



National Unit Specification: general information

UNIT Engineering Skills: Electrical and Electronic (Intermediate 2)

CODE F39C 11

COURSE Engineering Skills (Intermediate 2)

SUMMARY

This Unit has been designed as a mandatory Unit of the *Engineering Skills (Intermediate 2)* Course but can also be taken as a free-standing Unit. It is suitable for candidates with no previous electrical, electronic, or employment experience. Candidates will learn to select and safely use the correct tools and components required to construct extra low voltage functional circuits.

Candidates will have the opportunity to review the employability skills they have developed across the range of practical experiences.

OUTCOMES

- 1 Identify, select, and use a range of tools to terminate and test electrical cables and accessories.
- 2 Identify, select, and use a range of tools to terminate and test electronic cables and components.
- 3 Construct and test circuits from given diagrams.
- 4 Review and evaluate own employability skills in practical engineering contexts.

RECOMMENDED ENTRY

Entry is at the discretion of the centre, but while no formal entry qualifications are required, it would be beneficial if candidates embarking on the Unit demonstrated:

- ◆ an interest in engineering
- ◆ an ability in numeracy and literacy at SCQF level 4
- ◆ some aptitude for graphical forms of communication

Administrative Information

Superclass: XA

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CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*).

**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

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill None

Core Skill component Critical Thinking at SCQF level 4

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

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

Identify, select, and use a range of tools to terminate and test electrical cables and accessories.

Performance Criteria

- (a) Identify and state the use of cables and accessories used in electrical circuits correctly.
- (b) Identify and safely use tools correctly.
- (c) Terminate cables and accessories correctly.
- (d) Complete tests to ensure cable and accessory continuity and integrity.
- (e) Correctly observe safe working practices in all practical activities.

OUTCOME 2

Identify, select, and use a range of tools to terminate and test electronic cables and components.

Performance Criteria

- (a) Identify and state the use of cables and components used in electronic circuits correctly.
- (b) Identify and safely use tools correctly.
- (c) Terminate cables and components correctly.
- (d) Complete tests to ensure cable and component continuity and integrity.
- (e) Correctly observe safe working practices in all practical activities.

OUTCOME 3

Construct and test circuits from given diagrams.

Performance Criteria

- (a) Construct an electrical circuit from given diagrams and specifications correctly.
- (b) Construct an electronic circuit from given diagrams and specifications correctly.
- (c) Complete a quality check to test and record each circuit function.
- (d) Correctly observe safe working practices in all practical activities.

OUTCOME 4

Review and evaluate own employability skills in practical engineering contexts.

Performance Criteria

- (a) Review and evaluate own employability skills.
- (b) Seek and record feedback on own performance in employability skills.
- (c) Make a judgement on own strengths, weaknesses, and learning points in relation to employability skills.
- (d) Identify action points for improvement in relation to employability skills.

National Unit Specification: statement of standards

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Performance and written/oral evidence is required to show that all Outcomes and Performance Criteria have been achieved.

Performance evidence will be supported by assessor checklists. This evidence will be generated from an integrated assignment consisting of practical activities carried out in supervised workshop conditions.

The evidence may be gathered at different points throughout the Unit.

The practical activities in the preparation, planning, and construction of extra low voltage electrical and electronic circuits in a safe manner, which should conform to current legislation, will cover:

- ◆ interpretation of simple diagrams and specifications
- ◆ identification and use of the following electrical and electronic cables:
 - single core, multi core, twin and earth, screened, co-axial, and ribbon
- ◆ identification and use of the following electrical accessories:
 - consumer Unit, switches, lamp holders, sockets, and protective devices
- ◆ identification and use of the following electronic components:
 - resistors, capacitors, inductors, diodes, transistors, ICs, and audio/visual devices
- ◆ selection, function, and use of the following tools:
 - screwdrivers (various), wire strippers, wire cutters, pliers, crimping tool, solder irons, circuit assembly aids, and digital test instruments

The electrical circuit will be constructed:

- ◆ using any cable(s)
- ◆ using at least three different types of accessory
- ◆ using four tools

The electronic circuit will be constructed:

- ◆ using any cable(s)
- ◆ using at least four different types of component
- ◆ using four tools

The circuits should be tested using suitable test instruments and the results recorded.

Candidates will be required to carry out quality checks before submitting their work for final assessment.

National Unit Specification: statement of standards (cont)

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Written/Oral Evidence

Candidates will complete a self evaluation review of their own performance against the following employability skills:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness — to include wearing Personal Protective Equipment (PPE), safe working practices and understanding a basic risk assessment
- ◆ selecting and using engineering tools and materials — source and use tools in a correct and safe manner, use tools solely for the purpose for which they are designed and selection of engineering materials
- ◆ interpreting engineering drawings and specifications
- ◆ awareness of environmental considerations — to include safe and correct disposal of waste/hazardous materials, waste minimisation and fume and dust control
- ◆ quality checking own work
- ◆ self review and evaluation — to include identifying strengths and weaknesses, identifying learning points from practical experiences and having a positive attitude to learning

A signed record of the review must be retained by the assessor as assessment evidence.

The National Assessment Bank (NAB) item for this Unit provides an appropriate practical assignment, an appropriate candidate review sheet and assessor checklists. These exemplify the national standard. Centres wishing to develop their own assessments should refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Engineering Skills: Electrical and Electronic (Intermediate 2)

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

This Unit covers practical electrical and electronic activities. The candidate will develop the ability to select and use tools correctly and safely in the different activities in the Unit. It is therefore important that the learning takes place in a supervised workshop environment. Safe working practices will be included in the content as it is important that candidates learn to adhere to these at all times.

Candidates will work on a range of practical electrical and electronic tasks, which will enable them to become familiar with a variety of tools and materials in the workshop. Lecturers/teachers may include a wide range of short practical activities to equip candidates with the skills necessary to complete an electrical circuit and an electronic circuit. During the process of practical work the candidate will become accustomed to electrical and electronic terminology and will be able to demonstrate a knowledge and understanding of the terminology in everyday practice. Candidates should learn good working practices at each stage and how to carry out quality checks on their own work.

This Unit provides opportunities to develop engineering employability skills such as:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness
- ◆ selecting and using engineering tools and materials
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others
- ◆ planning and preparing for work
- ◆ applying time management
- ◆ awareness of environmental considerations
- ◆ quality checking own work
- ◆ self review and evaluation

The context for learning should include the requirement to be clean, presentable and appropriately dressed for the workshop, wearing PPE including protective clothing, when required.

Relevant aspects of current health and safety legislation, current COSHH (Control of Substances Hazardous to Health) Regulations, and any systems of work relevant to the candidates' workshop/workplace should be explained and adhered to as part of the work of this Unit.

National Unit Specification: support notes (cont)

UNIT Engineering Skills: Electrical and Electronic (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important there is an induction to the Unit which will include employability skills and health and safety awareness. This Unit involves experiential learning through the various practical experiences and activities. Candidates should experience workshop conditions and should be encouraged to perform tasks and conduct themselves in a manner appropriate to the workplace. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical electrical and electronic activities within the Unit. The electrical circuits should include both power and lighting circuits. The electronic circuits could include analogue and/or digital circuits. Centres may wish to introduce some terminology relating to control circuits when referring to electronic circuits. Where this Unit is being taught as part of the Course this may be of benefit to candidates during the completion of the Unit: *Engineering Skills: Design and Manufacture (Intermediate 2)*.

Each constructed circuit should be protected by an appropriate protective device such as a fuse, relay, Residual Current Device (RCD), or Miniature Circuit Breaker (MCB). As well as carrying out practical tasks, candidates will also learn from brief lessons on health and safety and workshop protocol. Teaching and learning approaches will also include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practice the skill emphasised by the demonstration.

Where centres authorise the use of power tools for candidates, this should only be allowed after suitable training and the completion of a risk assessment, and in accordance with current legislation for that candidate age group. Particular attention should be made to specific legislative requirements where school age candidates are involved.

Where centres opt to use power tools, it is essential that the safe and correct use of power tools is demonstrated before candidate use. In addition, candidates must be made aware of the dangers of misuse or usage without proper training or associated PPE.

Some centres may be able to arrange demonstrations by local firms or power tool manufacturers to emphasise correct and safe usage of power tools.

Integrated into the Unit are the employability skills that employers value. It should be stressed that all the employability skills are developed in this Unit but only specified employability skills will be assessed. Employability skills are a focus of this Unit and should be promoted from Unit induction to Unit completion.

In order to raise the candidates' awareness of local industries and the realities of the workplace, visits to local firms could be arranged if appropriate. Equally, visiting speakers from local firms should be encouraged. Additional useful material and employment opportunities can be resourced from the research of local engineering firms or from the internet.

National Unit Specification: support notes (cont)

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This Unit should be delivered by a combination of teaching and learning approaches which could include:

- ◆ Lecturing
- ◆ Demonstrations
- ◆ Practical activities
- ◆ Group discussions
- ◆ Tutorials
- ◆ Site visits
- ◆ Audio visual
- ◆ Guest speakers

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will perform calculations and take measurements by the interpretation of diagrams and specifications. These activities provide good opportunities to develop the Core Skills of *Numeracy* and *Communication*. Candidates will also share workspace, tools and equipment. This will provide them with a good context in which to learn to work cooperatively with others.

Achievement of this Unit gives automatic certification of the Core Skill component of *Critical Thinking* at SCQF level 4.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Unit assessment will include electrical skills, electronic skills and employability skills. It is recommended that the stated electrical skills, electronic skills, and employability skills are assessed throughout the Unit.

The electrical and electronic skills assessed in this Unit are:

- ◆ interpret diagrams and specifications
- ◆ cut
- ◆ terminate
- ◆ select and fit accessories
- ◆ select and fit components
- ◆ select and use tools
- ◆ complete appropriate tests
- ◆ preparation planning
- ◆ construct circuits to specification

The employability skills assessed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness
- ◆ selecting and using engineering tools and materials
- ◆ interpreting engineering drawings and specifications
- ◆ awareness of environmental considerations
- ◆ quality checking own work
- ◆ self review and evaluation

National Unit Specification: support notes (cont)

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The assessment of employability skills will be evidenced by a candidate review sheet supported with assessor observation checklists of the practical activities. It is recommended that the candidate review sheet should be completed towards the end of the Unit when the candidate and assessor will have had a reasonable time to make a judgement.

The assessment of electrical skills will be evidenced by practical assignments involving the construction and test of, for example, a lighting circuit and these will be supported by assessor observation checklists.

The assessment of electronic skills will be evidenced by practical assignments involving the construction and test of, for example, an analogue or digital circuit on a suitable type of circuit board, and these will be supported by assessor observation checklists.

The assessment for both electrical and electronic could be integrated into the construction and test of combined electrical and electronic circuitry, for example, a power source or alarm system.

It is anticipated that candidates will be given as much practice as possible in electrical and electronic techniques prior to assessment. The assessment activities should also make an important contribution to the learning process.

If candidates are working as a team on practical assignments, assessors must satisfy themselves that candidates are competent in each aspect of the given task.

Assessors are required to check the quality of candidates' work against prescribed standards and test readings. Candidates themselves are required to carry out a quality check against these same standards. Candidates must carry out their own quality check prior to the assessor check.

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)* and *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

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)*.