testing (Higher)

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that the candidates have achieved all of the Outcomes and Performance Criteria.

Written and/or recorded oral evidence is required to demonstrate that the candidate has achieved the Outcomes and Performance Criteria to the standard specified. This can be produced during one or more assessment occasions throughout the duration of the Unit but should last no more than two hours in total.

Evidence should be generated under supervised conditions during which the candidate can make use of relevant and appropriate standards and specifications and will be required to:

- ◆ interpret the requirements of a standard or specification used for **one** weld procedure approval
- ◆ interpret the requirements for **one** welder qualification approval test
- ◆ assess the weldability of a **one** specified steel
- ◆ complete **one** weld procedure pro forma for a given material
- ◆ determine the pre heat temperature of **one** material to be welded
- ◆ determine the range of approval for **one** specified welder qualification
- ◆ describe the principles for **one** method of NDT
- ◆ suggest an alternative method of NDT for a given application

The Assessment Support Pack (ASP) for this Unit provides samples of assessment materials which exemplify the national standard. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard.

## National Unit Specification: support notes

### UNIT Weld Procedure Specification and Testing (SCQF level 6)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

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

#### GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The Unit is in the National Qualification Group Award (NQGA) in *Fabrication and Welding Engineering*. It can also be taken as a free-standing Unit.

Current relevant International (ISO), European (BS EN) and British (BS) standards should be considered as the main teaching and learning materials although it may be helpful to include other standards or codes such as American (ASME)

The Unit covers three main areas:

#### ◆ weld procedure qualification

Weld procedure construction and the requirements of qualification welding conditions, parent material groups and filler material groups welding process heat treatment requirements and essential variables.

The necessary destructive and non-destructive weld testing requirements for butt welds and fillet welds.

Range of approval for a particular weld test to ensure the requirements for a particular purpose or application are satisfied.

#### ◆ welder approval qualification

A similar approach as above should be adopted to welder approval qualification to include the requirements of the qualification - test piece position, material thickness, welding process and welding positions. Also required will be parent material and filler material groups where a new test is required.

#### ◆ assessing the weldability of steels

The requirement to consider the effects of the following factors on the weldability of a steel:

- ◆ susceptibility to cracking during or after welding
- ◆ the use of heat treatment to reduce the effects of the thermal cycle on the weldment

## National Unit Specification: support notes (cont)

### UNIT Weld Procedure Specification and Testing (SCQF level 6)

The following factors to be used in assessing weldability:

- ◆ heat input, diffusible hydrogen, combined thickness and the carbon equivalent of the material composition
- ◆ the use of this information in determining if a pre heat treatment is required
- ◆ the temperature and the methods of how pre heat temperatures can be measured
- ◆ commonly used NDT processes: dye penetrant, magnetic particle, radiography and ultrasonic
- ◆ the principle of each process, how the process actually works, capillary attraction — magnetism — radiation and ultra sound
- ◆ the procedure or steps that are required to carry out each of the listed non destructive methods of testing
- ◆ the relationship of non destructive testing to weld procedure approval testing and also welder approval qualification

Candidates should have the technical terms and the implications of health and safety explained to them to integrate with the interpretation of the standards and specifications.

### **GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT**

It is recommended that this Unit is taught either in tandem or following Units on welding skill, welding processes or materials.

The main teaching support materials should make use of current standards and codes. Extracts of standards and the definitions of terms should be used. In addition, candidate support materials should make reference to current standards. IT research of standards could be used to supplement candidate knowledge.

Knowledge of the variables and parameters required for the welding processes are also necessary to assist the candidate in understanding welding procedures, welder qualification and weldability. Pro forma documentation should be used for welding procedures and welder qualification. However, simplified weld procedure documentation in the early stages will be beneficial.

The use of case study type exercises should be encouraged to provide candidates with the experience of using standards and specifications to draw up weld procedures and determine ranges of approval and testing requirements for weld procedures and welder qualifications.

It would be beneficial in understanding of the approval process if a practical exercise witnessed by the group of candidates where a proposed weld procedure is drawn up and a weld procedure test is carried out.

Exercises in determining if a pre-heat temperature is required taking into consideration the following:

- ◆ welding processes
- ◆ heat inputs
- ◆ material thickness
- ◆ joint configuration
- ◆ hydrogen scales

## National Unit Specification: support notes (cont)

### UNIT Weld Procedure Specification and Testing (SCQF level 6)

It is important that candidates have a good understanding of materials and material behaviour, during heating cycles and when subjected to stress.

It would be helpful if candidates had the opportunity to use each of the non destructive testing methods to reinforce the principles and especially the procedure used to carry out the test. The applications of the testing methods is reinforcement for the learning of the principles and procedures.

Applications for the listed non destructive tests will play just as important part in this Unit as the principles and the procedures for carrying out the test.

Methods of recording results of the tests to determine pass/fail criteria and for future reference.

### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

*Problem Solving* skills such as critical thinking, planning, organising, and reviewing and evaluating, could be effectively developed and enhanced in the Unit, which requires the application of theoretical knowledge to practical issues. Candidates analyse the effects of a range of factors on the weldability of steel, interpreting and applying appropriate standards in specific circumstances. They have to understand and apply current standards and codes as they affect all aspects of practical welding procedures. Observation of practical demonstrations could be supplemented by analytical class discussion on such issues as requirements for destructive and non-destructive weld testing and the range of approval for particular weld tests. Evaluation could focus on whether requirements for a particular purpose or application will be satisfied by solutions determined.

The ability to interpret and apply written and graphic information relevant to specification and testing is essential in drawing up and determining ranges of approval and testing requirements for weld procedures and welder qualifications. Knowledge and understanding of complex variables and parameters required for welding processes is also necessary to determine pre testing needs. Integration of assessment with other practical units will support development of skills across the award, with an emphasis on *Numeracy* as a tool to be used and applied efficiently in working contexts.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

#### Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

A holistic approach should be adopted for assessing this Unit. The candidate may benefit from an end of Unit test that allowed the demonstration of understanding of the subject using an industrial application requiring a meaningful solution. The use of pro forma standards and specifications is recommended.

## National Unit Specification: support notes (cont)

### UNIT Weld Procedure Specification and Testing (SCQF level 6)

The questions should be structured in a manner that guides the candidate through the assessment process.

There should be an opportunity for assessment on demand where appropriate for candidates with relevant and sufficient industrial experience.

Recommended Assessment Procedures:

- ◆ Assessment instruments could be structured written questions
- ◆ Industry standard pro forma may also be used where appropriate
- ◆ There could be **four** structured questions with having at least **four** questions directed to the stem of the question

Candidate could have a choice of any **three** from **four** of STRUCTURED questions.

Candidates may require extracts from relative standards as an Assessment Support Pack.

### CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* ([www.sqa.org.uk](http://www.sqa.org.uk)).