

National Unit Specification: general information



UNIT Land-based Engineering: Welding 1 (SCQF level 6)

CODE F91N 12

SUMMARY

This Unit may form part of a National Qualification Group Award or may be offered as a free standing Unit to candidates who wish to enhance their skills in a welding environment. The Unit is also suitable for those who are studying the subject for the first time.

This largely practical Unit is designed to provide candidates with knowledge, understanding and skills to carry out the Oxy-fuel and Manual Metal Arc (MMA) welding, Oxy-Fuel gas cutting and Soldering processes.

During the delivery of this Unit candidates will use these skills to produce a range of welded joints and Oxy-Fuel gas cuts. They will also be expected to work within the relevant industrial standards. Candidates will develop theoretical and practical skills in the safe working practices associated with welding and cutting processes and especially the use of explosive gases.

This Unit is suitable for candidates training to be agricultural/horticultural service engineers or technicians.

This Unit does not cover the repair of safety critical components.

OUTCOMES

- 1 Explain correctly the thermal joining and oxy-fuel cutting processes.
- 2 Select, check and set up equipment prior to thermal joining, soldering and cutting.
- 3 Produce a range of thermal fusion and thermal non-fusion joints.
- 4 Produce a range of oxy-fuel gas cuts.
- 5 Identify faults in thermal joints and gas cuts.

Administrative Information

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RECOMMENDED ENTRY

Whilst entry is at the discretion of the centre some knowledge and experience of working in a practical engineering environment where welding and cutting processes have been used would be an advantage.

CREDIT VALUE

1 credit at SCQF Level 6 (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, Working with Others, Numeracy* and *ICT* at SCQF level 5 in this Unit. There is no automatic certification of Core Skills or Core Skills components.

National Unit Specification: statement of standards

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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

Explain correctly the thermal joining and oxy-fuel cutting processes.

Performance Criteria

- (a) Explain correctly the oxy-acetylene gas welding processes.
- (b) Explain correctly the MMA processes.
- (c) Explain correctly the fuel gas cutting processes.
- (d) Explain correctly the soldering processes.

OUTCOME 2

Select, check and set up equipment prior to thermal joining, soldering and cutting.

Performance Criteria

- (a) Equipment and consumable selection is correct for welding, soldering and cutting processes.
- (b) Check equipment is safe and serviceable prior to use for each of the processes.
- (c) Setting of process parameters and variables is correct in terms of the given joint.
- (d) Preparation and setting up of joints for welding and soldering is correct
- (e) Preparation and setting up of materials for cutting is correct.

OUTCOME 3

Produce a range of thermal fusion and thermal non-fusion joints.

Performance Criteria

- (a) Production of oxy-fuel welded joints in low carbon steel (LCS) and soldered joints are within the range of materials' thickness and dimensions are correct.
- (b) Production of Manual Metal Arc welded joints in low carbon steel (LCS) are within the range of materials' thickness and dimensions are correct.
- (c) Equipment is closed down and stored safely and correctly on completion of use.

OUTCOME 4

Produce a range of oxy-fuel gas cuts.

Performance Criteria

- (a) Production of oxy-fuel gas cuts in low carbon steel (LCS) is correct
- (b) Equipment is closed down and stored safely and correctly on completion of use.

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OUTCOME 5

Identify faults in thermal joints and gas cuts.

Performance Criteria

- (a) Identification of faults is correct.
- (b) Explanation of the appropriate remedial measures for faults identified is correct.

EVIDENCE REQUIREMENTS FOR THIS UNIT

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

The assessment of this Unit should be approached in an integrated way with documentation covering all Outcomes developed as an integrated whole. A single workbook covering Outcomes 2 to 5 for the candidate to record pre/post weld and cutting activities would be preferred.

Written and/or recorded oral, product and performance evidence supplemented with an assessor observation checklist(s) should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

Note: This Unit does not cover the repair of safety critical components.

Outcome 1

A total of 12 written questions are required for Outcome 1.
A minimum of 3 written restricted response questions for PC s **(a)-(d)**.

Outcome 2

Observation checklists are required for PC s **(a)-(e)**.

Outcomes 3

MMA welded Joints

- ◆ Performance evidence supplemented by assessor observation checklists is required to demonstrate that the candidate has safely carried out the following welds to a satisfactory standard:

Soldered Joint

- ◆ A soldered joint using soldering equipment. The joint should be a lap joint no less than 50mm long and have a preferred thickness of 1.6 mm or maximum of 3mm.

National Unit Specification: statement of standards (cont)

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Brazing

- ◆ A brazed joint in LCS using oxy-fuel welding equipment. The joint should be a lap joint no less than 100mm long and have a minimum thickness of 1.6mm or maximum thickness of 3mm.
- ◆ A brazed joint in LCS using oxy-fuel welding equipment. The joint should be a 'T' fillet joint no less than 100mm long and have a minimum thickness of 1.6mm or maximum thickness of 3mm.

Oxy-fuel Welding

- ◆ A Butt joint in low carbon steel (LCS) using the oxy-fuel welding process. The joint should be a minimum of 100mm long and have a preferred thickness of 1.6mm or maximum thickness of 3mm.
- ◆ A lap joint in low carbon steel (LCS) using the oxy-fuel welding process. The joint should be a minimum of 100mm long and have a preferred thickness of 1.6mm or maximum thickness of 3mm.
- ◆ A fillet joint in low carbon steel (LCS) using the oxy-fuel welding process. The joint should be a minimum of 100mm long and have a preferred thickness of 1.6mm or maximum thickness of 3mm.

Manual Metal Arc

- ◆ A Butt joint in LCS using the manual metal arc process. The joint should be a minimum of 100mm long and have a maximum thickness of 10 mm.
- ◆ A Lap joint in LCS using the manual metal arc process. The joint should be a minimum of 100mm long and have a maximum thickness of 10 mm.
- ◆ A 'T' fillet joint in LCS using the manual metal arc process. The joint should be a minimum of 100mm long and have a maximum thickness of 10 mm.

Note:

At least one of the above MMA joints should be completed as a multi run weld.

At least one of the above MMA joints should be completed as a vertical joint.

Outcome 4

Oxy-fuel Fuel Cutting

Performance evidence supplemented by assessor observation checklists is required to demonstrate that the candidate has safely carried out the following oxy-fuel cuts to a satisfactory standard:

- ◆ Cut a 'T' shape from LCS plate.
- ◆ Cut a round bar of at least 25mm diameter.

Outcome 5

Written/oral evidence for each of the joints and cuts is required for PC (a) and PC (b). The candidate is required to state the welding and cutting faults and how he/she would rectify the identified fault. Note on the range of faults: incorrect profile; insufficient cleaning; lack of penetration; porosity; lack of fusion; spatter; undercut.

National Unit Specification: support notes

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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 forms part of the National Qualification Group Award (NQGA) in Land-based Engineering but it may also be taken as a freestanding Unit.

The Unit is designed to provide the Land-based Engineer with sufficient skills in welding and cutting for the Land-based Engineering Industry.

On completion of this Unit the candidate will be aware of the statutory safety regulations applicable to Oxy-acetylene, MMA welding, soldering and Oxy-fuel cutting. The candidate will know the factors that affect and control the making of quality welds, soldered joints and cuts in low carbon steel.

Although Health and Safety is assessed as part of the Land-based Engineering Health, Safety and the Environment Unit it should be emphasized in all its aspects, e.g. filter glass grades and/or use of auto-darkening welding helmets, fumes and gases, the correct use of welding fume extraction equipment etc.

Candidates should be instructed and be able to identify materials and their suitability for thermal joining processes and be able to prepare materials and joints for thermal joining and oxy-fuel gas cutting.

Joints and Cuts

All joint configurations should be taught. All cut configurations should be taught with candidates being given time to develop their welding, soldering and cutting skills.

Joints and cuts should be practised in various material thicknesses. In the gas welding and soldering processes, various material thickness should be practised with 1.6 mm being the preferred assessment thickness.

Equipment and Consumables

The candidate should be able to select gas cylinders; regulators; hose colour; screw thread type, nozzle size and type. Methods of assembling, cracking/purging and leak testing gas cylinders. Gas pressures and flame setting for oxy-fuel welding and cutting. Soldering iron types and flux choice, use and application of non-lead based solders should be emphasized.

Destructive testing could also be introduced for candidates to analyse penetration in the MMA process.

National Unit Specification: support notes (cont)

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Health, Safety and the Environment

As Outcomes 2-5 require candidates to practically service and repair equipment either onsite or in workshop situations, it is strongly recommended that candidates are inducted into current legislation, regulation and safe working procedures and practices before starting practical work.

A safe system of work should be established in line with the Health, Safety and the Environment Unit guidelines while taking cognisance of the candidate's previous experience and abilities prior to the commencement of practical activities. The storage and handling of materials and methods of disposal of waste materials produced during the servicing of land-based equipment should comply with current legislation and good practice. Health, safety and environmental issues associated with this Unit **should be taught with the subject topics and not separately** in the Land-based Engineering Health, Safety and the Environment Unit.

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

A Unit induction will be required to inform candidates of the requirements of the Unit and the assessment procedure and requirements. A safety induction will be necessary on the workshop practices and the safe use of welding equipment, preparation equipment, finishing equipment and welding shop extraction and ventilation equipment. Candidates should be supplied with safety support materials to reinforce the inductions. It would be helpful if the candidate could be supplied with weld procedures for each of the joints and cuts. A pro-forma inspection report could also be supplied along with information on the defect types and acceptance limits for imperfections/defects and guidance on the defect types that may be encountered.

Since this is mainly a practical workshop based Unit, demonstrations will be required. At first this may be group demonstrations and as the Unit progresses the demonstrations will be more individual to support the needs of each of the candidates.

Unit Sustainability

Candidates could be encouraged to work in an efficient manner throughout the Unit. Consideration should be given in instruction to the efficient use of materials and consumables, their economical use and avoidance of unnecessary waste.

Fluxes and solders for thermal processes should be used efficiently and consideration given to toxicity and the harmful effects to the candidate and the environment when using and disposing of unwanted flux and solder residue.

When using transformer type or inverter type electric welders candidates should be made aware of the energy consumption. The cost of energy use should be considered for the types and the candidate made aware of energy consumption costs.

The environmental effects of welding could be highlighted to the candidate.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Problem Solving

The Critical Thinking component of *Problem Solving* at SCQF level 5 may be developed in Outcomes 1-5 while candidates assess the safe condition of process equipment, set up equipment, produce a range of thermal joints and cuts and weld fault identification and fault rectification.

The Planning and Organisation component of *Problem Solving* at SCQF level 5 may be developed in Outcome 1-5 while candidates are involved with practical thermal process tasks, task organisation and resource allocation.

The Reviewing and Evaluating components will be addressed during weld fault identification and fault rectification in Outcome 5.

National Unit Specification: support notes (cont)

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Working with Others

The *Working with Others* Core Skill at SCQF level 5 may be developed in Outcomes 2-5 while candidates work in teams/pairs in equipment checking and materials preparation. Eg gas cylinder logistics steel manhandling and cutting/sizing prior to process welding.

The Reviewing Co-operative Contribution at SCQF level 5 may be developed in Outcomes 2, 3, 4 and 5 while candidates engage in practical work as they have to interact with their lecturers, support staff and other candidates, for example; while sharing welding workshop areas welding equipment and consumables.

Numeracy

The *Numeracy* Core Skill at SCQF level 5 may be addressed in Outcome 3 through calculation when candidates measure materials for welded joints and cutting dimensions.

The Using Graphical Information Core Skill at SCQF level 5 may be covered in Outcome 5 when candidates produce weld hardness graphs for MMA destructive testing methods.

ICT

The Accessing Information Core Skill at SCQF level 5 may be developed in Outcome 1 through the retrieval of manufacturers' welding equipment.

The Processing Information Core Skill at SCQF level 5 may be developed in Outcome 1 through the presentation of assessments and reports.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Health and Safety and Environment Regulation Compliance

Assessment of health, safety and environmental issues associated with this Unit should be cross-matched and assessed in the Land-Based Engineering Health, Safety and the Environment 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)*.

Evidence of safe working practice/s should be recorded on a safety checklist. The checklist could be used to record non-compliance with safe working practice and procedures. No entries would confirm the candidate has achieved this part of the required assessment.

National Unit Specification: support notes (cont)

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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).