



National Unit Specification: general information

UNIT Fault-finding on Low Voltage Electrical Systems and Equipment
(SCQF level 6)

CODE F5DF 12

SUMMARY

This Unit is intended for candidates with little or no prior knowledge and/or practical experience of applying fault-finding techniques to electrical systems and equipment, but who wish to gain an understanding of these techniques.

The aim of this Unit is to familiarise the candidate with the instruments used in diagnostic fault-finding on electrical systems and equipment, and provide opportunities for the use of these in practical situations.

The candidate will be able to use wiring diagrams, block diagrams and other documentary information, along with diagnostic test instruments, on faulty electrical systems and equipment and be able to interpret the results of the fault-finding exercises to identify and locate the faults.

This Unit may form part of a National Qualifications Group Award at SCQF level 6 or may be offered on a free-standing basis.

OUTCOMES

- 1 Explain the use of diagnostic instruments in fault-finding applications on electrical systems and equipment.
- 2 Explain fault-finding techniques on electrical systems and equipment.
- 3 Apply fault-finding techniques to a given electrical system and equipment.

Administrative Information

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following Standard Grades, or equivalent:

- ◆ Mathematics — credit level
- ◆ Technological Studies — credit level
- ◆ Physics — credit level

CREDIT VALUE

1 credit at SCQF level 6 (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

There is no automatic certification of Core Skills in this Unit.

The Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Communication (SCQF level 6)
- ◆ Problem Solving (SCQF level 6)
- ◆ Numeracy (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

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 the use of diagnostic instruments in fault-finding applications on electrical systems and equipment.

Performance Criteria

- (a) Explain clearly the types of fault which may occur on electrical systems and equipment.
- (b) Identify correctly types of diagnostic test instrument for fault-finding purposes.
- (c) Explain clearly the use of diagnostic instruments in fault-finding applications.
- (d) Identify clearly the choice of diagnostic test instruments in relation to types of fault on electrical systems and equipment.

OUTCOME 2

Explain fault-finding techniques on electrical systems and equipment.

Performance Criteria

- (a) Explain clearly the purpose of wiring diagrams, block diagrams and flow charts in fault-finding tasks.
- (b) Describe clearly the symptoms of various faults on electrical systems and equipment.
- (c) Explain clearly the logical technique of fault-finding on electrical systems and equipment.

OUTCOME 3

Apply fault-finding techniques to a given electrical system and equipment.

Performance Criteria

- (a) Describe clearly the symptoms of faults on a given electrical system and equipment.
- (b) Assemble the appropriate drawings and documentation for a given electrical system and equipment.
- (c) Identify correctly the range of diagnostic test equipment required to identify the given faults.
- (d) Demonstrate correctly and safely fault-finding techniques on a given electrical system and equipment.
- (e) Identify correctly and safely the types and location of fault on a given electrical system and equipment.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Performance evidence supplemented with an assessor observation checklist and written and/or recorded oral evidence should be produced to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria. The evidence should be produced under supervised, controlled conditions in a practical environment throughout the duration of the Unit.

An appropriate form of assessment could be a single, holistic practical assessment which incorporates all the Outcomes and Performance Criteria.

Candidates will be presented with a low voltage electrical system, (in the form of a test board) having a ring circuit of 13A socket outlets, a lighting circuit and an electric motor circuit all having appropriate control and protection devices. A range of electrical equipment including portable appliances and an electric motor will also be provided.

A series of faults, including open circuit, short circuit and insulation resistance, will be introduced into the system and the equipment.

Drawings, documentation and information regarding the electrical system and the operation of the equipment will be made available for the candidate and provided on request.

A range of diagnostic test instruments including, insulation resistance testers, continuity testers, voltmeters and ammeters will be made available for the candidate and provided on request.

The candidate should:

- ◆ describe the symptoms of faults on electrical systems and equipment
- ◆ assemble the appropriate drawings and documentation
- ◆ select the range of diagnostic test equipment required to identify the fault
- ◆ demonstrate the correct fault-finding techniques on electrical systems and equipment
- ◆ identify the types of fault on electrical systems and equipment
- ◆ identify the location of faults on electrical systems and equipment

National Unit Specification: statement of standards (cont)

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This exercise should be accompanied by written and/or recorded oral evidence in which the candidate:

- ◆ describes three types of fault which may occur on electrical systems and equipment
- ◆ identifies three types of diagnostic test instrument for fault-finding purposes
- ◆ explains the use of diagnostic instruments in fault-finding applications
- ◆ identifies the applications of diagnostic test instruments in fault-finding on electrical systems and equipment
- ◆ explains the purpose of wiring diagrams, block diagrams and flow charts in fault-finding exercises
- ◆ describes the symptoms of faults on electrical systems and equipment
- ◆ explains the logical technique of fault-finding on electrical systems and equipment

Note: Assessors **MUST** ensure that any connection of the system or equipment to the supply, for the purpose of diagnostic and/or functional testing, is carried out in a safe manner and that no danger will arise due to such connection. Assessors must also ensure that a safe low voltage supply is used for such purposes. A high level of candidate supervision is required during these tests.

National Unit Specification: support notes

UNIT Fault-finding on Low Voltage Electrical Systems and Equipment (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

This is an Optional Unit within the National Qualification Group Award in Electrical Engineering at SCQF level 6 but may also be studied as a free-standing Unit.

The aim of this Unit is to familiarise the candidate with the instruments used in diagnostic fault-finding, and provide opportunities for the use of these in practical situations.

The candidate will be able to use diagnostic instruments on faulty electrical systems and equipment and be able to interpret the results of the fault-finding exercises to identify and locate the faults.

A range of diagnostic equipment will be presented to candidates and they will become familiar with the applications and characteristics of these in fault-finding applications.

Candidate should be provided with drawings and documentation relating to the electrical systems and equipment being used in this Unit, and the importance of these in fault finding exercises should be highlighted.

Candidates should be introduced to logical fault-finding techniques and the procedures to be followed in such exercises and be provided with opportunities to carry-out fault-finding exercises on electrical installations and equipment. (the system could be constructed on a test board which is dedicated to the purpose of fault-finding).

The content and context of this Unit should provide candidates with an overview of fault-finding techniques, the instruments used and the interpretation of test results in the diagnosis of fault types and location.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Although much of the content of this Unit is of a descriptive nature, it should be delivered in an Electrical Installation environment. This could be in a classroom, laboratory or workshop in which the environmental emphasis is placed on electrical systems.

Delivery of the Unit content could utilize relevant case studies, and wiring and block drawings and specifications of electrical systems and equipment. The use of relevant video's or DVD recordings illustrating the use of test instruments and logical fault-finding techniques should be encouraged.

Candidates should be encouraged to discuss and debate the various issues raised by the subject content in order that this interaction might stimulate their thought processes and reinforce the learning.

Case studies, discussion groups and practical exercises are some of the methods which could be used to engage with candidates to emphasise the importance of the topics included in this Unit.

National Unit Specification: support notes (cont)

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The Outcomes should be delivered in the sequence given in the ‘statement of standards’.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The need of candidates to understand information and data relating to circuit diagrams, wiring diagrams, equipment specifications and other documentation, provide them with opportunities to develop both written and oral communication skills. The need for candidates to evaluate and interpret the results of fault-finding exercises, provides opportunities for the development of problem solving skills. The use of graphical data provides opportunities for the development of numeracy skills.

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)*.

The assessment of this Unit could take the form of a ‘Practical Assignment’ which extends over the duration of the Unit.

This assignment could contain the four elements specified in the Unit Outcomes ie:

- ◆ explain the use of diagnostic instruments in fault-finding applications
- ◆ explain fault-finding techniques on electrical systems and equipment
- ◆ apply fault-finding techniques to electrical systems and equipment
- ◆ identify faults on electrical systems and equipment

These four elements could be integrated into one practical assignment with the achievements of each element being clearly recorded for each candidate.

The practical assignment could be conducted in a workshop environment under supervised and controlled conditions.

Candidates could be presented with a low voltage electrical system, (in the form of a test board) which includes a range of circuits, and a range of electrical equipment (including portable appliances and an electric motor). A series of faults, including open circuit, short circuit and insulation resistance, are introduced into the system and the equipment.

Drawings, documentation and information regarding the electrical system and the operation of the equipment should be available for the candidate and provided on request.

National Unit Specification: support notes (cont)

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A range of diagnostic test instruments including, insulation resistance testers, continuity testers, voltmeters, ammeters should be made available and provided on request

Note: Assessors **MUST** ensure that any connection of the system or equipment to the supply, for the purpose of diagnostic and/or functional testing, is carried out in a safe manner and that no danger will arise due to such connection. Assessors must also ensure that a safe low voltage supply is used for such purposes.

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).